Ecological Evaluation of Proposed Dredged Material From Oakland Harbor Intensive Study, IC-1 and OC4-B

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SUMMARY

The Oakland Harbor Intensive Study Area is located southwest of the Seventh Street Complex in Oakland, California. This area and its access channels are no longer wide or deep enough to accommodate modern deeper-draft vessels. Battelle/Marine Sciences Laboratory (MSL), operating under contract to U.S. Army Corps of Engineers (USACE), conducted an evaluation of the Oakland Outer and Inner Harbor Channels titled *Ecological Evaluation of Proposed Discharge of Dredged Material from Oakland Harbor into Ocean Waters (Phase III A of -42-Foot Project)* (Ward et al. 1992) and *Ecological Evaluation of Proposed Discharge of Dredged Material from Oakland Harbor into Ocean Waters (Phase III B of -42-Foot Project)* (Kohn et al. 1992). The results from these programs were used by USACE and several regulatory agencies to determine preliminary suitable disposal options for approximately 4.8 million cubic yards (approximately 84% of the dredged sediment in Oakland Inner and Outer Harbor -42-Foot Project). Based on the results of the Phase III A and III B Projects, the U.S. Environmental Protection Agency (EPA) and the USACE separated the Oakland -42-Foot Project sediments into 19 polygon areas for unconfined aquatic disposal suitability determinations. Of these, two polygon areas IC-1 and OC4-B, representing from 750 to 800 thousand cubic yards, were determined to require additional information in order to determine the suitability of these sediments for unconfined aquatic disposal.

The MSL collected 20 core samples, both 4 in. and 12 in., to a project depth of -44 ft mean lower low water (MLLW) (-42 ft MLLW plus 2 ft of overdepth) using a vibratory-hammer core. The 20 field samples were combined in the laboratory to form 5 test treatments that were subjected to geologic, chemical, biological toxicity, and bioaccumulation analysis following the guidelines in the *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual)* published jointly by the EPA and the USACE (EPA/USACE 1991) hereinafter referred to as the *1991 Implementation Manual*. Solid-phase tests were conducted with the amphipod, *Rhepoxynius abronius*; the clam, *Macoma nasuta*; and the polychaete worm, *Nephtys caecoides*. Suspended-particulate-phase (SPP) tests were conducted with the sanddab, *Citharichthys stigmaeus*; the mysid, *Holmesimysis costata*; and the bivalve, *Mytilus edulis*. Bioaccumulation of contaminants was measured in tissues of *M. nasuta* and *N. caecoides*.

One ocean reference, the Deep Off-Shelf Reference Site (R-OS), and two in-bay references, the Bay Farm Borrow Area (R-BF) and the Alcatraz Environs Reference Area (R-AM), were tested concurrently. Results from analysis of the five test treatments were statistically compared to R-OS in the first four sections of this report. Appendixes L and M contain the comparisons of the test treatments to reference areas R-BF and R-AM, respectively.

The solid-phase tests of Oakland Harbor sediments showed solid-phase acute toxicity to *R. abronius* exposed to test treatment COMP IC1-B, COMP IC1-B Special, and COMP IC1-C when compared to the reference sediment R-OS using Dunnett's test. The solid-phase toxicity observed in COMP IC1-B and COMP IC1-B Special was probably caused by the presence of ammonia found in these sediments. There were no statistically significant differences in acute toxicity to *M. nasuta*. Test treatment COMP IC1-B Special was acutely toxic to *N. caecoides* relative to the reference sediment R-OS. The Oakland Harbor sediments treatment COMP IC1-A showed no acute toxicity to any test species.

The SPP results showed acute toxicity to *C. stigmaeus* for test treatments COMP IC1-B, COMP IC1-B R, COMP IC1-B Special, COMP IC1-B Special R, and COMP IC1-C. The LC50 was calculated for COMP IC1-B at 49.0% SPP and COMP IC1-B Special at 76.4% SPP. The t-test results for *H. costata* showed no acute toxicity to any of the test treatments. Due to high survival in all test treatments, LC50s could not be calculated. The t-test results for *M. edulis* showed acute toxicity to test treatments COMP IC1-B Special and COMP OC4-B relative to the 0% SPP. The LC50 for COMP IC1-B Special was 79.9% SPP.

M. nasuta and *N. caecoides* tissue-contaminant concentrations were orders of magnitude below the Food and Drug Administration (FDA) action limits after exposure to Oakland Harbor sediments. Although the majority of contaminants were not elevated in *M. nasuta* and *N. caecoides* tissues, statistically significant elevations of several contaminants were detected when compared to tissues exposed to the Deep Off-Shelf reference sediment (R-OS) using Dunnett's test.

One low-molecular-weight polynuclear aromatic hydrocarbon (PAH) (anthracene), five high-molecular-weight PAHs [fluoranthene, benzo(a)anthracene, pyrene, chrysene, and benzo(k)fluoranthene], three pesticides (4,4'-DDD, 4,4'-DDE, and dieldrin), the polychlorinated biphenyl (PCB) Aroclor-1254, and the metal, lead, were elevated in *M. nasuta* tissues exposed to at least one of the test treatments relative to the reference sediment R-OS. Two high-molecular-weight PAHs, pyrene and benzo(k)fluoranthene, and the PCB Aroclor-1254 were elevated in *M. nasuta* tissues at magnitudes of >10 times above the concentrations present in tissues exposed to the reference sediment R-OS.

One high-molecular-weight PAH (pyrene), two pesticides (4,4'-DDD and 4,4'-DDE), PCB Aroclor-1254, and four metals (arsenic, cadmium, nickel, and lead) were elevated in *N. caecoides* exposed to at least one of the test treatments relative to the reference sediment R-OS. Pyrene was elevated at a magnitude of >10 times in *N. caecoides* tissues exposed to COMP OC4-B relative to tissues exposed to the reference sediment R-OS. Butyltins were not statistically significantly elevated in *N. caecoides* tissues exposed to any of the test treatments relative to the tissues exposed to the reference sediment R-OS.

The purpose of this study was to conduct comprehensive evaluations, including chemical, biological, and bioaccumulation testing, of sediments in the polygon areas designated IC-1 and OC4-B. This information was required by the EPA and the USACE in evaluating the suitability of sediments in these areas for unconfined aquatic disposal.

CONTENTS

SUMMARY	iii
1.0 INTRODUCTION	1.1
2.0 MATERIALS AND METHODS	2.1
2.1 SEDIMENT AND TEST ORGANISM COLLECTION	2.1
2.1.1 Oakland Harbor Core Samples	2.1
2.1.2 Reference and Control Samples	2.4
2.1.3 Test Organism Collection	2.4
2.2 SEDIMENT SAMPLE PREPARATION	2.5
2.2.1 Laboratory Glassware and Equipment Preparation	2.5
2.2.2 Geologic Description of Cores	2.6
2.2.3 Preparation of Solid-Phase Samples	2.6
2.2.4 Preparation of Suspended-Particulate-Phase	2.7
2.3 TOXICOLOGICAL TESTING PROCEDURES	2.8
2.3.1 10-Day Solid-Phase Static Test with <i>R. abronius</i>	2.9
2.3.2 10-Day Solid-Phase Flow-Through Test with <i>N. caecoides</i> and <i>M. nasuta</i>	2.11
2.3.3 28-Day Solid-Phase Flow-Through Test with <i>N. caecoides</i> and <i>M. nasuta</i>	2.13
2.3.4 96-h Suspended-Particulate-Phase Test with <i>C. stigmaeus</i>	2.13
2.3.5 96-h Suspended-Particulate-Phase Test with <i>H. costata</i>	2.14
2.3.6 72-h Suspended-Particulate-Phase Test with Larval <i>M. edulis</i>	2.15
2.4 SEDIMENT AND TISSUE CHEMISTRY PROCEDURES	2.17
2.4.1 Conventional Sediment Measurements	2.18
2.4.2 Semivolatile Organic Compounds	2.21
2.4.3 Chlorinated Pesticides and PCBs	2.22
2.4.4 Metals	2.22
2.4.5 Butyltins	2.23

2.5 DATA ANALYSIS AND INTERPRETATION	2.24
2.5.1 Randomization	2.24
2.5.2 Statistical Analysis of Solid-Phase Tests	2.24
2.5.3 Statistical Analysis of Suspended-Particulate-Phase Tests	2.25
2.5.4 Statistical Analysis of Bioaccumulation	2.25
2.6 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES	2.26
2.6.1 Sample Tracking and Storage	2.26
2.6.2 Sediment and Tissue Chemistry Quality Control Procedures	2.26
2.6.3 Toxicological Testing Quality Control Procedures	2.28
3.0 RESULTS	3.1
3.1 SEDIMENT COLLECTION AND SAMPLE PREPARATION	3.1
3.1.1 Oakland Harbor Intensive Study Core Sampling	3.1
3.1.2 Reference and Control Sediment Sampling	3.5
3.1.3 Sample Preparation	3.5
3.2 GEOLOGIC DESCRIPTION	3.5
3.2.1 Older Bay Mud (OBM)	3.14
3.2.2 Younger Bay Mud (YBM)	3.14
3.3 SEDIMENT CHEMISTRY	3.15
3.3.1 Sediment Conventional Measurements	3.15
3.3.2 Polynuclear Aromatic Hydrocarbons	3.19
3.3.3 Chlorinated Pesticides and Polychlorinated Biphenyls	3.22
3.3.4 Metals	3.26
3.3.5 Butyltins	3.33
3.4 TOXICOLOGICAL TESTING RESULTS	3.35
3.4.1 10-Day Solid-Phase Static Test with <i>R. abronius</i>	3.38
3.4.2 10-Day Solid-Phase Flow-Through Test with <i>M. nasuta</i>	3.41
3.4.3 10-Day Solid-Phase Flow-Through Test with <i>N. caecoides</i>	3.43

3.4.4	28-Day Solid-Phase Flow-Through Test with <i>M. nasuta</i> and <i>N. caecoides</i>	3.44
3.4.5	96-h Suspended-Particulate-Phase Static Test with <i>C. stigmaeus</i>	3.44
3.4.6	96-h Suspended-Particulate-Phase Static Test with <i>H. costata</i>	3.47
3.4.7	72-h Suspended-Particulate-Phase Static Test with <i>M. edulis</i>	3.49
3.5	TISSUE BIOACCUMULATION	3.50
3.5.1	Polynuclear Aromatic Hydrocarbon Bioaccumulation in <i>M. nasuta</i>	3.52
3.5.2	Chlorinated Pesticide and Polychlorinated Biphenyl Bioaccumulation in <i>M. nasuta</i>	3.54
3.5.3	Metals Bioaccumulation in <i>M. nasuta</i>	3.55
3.5.4	Butyltins Bioaccumulation in <i>M. nasuta</i>	3.55
3.5.5	Polynuclear Aromatic Hydrocarbon Bioaccumulation in <i>N. caecoides</i>	3.58
3.5.6	Chlorinated Pesticide and Polychlorinated Biphenyl Bioaccumulation in <i>N. caecoides</i>	3.60
3.5.7	Metals Bioaccumulation in <i>N. caecoides</i>	3.60
3.5.8	Butyltins Bioaccumulation in <i>N. caecoides</i>	3.61
4.0	DISCUSSION AND CONCLUSIONS	4.1
4.1	SEDIMENT CHARACTERISTICS	4.1
4.2	TIER III EVALUATIONS	4.1
4.2.1	Deposited Sediment (Solid-Phase) Acute Toxicity	4.1
4.2.2	Water Column Effects	4.2
4.2.3	Deposited Sediment Bioaccumulation	4.3
4.3	TOTAL AMMONIA INFLUENCE TO THE OBSERVED ACUTE TOXICITY OF <i>R. abronius</i> AND <i>C. stigmaeus</i>	4.4
4.4	CONCLUSIONS AND RECOMMENDATIONS	4.7
5.0	REFERENCES	5.1
APPENDIX A	MATERIALS AND METHODS USED FOR THE DESCRIPTION OF SEDIMENT CORES	A.1
APPENDIX B	CORE DATA LOGS	B.1
APPENDIX C	SEDIMENT CHEMISTRY AND QUALITY ASSURANCE DATA	C.1

APPENDIX D	BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE STATIC TEST WITH 96-HOUR REFERENCE TOXICANT TEST FOR <i>RHEPOXYNIUS abronius</i>	D.1
APPENDIX E	BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE TEST WITH <i>MACOMA nasuta</i> AND <i>NEPHTYS caecoides</i>	E.1
APPENDIX F	BIOASSAY RESULTS FOR 28-DAY SOLID-PHASE TEST WITH <i>MACOMA nasuta</i> AND <i>NEPHTYS caecoides</i>	F.1
APPENDIX G	BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE- PHASE TEST, 96-HOUR REFERENCE TOXICANT TEST AND 96-HOUR AMMONIA TEST FOR <i>CITHARICHTHYS stigmaeus</i>	G.1
APPENDIX H	BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE- PHASE TEST AND 96-HOUR REFERENCE TOXICANT TEST FOR <i>HOLMESIMYSIS costata</i>	H.1
APPENDIX I	BIOASSAY RESULTS FOR 72-HOUR SUSPENDED-PARTICULATE- PHASE TEST AND 72-HOUR REFERENCE TOXICANT TEST FOR <i>MYTILUS edulis</i>	I.1
APPENDIX J	TISSUE CHEMISTRY AND QUALITY ASSURANCE DATA FOR <i>MACOMA nasuta</i>	J.1
APPENDIX K	TISSUE CHEMISTRY AND QUALITY ASSURANCE DATA FOR <i>NEPHTYS caecoides</i>	K.1
APPENDIX L	POTENTIAL EFFECTS OF DISPOSAL OF OAKLAND HARBOR INTENSIVE STUDY SEDIMENTS AT THE BAY FARM BORROW AREA	L.1
APPENDIX M	POTENTIAL EFFECTS OF DISPOSAL OF OAKLAND HARBOR INTENSIVE STUDY SEDIMENTS AT THE ALCATRAZ ENVIRONS REFERENCE AREA	M.1

FIGURES

1.1	Locations of Preliminary Disposal Options for Oakland Inner and Outer Harbor Sediment Treatments	1.2
1.2	Location of Oakland Harbor Intensive Study Area	1.3
2.1	Components of the 4-in. and 12-in. Vibratory-Hammer Coring Devices	2.2
2.2	Static Mason Jar for <i>R. abronius</i> Toxicity Test	2.10
2.3	Flow-Through Aquaria for <i>M. nasuta</i> and <i>N. caecoides</i> Toxicity Tests	2.12
3.1	Sampling Stations and Compositing Scheme, Oakland Harbor Intensive Study COMP IC1-A, COMP IC1-B, and COMP IC1-B Special	3.3
3.2	Sampling Stations and Compositing Scheme, Oakland Harbor Intensive Study COMP IC1-C and COMP OC4-B	3.4
3.3	Location of Deep Off-Shelf Reference Area (R-OS)	3.7
3.4	Location of Bay Farm Borrow Area (R-BF)	3.8
3.5	Location of Alcatraz Environs Reference Area (R-AM)	3.9
3.6	Location of <i>M. nasuta</i> Control (C-SB), Sequim Bay, Washington	3.10
3.7	Location of <i>R. abronius</i> Control (C-WB), West Beach, Whidbey Island, Washington	3.11
3.8	Location of <i>N. caecoides</i> Control (C-NE), Tomales Bay, California	3.12
3.9	Grain Size Distribution in Sediment Treatments	3.18
3.10	Concentrations of TOC in Sediment Treatments	3.19
3.11	Concentrations of TVS in Sediment Treatments	3.20
3.12	Concentrations of Oil and Grease in Sediment Treatments	3.21
3.13	Concentrations of TPH in Sediment Treatments	3.22
3.14	Concentrations of Total PAH in Sediment Treatments	3.23
3.15	Concentrations of 4,4'-DDD in Sediment Treatments	3.27
3.16	Concentrations of 4,4'-DDE in Sediment Treatments	3.28
3.17	Concentrations of Aroclor-1254 in Sediment Treatments	3.29
3.18	Concentrations of Aroclor-1260 in Sediment Treatments	3.30
3.19	Concentrations of Silver in Sediment Treatments	3.31
3.20	Concentrations of Arsenic in Sediment Treatments	3.32

3.21	Concentrations of Cadmium in Sediment Treatments	3.33
3.22	Concentrations of Chromium in Sediment Treatments	3.34
3.23	Concentrations of Copper in Sediment Treatments	3.35
3.24	Concentrations of Mercury in Sediment Treatments	3.36
3.25	Concentrations of Nickel in Sediment Treatments	3.37
3.26	Concentrations of Lead in Sediment Treatments	3.38
3.27	Concentrations of Selenium in Sediment Treatments	3.39
3.28	Concentrations of Zinc in Sediment Treatments	3.40
3.29	Concentrations of Tributyltin in Sediment Treatments	3.41
3.30	Concentrations of Dibutyltin in Sediment Treatments	3.42
3.31	<i>R. abonius</i> Proportion Survival vs. Total Ammonia in Interstitial Water	3.44
3.32	<i>C. stigmaeus</i> Proportion Survival vs. Total Ammonia in the 100% Suspended- Particulate-Phase Samples	3.50
4.1	Matrix of Sediment Chemistry, Significant Acute Toxicity, and Bioaccumulation for Oakland Harbor Sediments Relative to the Deep Off-Shelf Reference R-OS	4.8

TABLES

2.1	Analytical Chemistry Requirements for Oakland Harbor Sediment Treatments	2.18
2.2	Analytical Chemistry Requirements for Oakland Harbor Tissue Samples	2.19
2.3	Grain Size Fractions Measured	2.20
2.4	Analytical Method and Corresponding Metal for Each Sample Matrix	2.23
3.1	Sampling Information for Sediment Composites, Oakland Harbor Intensive Study ...	3.2
3.2	Reference and Control Sediment Sampling	3.6
3.3	Sediment Samples and Testing Strategy, Oakland Harbor Intensive Study	3.13
3.4	Conventional Sediment Measurement Results for the Oakland Harbor Intensive Study Sediment Treatments	3.16
3.5	Organics and Metals Concentrations in Oakland Harbor intensive Study Sediment Treatments	3.24
3.6	Detectable Chlorinated Pesticides in Oakland Harbor Sediment Treatments	3.26
3.7	Results of the 10-Day Solid-Phase Static Test with <i>R. abronius</i>	3.43
3.8	ANOVA Results for the 10-Day Solid-Phase Static Test with <i>R. abronius</i>	3.43
3.9	Results of the 10-Day Solid-Phase Flow-Through Test with <i>M. nasuta</i>	3.45
3.10	ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with <i>M. nasuta</i>	3.45
3.11	Results of the 10-Day Solid-Phase Flow-Through Test with <i>N. caecoides</i>	3.46
3.12	ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with <i>N. caecoides</i> ..	3.46
3.13	Results of the 28-Day Solid-Phase Flow-Through Test with <i>M. nasuta</i> and <i>N. caecoides</i>	3.47
3.14	Results of the 96-h Suspended-Particulate-Phase Static Test with <i>C. stigmaeus</i>	3.48
3.15	T-Test and LC50 Determinations for the 96-h Static Suspended-Particulate-Phase Test with <i>C. stigmaeus</i>	3.49
3.16	Results of the 96-h Suspended-Particulate-Phase Static Test with <i>H. costata</i>	3.51
3.17	T-Test and LC50 Determinations for the 96-h Static Suspended-Particulate-Phase Test with <i>H. costata</i>	3.52
3.18	Results of the 72-h Suspended-Particulate-Phase Static Test with <i>M. edulis</i>	3.53
3.19	T-Test and LC50 Determinations for the 72-h Static Suspended-Particulate-Phase Test with <i>M. edulis</i>	3.54

3.20	T-Test and EC50 Determinations for the 72-h Static Suspended-Particulate-Phase Test with <i>M. edulis</i>	3.54
3.21	Mean Low Molecular Weight PAH Concentrations in the Tissues of <i>M. nasuta</i> Exposed to Oakland Harbor Sediments	3.55
3.22	Mean High Molecular Weight PAH Concentrations in the Tissues of <i>M. nasuta</i> Exposed to Oakland Harbor Sediments	3.56
3.23	ANOVA Results for Chemical Parameters in Tissues of <i>M. nasuta</i> Compared to the Deep Off-Shelf Reference (R-OS)	3.57
3.24	Mean Pesticide and PCB Concentrations in the Tissues of <i>M. nasuta</i> Exposed to Oakland Harbor Sediments	3.58
3.25	Mean Metals Concentrations in the Tissues of <i>M. nasuta</i> Exposed to Oakland Harbor Sediments	3.59
3.26	Mean Butyltins Concentrations in the Tissues of <i>M. nasuta</i> Exposed to Oakland Harbor Sediments	3.60
3.27	Mean High Molecular Weight PAH Concentrations in the Tissues of <i>N. caecoides</i> Exposed to Oakland Harbor Sediments	3.61
3.28	ANOVA Results for Chemical Parameters in Tissues of <i>N. caecoides</i> Compared to the Deep Off-Shelf Reference (R-OS)	3.62
3.29	Mean Pesticide and PCB Concentrations in the Tissues of <i>N. caecoides</i> Exposed to Oakland Harbor Sediments	3.63
3.30	Mean Metals Concentrations in the Tissues of <i>N. caecoides</i> Exposed to Oakland Harbor Sediments	3.64
4.1	Comparison of Oakland Harbor Solid-Phase Acute Toxicity to the Deep Off-Shelf Reference R-OS	4.3
4.2	Suspended-Particulate-Phase Toxicity Test Results	4.4
4.3	Comparison of FDA Action Levels With Contaminant Levels in <i>M. nasuta</i> and <i>N. caecoides</i> Exposed to Oakland Harbor Sediments	4.5
4.4	Summary of Acute Toxicity and Bioaccumulation for Oakland Harbor Sediment Treatments Relative to the Reference Sediment R-OS	4.6

1.0 INTRODUCTION

Oakland Harbor is located on the eastern shoreline of central San Francisco Bay in Alameda County, between the cities of Oakland and Alameda, California. Oakland Harbor and its access channels are no longer wide or deep enough to accommodate modern deeper-draft vessels. The Water Resources Development Act of 1986 (Public Law 99-662) authorized the U.S. Army Corps of Engineers (USACE), San Francisco District to deepen and widen the navigation channels to -44 ft mean lower low water (MLLW) (-42 ft MLLW plus 2 ft of overdraft) in Oakland Harbor. Several options for disposal of the material from this dredging project are under consideration by USACE. Those options include disposal within San Francisco Bay, at open-ocean sites, or at upland disposal sites.

Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), Public Law 92-532, specifies that all proposed disposal of dredged material into open water be evaluated to determine the potential environmental impacts to those activities. To comply with those requirements, the potential environmental impacts of the dredged material must be evaluated by chemical characterization, toxicity testing, and bioaccumulation testing prior to dredging and disposal.

Battelle/Marine Sciences Laboratory (MSL)^(a), operating under contract to USACE, conducted an evaluation of the Oakland Outer and Inner Harbor Channels (*Ecological Evaluation of Proposed Discharge of Dredged Material from Oakland Harbor into Ocean Waters*) (Phase III A of -42 foot Project) (Ward et al. 1992) and (*Ecological Evaluation of Proposed Discharge of Dredged Material from Oakland Harbor into Ocean Waters*) (Phase III B of -42 Foot Project) (Kohn et al. 1992). The results from these programs were used by USACE and several regulatory agencies to determine preliminary suitable disposal options for approximately 4.8 million cubic yards or about 84% of dredged material from both Oakland Inner and Outer Harbors. Based on the results of the Phase III A and III B Projects, the U.S. Environmental Protection Agency (EPA) and the USACE separated the Oakland -42-Foot Project sediments into 19 polygon areas for unconfined aquatic disposal suitability determinations (Figure 1.1). Of these, two polygon areas IC-1 and OC4-B, representing from 750 to 800 thousand cubic yards, were determined to require additional information in order to determine the suitability of these sediments for unconfined aquatic disposal.

The study area for the Oakland Harbor Intensive Study included 20 stations, 5 in the Outer Harbor and 15 at the entrance to the Inner Harbor (Figure 1.2). Sediments from these

(a) The Battelle/Marine Sciences Laboratory is part of the Pacific Northwest Laboratory, which is operated for the U.S. Department of Energy by Battelle Memorial Institute.

FIGURE 1.1. Locations of Preliminary Disposal Options for Oakland Inner and Outer Harbor Sediment Treatments

FIGURE 1.2. Location of Oakland Harbor Intensive Study Area

stations were collected with a vibratory-hammer corer to a project depth of -44 ft MLLW (-42 ft MLLW plus 2 ft of overdepth). The 20 field samples were combined in the laboratory to form 5 test composites that were subjected to geologic analysis, physical/chemical analysis, biological toxicity, and tissue chemistry analysis following the guidelines in the *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual)* (EPA/USACE 1991) published jointly by the U.S. Environmental Protection Agency (EPA) and the USACE hereinafter referred to as the *1991 Implementation Manual*. The guidelines require that reference and control sediment samples be evaluated in the same manner as the test sediments. The testing of reference samples allows the biological responses and contaminant levels of a proposed dredged sediment to be compared to those of a potential disposal area. The experimental control sediments allow for the evaluation of the health and normal behavior of the test organisms.

In December 1992, the EPA released a Draft Environmental Assessment for San Francisco Bay Deep Water Dredged Material Disposal Site Designation (USACE 1992). The Draft Environmental Assessment described several offshore study areas and named three alternative ocean disposal sites. All three of the alternative sites are located off the continental slope (west of the continental shelf, approximately 50 nautical miles from the Golden Gate Bridge). The focus of this report is the comparison of the five test composites to the Deep Off-Shelf reference station (R-OS). The five test composites were also compared to two in-bay reference stations, the Bay Farm Borrow Area (R-BF) and the Alcatraz Environs Reference Area (R-AM). These comparisons are presented in Appendix L and M, respectively.

Geologic examination of the 20 stations included descriptions of sediment layers and other visually evident aspects of the sediment. Chemical analyses provided a characterization of the dredged sediment and included measurements of conventional parameters, EPA priority pollutant organics (polynuclear aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], and chlorinated pesticides), metals, and butyltins. Biological toxicity tests included controlled laboratory exposures of sensitive marine organisms to the solid-phase and suspended-particulate-phase (SPP) of the dredged material. Solid-phase and bioaccumulation tests examine the effects of the dredged sediment on sensitive benthic organisms relative to a reference sediment that represents a possible disposal site. Three species were exposed to the solid-phase test: the bentnose clam, *Macoma nasuta*; the polychaete, *Nephtys caecoides*; and the amphipod, *Rhepoxynius abronius*. The SPP toxicity tests are designed to test for the effects of dissolved contaminants plus those associated with the suspended particulates in the water column, after allowing for initial mixing of the dredged material. Three species were exposed to the concentrations of SPP: the mysid, *Holmesimysis costata*; the juvenile sanddab, *Citharichthys stigmaeus*; and the larvae of the bay mussel, *Mytilus edulis*.

Bioaccumulation potential was determined through a 28-day exposure of *M. nasuta* and *N. caecoides* to the solid-phase of the proposed dredged material, followed by chemical analyses of the tissues for the above EPA priority pollutant organics, metals, and butyltins. Contaminant levels in the tissues of the organisms exposed to the test treatments were statistically compared to the contaminant levels in the tissues exposed to the reference treatments. The purpose of these analyses was to provide information required to address potential ecological effects resulting from ocean disposal of the dredged material.

This report is divided into five sections. Section 1.0 is the introduction containing a brief overview. Section 2.0 describes the methods and materials used for sample collection, processing, biological testing, physical and chemical analyses of sediments and tissues, data analysis, and quality assurance requirements. Section 3.0 presents the results of geologic descriptions, biological testing, and physical and chemical analyses. Section 4.0 presents a discussion of the results and the conclusions. Section 5.0 lists the literature cited in support of this document. A series of appendixes contain detailed data listings for the following areas:

Appendix A	Materials and Methods Used for the Description of Sediment Cores
Appendix B	Core Data Logs
Appendix C	Sediment Chemistry and Quality Assurance Data
Appendix D-I	Toxicity Test Data
Appendix J-K	Tissue Chemistry and Quality Assurance Data
Appendix L	Potential Effects of Disposal of Oakland Harbor Intensive Study Sediments at the Bay Farm Borrow Area
Appendix M	Potential Effects of Disposal of Oakland Harbor Intensive Study Sediments at the Alcatraz Environs Reference Area

2.0 MATERIALS AND METHODS

2.1 SEDIMENT AND TEST ORGANISM COLLECTION

Sediment core samples were collected using either a 4-in. or 12-in. vibratory-hammer corer from 20 stations in Oakland Harbor. The sediment samples were collected to -44 ft MLLW (-42 ft plus 2 ft overdepth). Specific locations of sediment sampling stations are presented with the sampling results in Section 3.1. Four-inch core samples were collected and used for geologic description and sediment chemistry. Twelve-inch core samples were taken at each of the 20 stations and combined to form 5 sediment composites (COMPs). These five sediment composites were submitted for chemical analyses and used for biological testing of the sediments. In addition to the sediment samples, three reference station sediment samples were collected: four stations at the Bay Farm Reference Site, eight stations at the Alcatraz Environs Reference Site, and two stations at the Deep Off-Shelf Reference Site. Sediment was also collected from the three control stations. Reference and control sediment samples were collected to provide a comparison for sediment chemistry and biological testing. Biological testing required the collection of six species of marine organism; three of the species were collected in Northern California (*N. caecoides*, *C. stigmaeus*, and *H. costata*), and the remaining three species were collected in Western Washington (*R. abronius*, *M. nasuta*, and *M. edulis*).

2.1.1 Oakland Harbor Core Samples

Navigation support for locating the sampling stations in Oakland Harbor was provided by Towill, Inc., of Concord, California and included a survey vessel and operator. The surveyors used a laser/range azimuth positioning system (EDM-Geodimeter AGA-120, Wild T-2 one second theodolite). Towill provided corrected water depths at each station by measuring the actual depth with a recording fathometer (DE719-E), measuring the water surface elevation, and calculating the difference between the water surface elevation and 0 ft MLLW.

All stations were sampled to -44 ft MLLW using a 12-in. vibratory-hammer split corer and a 4-in. vibratory-hammer corer. Both samplers were designed by MSL and Manson Construction (Figure 2.1). The 12-in. corer was used to collect the large volume of sediment needed for biological testing and chemical characterization while minimizing contamination caused by excessive sample handling. The 4-in. cores were used to collect sediment for geologic descriptions and chemical characterizations at each station. The 4-in. cores were collected and stored in noncontaminating Lexan polycarbonate tubes which maintain the stratigraphic integrity of sediments and allow a geologist to describe the types of sediments present at each station.

Both the 12-in.- and 4-in.- core samplers were deployed from the Manson Construction derrick barge *Hagar*. The two sizes of cores were collected in a similar manner but the sediment samples were handled differently. The coring apparatus was attached to an electric vibratory

Vibratory-hammer Core

Core Cutter Head Assembly

FIGURE 2.1. Components of the 4-in. and 12-in. Vibratory-Hammer Coring Devices

hammer. The corer and the vibratory hammer were suspended by the crane on the derrick barge. When the coring apparatus was directly above the sampling station, the core was lowered through the water to the sediment surface. Then, for harder-packed sediments, the vibratory hammer was started and the corer penetrated down through the sediment to a project depth of -44 ft MLLW as indicated by the water surface level relative to marks on the outside of the core barrel. For soft sediment the weight of the coring apparatus caused penetration through the sediment without vibration; once harder material was reached, the hammer was turned on and the corer penetrated to project depth. The coring apparatus was then pulled from the sediment, detached from the vibratory hammer, and lowered onto the barge deck.

As each core was brought on board the barge platform, the hinged door of the core barrel was opened and the sediment was measured from the mudline downward to ensure that appropriate depth was reached. If the required core length was not achieved, the sediment in the core barrel was emptied and rinsed with seawater to prepare for a second core attempt. If the required core length was achieved on the second attempt, the sediment was marked at -44 ft MLLW.

After the core segments were measured, the appropriate amount of sediment (calculation of volume to be removed was based on the amount of sediment needed for chemical and biological analyses) was transferred, using a stainless steel spade, from the core barrel to an epoxy-coated 5-gal bucket. Each sample container was labeled with the project name, station or composite designation, contributing station(s), and the sampling date(s). The containers were sealed and kept cool (~4°C) in a freezer on board the sampling vessel until loaded into a refrigerated truck at the end of the sampling day.

Sediment was also collected to -44 ft MLLW using the 4-in.-diameter vibratory-hammer corer sampler; one core was collected per station. The core barrel was lined with a 3.125-in. (inner diameter) steam-cleaned Lexan core liner. When each core was brought on board, the liner was pulled from the barrel and the sediment measured from the mudline down to determine whether appropriate depth was reached. If not, the liner was replaced, and a second core sample was attempted. If the second core reached project depth, it was carefully carried to the cutting stand where it was capped, sealed, labeled, and if necessary, cut into shorter sections to fit in the freezer. Each core label included an arrow pointing to the top of the core, the station designation, core section indicator (i.e., Section 1 of 2 and Section 2 of 2), length interval from the mudline (i.e., 0-3 ft), and sampling date. When each 4-in. core was labeled and sealed, it was kept in a freezer on board the sampling vessel at ~4°C.

Detailed sampling records were maintained at each station and included: station name, date, type of core (12 in. or 4 in.), replicate number, uncorrected water depth, tide height, corrected water depth, required core length, sampling time, total core collected, and comments. At the end of

each sampling day, cores were off-loaded from the barge and stored in a refrigerated truck at the staging area. When sampling was completed, the inventory of the samples was confirmed and recorded on the MSL chain-of-custody forms. The custody forms were signed by the field leader, who kept one copy and sealed the others with the core samples. The refrigerated truck interior was maintained at 4°C while it transported the core samples to the MSL in Sequim, Washington.

2.1.2 Reference and Control Samples

Sediment samples from the 2 in-bay reference stations (R-AM and R-BF) were collected by Brezina and Associates using a grab sampler. The Deep-Off Shelf Reference (R-OS) was collected using a pipe dredge deployed from the *FV Cobra*, a charter boat owned and operated by Bob Smith Sportfishing. Sampling locations were determined by LORAN C and variable fix and range radar systems aboard the vessel or by a Raytheon Global Positioning System (GPS). The vessel navigation systems were verified at known fixed locations, such as the Golden Gate channel pilot buoy, whenever possible. Reference sampling records were maintained in a log book, and consisted of station position, date, time, replicate, water depth, sediment type, and comments. All reference samples were kept in labeled coolers on board the sampling vessel until they were off-loaded to the refrigerated truck.

The control sediment sampling stations were located in Sequim Bay, Washington; West Beach, Whidbey Island, Washington; and Dillon Beach/Tomales Bay, California. The control sediment from Sequim Bay, Washington (C-SB) was collected with a modified van Veen grab sampler (0.1 m²) deployed from an MSL research vessel. West Beach sediment (C-WB), was collected with a small, MSL-designed, anchor-dredge sampler that also obtains sufficient quantities of *Rhepoxynius abronius* for test purposes. The dredge was deployed from MSL's 17-ft Boston Whaler in approximately 15 ft of water. The West Beach sampling location was determined by reference to shoreline features. Dillon Beach (C-NE) control sediment was collected by Brezina and Associates, using a shovel, and was collected concurrently with the test organisms *N. caecoides* and *C. stigmatheus*. The Dillon Beach sediment was shipped overnight to the MSL, where it was stored at 4±2°C. The test organisms were also shipped to the MSL and maintained at proper holding conditions.

2.1.3 Test Organism Collection

Six species of marine organisms were used in Oakland Harbor toxicity tests:

- Benthose clam *Macoma nasuta*
- Polychaete *Nephtys caecoides*
- Phoxocephalid amphipod *Rhepoxynius abronius*
- Juvenile flatfish (sanddab) *Citharichthys stigmatheus*
- Juvenile mysid shrimp *Holmesimysis costata*
- Larvae of bay mussel *Mytilus edulis*

All of the organisms were wild-captured individuals collected either by a commercial supplier or by the MSL. *M. nasuta* were collected from intertidal zones in Discovery Bay near Gardiner, Washington, by a commercial supplier using a shovel, sieve, and bucket. In the field, clams were kept cool in large containers filled with sediment and seawater from the collection station.

R. abronius were collected by MSL off West Beach, Whidbey Island, using the specially designed anchor dredge deployed from a 17-ft Boston Whaler. Sediment brought up with the dredge was sieved through a 2-mm mesh screen to remove large debris and predatory species. During sampling, the amphipods were kept in coolers partially filled with their native sediment and seawater until delivery to a holding tank at the MSL.

Brezina and Associates (Dillon Beach, California) supplied *N. caecoides*, *C. stigmaeus*, and *H. costata* individuals for toxicity testing. *N. caecoides* were collected from mud flats in Tomales Bay, California, using a shovel, bucket, and sieve. *N. caecoides* were placed into clean coolers containing sediment and seawater from the collection station. Prior to overnight shipment to the MSL, the seawater in each cooler was supersaturated with oxygen (22 ppm). The *C. stigmaeus* were collected from Tomales Bay, California, in 12 to 15 ft of water. *C. stigmaeus* were captured with a small trawl with a 0.25-in. mesh net. The trawl was held close to the work boat so a dip net could be used to transfer *C. stigmaeus* into double plastic bags containing oxygen-saturated seawater. *H. costata* were collected wild capture with a plankton dip net and transferred to a holding container aboard the work boat, where they were sorted by appropriate age and size class and then shipped to the MSL in bags containing oxygen-saturated water.

2.2 SEDIMENT SAMPLE PREPARATION

According to the 1991 *Implementation Manual*, sediments must be initiated into biological tests within 14-days of sample collection. In the 14-day holding period the core samples were received at the MSL and inventoried against the chain of custody, processed for solid-phase and SPP testing, and initiated into the appropriate biological tests. The following sections describe equipment preparation, geologic descriptions of core samples, and preparation of sediments for solid-phase and SPP tests.

2.2.1 Laboratory Glassware and Equipment Preparation

All glassware, stainless steel utensils, plastic, laboratory containers and equipment undergo stringent cleaning procedures to avoid contamination of sediment samples. Glassware, including test containers, aquaria, and sediment transfer equipment, were washed with warm, soapy water, rinsed five times with deionized water, then soaked in a 5% reagent grade nitric acid bath for a minimum of 4 h. After soaking, glassware was rinsed with deionized water five times and allowed to dry. Titanium tools, PVC, Nalgene, and other plastic items such as funnels were washed and soaked in acid baths in the same manner as glassware.

Stainless steel bowls, spoons, spatulas, and other utensils were washed with warm, soapy water, rinsed five times with deionized water, and allowed to air dry. They were then rinsed with methylene chloride under a fume hood and allowed to evaporate under the hood before use.

Rubber stoppers and other porous materials were washed with warm, soapy water and rinsed five times with deionized water. These items were then "seasoned" by continuous soaking in or exposure to 0.45- μ m-filtered seawater for at least 2 days prior to use.

Large pieces of laboratory equipment such as the epoxy-coated mixer used to mix sediment and epoxy-coated boards used to hold cores for geologic descriptions were washed with mild soap solution and thoroughly rinsed with tap water followed by deionized water.

Equipment used for water quality such as pH, dissolved oxygen, temperature, and refractometers, were calibrated according to suggested manufacture dates or as specified in MSL Standard Operating Procedures (SOPs).

2.2.2 Geologic Description of Cores

A geologic characterization of each Oakland Harbor sampling station was conducted by an MSL geologist. The description was performed on the 4-in. core collected and stored in the Lexan core tube which maintained the stratigraphic integrity of the sediment. All core sections from one station were removed from storage and cut longitudinally with a circular saw. A linoleum knife was used to split the core open to expose the sediment stratigraphy. The geologist measured and described the core from top to bottom, recording data on a core data log. The geologic characterization protocol (Appendix A) was consistent with ASTM Method D2488-84 (ASTM 1984).

2.2.3 Preparation of Solid-Phase Samples

Solid-phase, also called bulk sediment or whole sediment, refers to the sediment itself, as opposed to suspended or dissolved phases. In biological tests, the solid-phase of sediments can be from the test sediment (represents dredged material once it has settled at an aquatic disposal site), the reference sediment (the existing environment of a disposal site without dredged material), or the control sediment (environment of a benthic test organism). When referring to all three sediment types, the test, reference, and control, the term sediment treatment will be used.

All of the sediment used for biological testing came from stations that were combined to yield five sediment composites. The compositing scheme was provided by USACE prior to field sampling. Individual stations were sampled with the 12-in. vibratory-hammer corer, and specific and equal volumes from each station were removed and placed in the appropriate labeled bucket. The labeled buckets with the appropriate composite name were then sent back to the MSL for processing. The procedure for homogenizing Oakland Harbor test sediment composites involved placing the sediment in a mixer coated with a special epoxy paint and mixing the sediment with

minimal amounts of 0.45- μ m-filtered seawater to achieve a homogeneous consistency. Once a sediment composite was thoroughly homogenized it was referred to as a sediment treatment, indicating that all the necessary sample processing was completed and the sediment could be chemically analyzed and used in testing. Sample aliquots for chemical analyses were placed in cleaned and labeled containers appropriate for the parameters to be measured. Solid-phase sediment treatments not used immediately were returned to the labeled, epoxy-coated metal buckets and stored at 4°C.

The reference and control sediment sample processing involved sieving prior to compositing. To perform the sieving process, sediments were placed on screens having mesh diameters of 0.5 or 1.0 mm, depending on sediment type, and dry sieved into clean epoxy-coated buckets. Depending on the sediment consistency, measurable amount of 0.45- μ m filtered seawater may have been added to ensure thorough mixing. Any sediment or organisms collected on the sieves were discarded because they could endanger the safety of the test organisms. Small amounts of debris, such as shells or wood chips, were placed into the collection bucket to preserve the physical nature of the sediment. At the end of the mixing period, the sediment was stored at 4°C until needed for testing. Between sieving of reference sediments, all equipment was thoroughly rinsed with 0.45- μ m-filtered seawater to avoid potential cross-contamination of samples.

2.2.4 Preparation of Suspended-Particulate-Phase

The SPP of sediment composites was used to evaluate water column effects of open-water dredged material disposal. The SPP is the liquid supernatant that remains after mixing sediment with seawater and allowing heavier particles to settle to the bottom. Because SPP preparation does not involve filtration, this phase contains suspended particles as well as dissolved constituents. The SPP tests evaluate effects caused by both the physical presence of the suspended particles and the chemical toxicity of contaminants associated with the particles or dissolved fractions. The process is intended to approximate exposure conditions created as a result of materials being discharged through the water column during dredge-disposal operations.

The first step of SPP preparation was creating a 4:1 (volume:volume) water to sediment slurry in 1-L glass jars with Teflon-lined lids. The jars were marked at 200 mL and 400 mL with 0.45- μ m-filtered seawater added to the 200-mL mark, and homogenized sediment added until the water was displaced to the 400-mL mark. The jar was filled to 1 L with filtered seawater. A set of 12 jars of sediment and water were placed on a shaker table and agitated for 30 min at a shaking rate of 120 to 150 cycles/min. After shaking, the slurry was poured into 500-mL Teflon containers with tightly fitted lids. These containers were placed in a centrifuge and spun for 10 to 15 min at approximately 1750 rpm. The 10-min centrifugation was necessary to ensure that test organisms would be visible at the first observation after exposure to SPP test treatments. After

centrifugation, the supernatant was poured into clean 10-gal aquaria for use in the SPP tests as soon as possible while the remaining sludge mixture was discarded. If SPP was not used immediately, the aquaria were stored at 4°C. The Teflon jars were rinsed out after each use and the above process was continued until an adequate amount of SPP was produced. Between different sediment SPP preparations, all glass and Teflon containers were appropriately cleaned according to procedures described in Section 2.2.1.

2.3 TOXICOLOGICAL TESTING PROCEDURES

Biological tests including solid-phase, bioaccumulation and SPP were performed at the MSL in Sequim, Washington. These tests assess distinct ecological effects of aquatic disposal of dredged material from the Oakland Harbor Intensive Study.

The solid-phase tests were used to assess the acute toxicity potential of dredged material after settling at an aquatic disposal site. Three species of marine organisms were exposed to the sediment composites from Oakland Harbor, reference area sediment, and control sediment. Two acute toxicity tests were conducted: 1) a 30-day solid-phase flow-through acute toxicity test using the polychaete, *N. caecoides* and the clam, *M. nasuta*, and 2) a 10-day solid-phase static test using the amphipod, *R. abronius*.

The bioaccumulation test was a 28-day exposure of *N. caecoides* and *M. nasuta*. The purpose of the bioaccumulation test was to assess the potential for bioaccumulation of contaminants from the sediment into the tissues of the organisms. The sediment treatments and procedures were similar to the 10-day test except they involved a longer exposure period, larger test population, and depuration process for surviving *M. nasuta* and *N. caecoides*.

The SPP tests evaluate effects caused by the physical presence of suspended particles and the toxicity of chemical contaminants associated with the particles or dissolved into the water after release. Three marine species were used in these tests: mysids (*H. costata*), juvenile sanddabs (*C. stigmaeus*), and larvae of the bay mussel (*M. edulis*). The SPP treatments were prepared as described in Section 2.2.4. For each SPP treatment, there were five replicates of each of the four SPP concentrations: 0% (MSL filtered seawater), 10%, 50%, and 100% SPP.

The MSL facilities provided the required conditions for flow-through solid-phase tests, static solid-phase tests, and static SPP tests. Laboratory equipment providing these testing conditions included a controlled-temperature environment, flow-through seawater supply, lighting control, and air supply.

2.3.1 10-Day Solid-Phase Static Test with *R. abronius*

The amphipods were kept in a large holding tank containing their native sediment with flowing 15°C seawater. Organisms were not fed during the holding period, which was less than 2 weeks before test initiation.

The *R. abronius* test was conducted in 1-L glass mason jars (Figure 2.2) placed in random positions on a water table maintained at 15°C. Prior to test initiation, test sediment was added to the jars to a depth of 2 cm, and then slowly filled with a 0.45- μ m-filtered seawater to a volume of 750 mL. The jars were aerated and placed on the water table overnight to stabilize temperature to test conditions. After settling, initial water quality parameters were measured in each container and recorded on water quality forms.

The amphipods were gently sieved from the holding tank into clean seawater and counted into small transfer containers. The number of organisms was then confirmed by a second observer before the amphipods were transferred into the test container. Initiation of testing began by adding 20 *R. abronius* to each test container. The date and time of initiation were recorded on data forms. *R. abronius* were observed daily during the test, and the number of organisms floating on the surface, swimming in the jar, or on the sediment surface was recorded on observation forms. Amphipods that were floating on the surface were gently pushed below the water surface with a pipette tip and observed as they either buried or did not rebury into the sediment.

Water temperature, salinity, pH, and DO were measured daily in one replicate of each sediment treatment, and in all containers at initiation and termination of the bioassay. Acceptable ranges for water quality parameters during the experiment were

Dissolved Oxygen	≥ 6.0 mg/L
pH	ambient ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	$15^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$.

At the end of the test (day 10), the contents of each jar were sieved through a 0.5-mm Nytex screen to collect the *R. abronius*. The organisms were placed in clean seawater in a glass dish labeled with the sediment treatment and replicate number. The number of live and dead organisms was counted, and if necessary, examined under a dissecting microscope. The presence or absence of body parts recovered at the end of the test was also noted. If a *R. abronius* did not respond to gentle probing after several minutes of observation, it was considered dead. At least 10% of the mortality counts were confirmed by a second observer.

A 96-h reference toxicant test was also conducted to establish the health and expected response of the test organisms. The reference toxicant test was conducted in the same manner as the 10-day solid-phase test. *R. abronius* were exposed to a seawater control plus four

FIGURE 2.2. Static Mason Jar for *R. abronius* Toxicity Test

concentrations of cadmium chloride (0, 0.25, 0.5, 1.0 and 2.0 mg/L as Cd). There were three replicates of each treatment.

2.3.2 10-Day Solid-Phase Flow-Through Test with *N. caecoides* and *M. nasuta*

Prior to testing, *N. caecoides* were held in their native sediment in shallow trays covered with well-aerated 15°C seawater from a gravity-fed flow-through system. *M. nasuta* were held in large water tables or holding tanks containing clean sediment with flow-through 15°C seawater. Temperature, pH, dissolved oxygen (DO), and salinity of water in each holding tank were monitored daily. The organisms were not fed during the holding period.

The flow-through test with *M. nasuta* and *N. caecoides* was conducted in 10-gal aquaria placed in random positions on water tables. Figure 2.3 shows the system used for flow-through tests. Each aquarium was filled with approximately 8 L of sand-filtered seawater via the flow-through system. Then, sediment was added to a depth of 3 cm by measuring the required amount (3870 mL) into a glass container, and pouring it into the aquaria while washing with seawater to distribute the sediment evenly over the bottom. The flow-through system was initiated, and aquaria were allowed to fill to a total volume of approximately 36 L. For 4 h, suspended materials in the aquaria were allowed to settle and the flow-through system was adjusted and calibrated to deliver 125 ± 10 mL/min of seawater flow to each aquarium. The system was allowed to operate overnight before the addition or initiation of organisms.

To initiate the test, 20 *M. nasuta* and 20 *N. caecoides* were collected from the holding tanks and placed in each aquarium. The label on each test aquarium included: initiation time/date and the initials of the examiner who placed the organisms in each chamber. Water quality parameters (noted below) were measured daily in at least one replicate of each sediment treatment and recorded on water quality data sheets. (Water quality data are provided in Appendix D). The water quality parameters and ranges established for the tests were

Dissolved Oxygen	≥ 6.0 mg/L
pH	ambient ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	$15.0^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$
Flow Rates	125 ± 10 mL/min.

Daily observations of test-animal behavior were made and recorded on data forms. The number of *M. nasuta* on the sediment surface and the number of those with their siphons exposed were noted, as well as the number of *N. caecoides* on the sediment surface and the number of those with only their heads exposed. In addition, the number of dead organisms in each aquarium was recorded on daily observation forms. Dead organisms were removed from the aquaria and incinerated; no replacement of dead organisms occurred during testing. If any dead *N. caecoides* was removed, the specimen was identified as a whole animal, a head, or a tail portion.

FIGURE 2.3. Flow-Through Aquaria for *M. nasuta* and *N. caecoides* Toxicity Tests

At the end of the 10-day test, water quality measurements were performed in all replicates and the contents of each aquarium were gently passed through a 1.0-mm Nytex screen to recover the *N. caecoides* and *M. nasuta*. The organisms were placed in glass baking dishes labeled with the sediment treatment number. At this time, the number of dead and live organisms of each species was counted. Death was determined by observing whether the *N. caecoides* reacted to gentle probing; if there was no movement, the organism was considered dead. Death of *M. nasuta* was determined by the presence of gaping shells. The mortality data were recorded on the termination forms. At least 10% of the mortality counts were confirmed by a second observer.

2.3.3 28-Day Solid-Phase Flow-Through Test with *N. caecoides* and *M. nasuta*

The procedure for conducting the 28-day solid-phase flow-through test with *N. caecoides* and *M. nasuta* was identical to that of the 10-day test with three exceptions: 1) the number of organisms was increased to 25 *M. nasuta* and 55 *N. caecoides* because more individuals were needed to produce enough tissue for chemical analysis; 2) the exposure period was increased from 10 to 28 days; and 3) the surviving test organisms were depurated and tissues were sampled for chemical analysis. The ranges for water quality parameters as well as the test conditions, such as temperature and flow rate, were the same in the 28-day test as for the 10-day test. Water quality parameters were measured and mortality of the test organisms monitored at the same frequency for both tests.

When the 28-day test was terminated, the living *M. nasuta* and *N. caecoides* were collected for chemical evaluation of bioaccumulation. To ensure that tissue chemistry results would not be biased by contaminants associated with sediment grains in the digestive tract, the test organisms were allowed to depurate, or void the digestive tract, for 48 h following the 28-day exposure. The surviving *N. caecoides* from one test aquarium were placed in another flow-through 10-gal aquarium with approximately 2 in. of clean sediment in the bottom. Clean sediment was necessary only for *N. caecoides* because these organisms require sediment to surround their tissues to survive. The animals were not fed during the depuration period. The surviving *M. nasuta* were contained in a glass baking dish (without sediment), and placed in the depuration aquarium containing the *N. caecoides* from the same sediment treatment and replicate. After 48 h of depuration, the *M. nasuta* shells were cleaned with a scrub brush, and the tissues were removed using titanium knives. The tissues were placed into clean jars and submitted for chemical analysis. The *N. caecoides* were gently washed in clean seawater to remove external sediment grains and put in containers for chemical analysis.

2.3.4 96-h Suspended-Particulate-Phase Test with *C. stigmaeus*

The test chambers for the SPP test with *C. stigmaeus* were 10-gal aquaria randomly positioned on the water tables, with 20 to 24 aquaria per table. Test temperature was maintained

by a circulating water bath on the water table. Aeration was provided through a glass pipette connected by silastic tubing to an overhead air manifold. Aquaria were labeled with a sediment treatment code, concentration, and replicate number. The volume of test material in each aquarium was 16 L. To obtain the 100% SPP treatment, 16 L of 100% SPP was added directly to the aquarium; the 0% SPP treatment was 16 L of 0.45- μ m-filtered Sequim Bay seawater. To prepare the 10% and 50% SPP concentrations, appropriate volumes of 100% SPP and 0.45- μ m-filtered Sequim Bay dilution water were mixed directly in the test aquaria and filled to a volume of 16 L.

After SPP preparation and placement of containers on the water table, aeration was started and initial water quality parameters were measured in all replicates. Ten *C. stigmaeus* were then removed from the holding tanks, using a net, and added to each test container. The test population for each concentration was 50 individuals (200 individuals per SPP treatment). Initiation time and date were documented on test containers and data forms.

C. stigmaeus were not fed during the 96-h exposure. After initiation, DO, pH, salinity, and temperature were measured daily in at least one replicate. Acceptable ranges for the water quality parameters during the experiment were

Dissolved oxygen	≥ 6.0 mg/L
pH	ambient ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	$15.0^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$.

Observations of *C. stigmaeus* activity and behavior in each test container were made at test initiation and at 4, 24, 48, and 72 h. An organism was considered dead if it did not respond to gentle probing.

Before termination of the test at 96 h, water quality parameters were measured in all replicates. At 96 h, the number of live and dead organisms was counted in each test container. As a quality control check, a second observer confirmed at least 10% of the mortality counts.

A 96-h reference toxicant test was also conducted to establish the health and expected response of the test organisms. The reference toxicant test was conducted in the same manner as the SPP tests. *C. stigmaeus* were exposed to a seawater control plus four concentrations of copper sulfate (0, 0.5, 1.0, 1.5, and 2.0 mg/L as Cu). There were three replicates of each treatment.

2.3.5 96-h Suspended-Particulate-Phase Test with *H. costata*

Prior to testing, *H. costata* were held for at least 48 h in flow-through aquaria maintained at test temperature (15°C). *H. costata* were fed finely ground, flaked fish food twice a day, and water quality parameters in the holding tanks were monitored daily.

The test containers for the *H. costata* test were 400-mL glass jars placed in random positions on water tables. Test temperature was maintained by immersing these containers in a circulating water bath. Aeration was provided through a pipette connected by silastic tubing to an overhead air manifold. Appropriate volumes of 100% SPP and 0.45- μ m-filtered Sequim Bay dilution water were added to clean gallon jars to make 0%, 10%, 50%, and 100% SPP concentrations for the *H. costata* test. A total of 1500 mL was prepared for each dilution to achieve the test volume of 300 mL in each replicate. The test containers were labeled with a sediment treatment code, concentration, and replicate number.

After the concentrations were prepared and placed on the water table, gentle aeration was started and water quality was measured in all replicates. *H. costata* were then removed from the holding tanks, using a wide-bore pipette. To initiate the test, 10 individuals were added to each container to produce a test population of 50 individuals per concentration (200 individuals per treatment). The test initiation time and date were documented on data forms. After test initiation, water quality parameters were measured in one replicate. The parameters for this test were

Dissolved oxygen	≥ 4.0 mg/L
pH	ambient ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	$15.0^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$.

Observations of test organisms were made at test initiation and at 4, 24, 48, and 72 h, using a light table to enhance visibility of the *H. costata*. During the 96-h exposure, *H. costata* were fed small amounts of ground flaked fish food at 4, 24, 48, and 72 h. Excess food was removed with a small pipette before daily observations, using extra caution not to disturb test animals. Molted exoskeletons and any particulates from the SPP solution that had precipitated were also removed.

Prior to test termination, water quality parameters were measured in all replicates. At 96 h, the number of live and dead animals was counted in each test container. An organism was considered dead if it did not respond to gentle probing. As a quality control check, a second observer confirmed surviving test organisms in at least 10% of the mortality counts.

A 96-h reference toxicant test was also conducted to establish the health and expected response of the test organisms. The reference toxicant test was conducted in the same manner as the SPP tests. *H. costata* were exposed to a seawater control plus four concentrations of copper sulfate (0, 50, 100, 200 and 500 μ g/L as Cu). There were three replicates of each treatment.

2.3.6 72-h Suspended-Particulate-Phase Test with Larval *M. edulis*

Prior to testing, adult *M. edulis* were kept in flow-through holding tanks at ambient temperature. The test chambers for the bivalve larvae test were 1-L glass mason jars in which

dilutions of SPP for the bivalve test (0%, 10%, 50%, and 100%) were directly prepared. The dilution water consisted of off-shore Strait of Juan de Fuca seawater screened at 20 μm . This off-shore water was collected to reduce the risk of using nearshore water, which might have algal blooms. Algal blooms may or may not affect the mussels, but the precaution was taken. The final volume of test material in each container was 300 mL. Test chambers containing SPP were placed in random positions on a water table and gentle aeration was started. Initial water quality parameters were measured in all replicates once the containers had reached test temperature ($16^{\circ}\text{C} \pm 2^{\circ}\text{C}$).

Adult *M. edulis* were induced to spawn by placing individuals in seawater that was quickly warmed to 20°C . Broodstock mussels were maintained at 20°C seawater for 45 min with dissolved oxygen levels monitored periodically. If no spawning occurred within 1 h, adult mussels were removed from the water and allowed to air dry for approximately 15 min while 20°C water was replenished.

Most adults had spawned within 1 h. As new adults were observed spawning, mussels were removed from the 20°C holding container, and placed in individual baking dishes for the collection of gametes. Sperm from up to three males was pooled and screened through 35- μm mesh to remove debris. The pooled sperm was then introduced to containers of egg suspension and allowed to fertilize. The egg suspensions were mixed frequently using a perforated plunger over a period of 90 to 140 min, at which time development of the embryos was assessed. The egg suspensions with a high percentage of embryo development were pooled into a common stock for use in the test. The pooled egg suspension was screened through 75- μm mesh to remove debris, and then retained on a 20- μm screen to rinse away excess sperm. Finally, the eggs were rinsed from the 20- μm screen into a clean container and diluted with seawater.

To estimate fertilization success and embryo density, a 1-mL sample was removed from the container (after thorough mixing) and diluted to 100 mL with seawater. Three, 1-mL samples were removed from this 100:1 suspension, and the number of developing embryos and non-fertilized eggs was scored using a Sedgewick-Rafter counting chamber on a compound microscope at low magnification. The mean number of embryos from the replicate counts was multiplied by 100 (to correct for the dilution factor) to estimate the density of embryos in the egg stock. The resulting density of embryos/mL was used to calculate the amount of embryo stock to add to each test container as well as to calculate percent fertilization.

To initiate the test, the appropriate volume (based on the density) of bivalve embryo stock solution was pipetted into each test container to yield a density of 25 embryos per mL in the containers of test material. A perforated plunger was used to thoroughly mix the contents of the stock container before removing each aliquot with the pipette. The test initiation date and time were recorded on data forms. To obtain the actual embryo stocking density, 10-mL subsamples

were removed from 14 control containers (two replicates per treatment control) 1 h after test initiation, and after mixing the contents of the container with the perforated plunger. Each subsample was placed in a labeled vial, fixed with 1 mL of 50% formalin, and scored for the number of fertilized eggs.

Water quality parameters were measured in one replicate of each dilution 24 h after test initiation. Acceptable ranges for water quality parameters during the experiment were

Dissolved oxygen	≥ 4.0 mg/L
pH	ambient ± 0.5 units
Salinity	31 ± 2.0 ‰
Temperature	$16.0^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$.

The bivalve test was terminated after 72 h, when development of D-shaped larvae predominated in control containers. Final water quality measurements were recorded for all replicates. Then, each chamber was homogenized with the perforated plunger, and a 10-mL aliquot was removed with a calibrated pipette and placed in a labeled vial containing 1 mL of 50% formalin. Samples were scored for the appearance of normal D-shaped larvae, abnormally developed larvae, blastula-stage larvae, and total number of larvae. At least 10% of the counts were confirmed by a second observer.

A 48-h reference toxicant test was also conducted to establish the health and expected response of the test organisms. The reference toxicant test was set up and conducted in the same manner as the SPP tests. *M. edulis* larvae were exposed to a seawater control plus four concentrations of copper sulfate (3 $\mu\text{g/L}$, 9 $\mu\text{g/L}$, 30 $\mu\text{g/L}$, and 100 $\mu\text{g/L}$ as Cu). There were three replicates of each treatment.

2.4 SEDIMENT AND TISSUE CHEMISTRY PROCEDURES

Oakland Harbor sediment treatments were analyzed for conventional and chemical parameters. Conventional parameters are: grain size, TOC, TVS, oil and grease, total petroleum hydrocarbons and percent solids. Chemical analyses are polynuclear aromatic hydrocarbons (PAHs), chlorinated pesticides, polychlorinated biphenyls (PCBs), metals, and butyltins. Table 2.1 lists the parameters for which the Oakland Harbor sediment treatments were analyzed and shows the quality assurance ranges and detection limits for each parameter. Oakland Harbor tissues of *N. caooides* and *M. nasuta* were analyzed for the same set of PAHs, chlorinated pesticides, PCBs, metals, and butyltins as illustrated in Table 2.2.

The following sections briefly describe the methods used for analysis of sediments and tissues for the required physical and chemical parameters. Analyses followed established EPA procedures where applicable. Quality control samples included method blanks, matrix spike (MS) analyses, standard reference materials (SRMs), and analytical replicates. The MS and

TABLE 2.1. Analytical Chemistry Requirements for Oakland Harbor Sediment Treatments

Parameters	Detection Limits (a) (mg/kg dry wt)	Number of Samples	Range of Recovery (%)	Relative Precision (%)
<u>Sediment Conventional</u>				
TOC	0.1%	36	NA (b)	10
Oil and Grease	20	36	50 - 150	20
TPH	20	36	50 - 150	20
Grain Size	1.0 %	36	NA	20
Total Solids	1.0 %	36	NA	10
TVS	0.1%	36	NA	20
<u>Metals</u>				
Ag	0.02	36	75 - 125	20
As	2.5	36	NA	20
Cd	0.1	36	75 - 125	20
Cr	33	36	NA	20
Cu	5.5	36	NA	20
Hg	0.01	36	75 - 125	20
Ni	7.5	36	NA	20
Pb	6.2	36	NA	20
Se	0.1	36	75 - 125	20
Zn	7.8	36	NA	20
<u>Organic Compounds</u>				
Butyltins	0.01	36	40 - 120	30
PCBs(c)	0.02	36	40 - 120	30
PAHs(d)	0.02	37	40 - 120	30
Pesticides(e)	0.002 - 0.03	36	40 - 120	30

(a) Target detection limits; all efforts were made to reach lowest practical detection limits.

(b) Not applicable.

(c) Reported as Aroclor equivalents 1242, 1248, 1254, and 1260 and total PCB. Analyzed using EPA Method 8080.

(d) All compounds on EPA Method 610 list. Analyzed using Method 8270 in SIM mode.

(e) All compounds on EPA Method 608 list. Analyzed using Method 8080.

SRM were used as a measurement of analytical accuracy. The analytical replicates were used to evaluate analytical precision.

2.4.1 Conventional Sediment Measurements

Conventional sediment measurements consist of grain size, total organic carbon (TOC), total volatile solids (TVS), oil and grease and total petroleum hydrocarbons (TPH), and percent solids. The procedures for each of these analyses are discussed in the following paragraphs.

TABLE 2.2. Analytical Chemistry Requirements for Oakland Harbor Tissue Samples

<u>Parameters</u>	<u>Detection Limits (a) (mg/kg dry wt)</u>	<u>Number of Samples</u>	<u>Range of Recovery (%)</u>	<u>Relative Precision (%)</u>
<u>Metals</u>				
Ag	0.1	90	75 - 125	20
As	2.0	90	NA(b)	20
Cd	0.1	90	75 - 125	20
Cr	1.0	90	75 - 125	20
Cu	4.3	90	NA	20
Hg	0.01	90	75 - 125	20
Ni	1.0	90	75 - 125	20
Pb	1.0	90	75 - 115	20
Se	1.0	90	NA	20
Zn	35	90	NA	20
<u>Organic Compounds</u>				
Butyltins	0.01	90	40 - 120	30
PCBs (c)	0.02	90	40 - 120	30
PAHs (d)	0.02	90	40 - 120	30
Pesticides(e)	0.002	90	40 - 120	30

(a) Target detection limits; all efforts were made to reach lowest practical detection limits.

(b) Not applicable.

(c) Reported as Aroclor equivalents 1242, 1248, 1254, and 1260 and total PCB, EPA Method 8080.

(d) All compounds on EPA Method 610 list. Analyzed using Method 8270 in SIM mode.

(e) All compounds on EPA Method 608 list. Analyzed using Method 8080.

Grain size analysis was conducted by Soil Technology, Inc., of Bainbridge Island, Washington. Sixteen grain size fractions were determined by a combination of sieve and pipette techniques from the Puget Sound Estuary Program (PSEP) Protocols for Measuring Selected Environmental Variables in Puget Sound (PSEP 1986). These methods are consistent with ASTM D2217 (ASTM 1985) and D422 (ASTM 1972) (with the substitution of the No. 100 sieve for the No. 140 sieve). An additional measurement for salt content was performed and each grain size fraction was corrected for this salt measurement. Table 2.3 presents the fractions measured.

Approximately 25 g of each sediment sample was analyzed for total solids while another 10-g to 100-g aliquot was weighed for grain size analysis. To separate the coarser sand and gravel fraction from the silt/clay fraction, sediment was washed with distilled water through a 63.5- μ m (4.0 phi) sieve into a 1-L graduated cylinder. The coarse fraction was dried, weighed, and shaken through a nest of sieves to yield the required seven coarse subfractions. Any material still passing through the final 63.5- μ m sieve was added to the previous fines in the

TABLE 2.3. Grain Size Fractions Measured

<u>Grain Size (μm)</u>	<u>Phi</u>	<u>Screen Number</u>
4750	-2	4
2000	-1	10
850	0	20
425	1.5	40
250	2	60
149	3	100
75	3.75	200
62.5	4	230
48	4.5	NA ^(a)
31.2	5	NA
23	5.5	NA
15.6	6	NA
7.8	7	NA
3.9	8	NA
1.9	9	NA
0.976	10	NA
0.4883	11	NA

(a) Not applicable.

1-L graduated cylinder. The silt/clay fraction was then subdivided by a pipette technique based on Stoke's Law of differential settling velocities for different sized particles. The silt/clay fraction was disassociated by a dispersant (sodium hexametaphosphate) in distilled water in a 1-L graduated cylinder. At specified time intervals and specified depths below the surface, 20-mL aliquots were withdrawn from the graduated cylinder, delivered to a preweighed container, and dried at $90^{\circ} \pm 2^{\circ}\text{C}$ to a constant weight. Triplicate analysis of two samples was performed as a quality control measure. Other quality control measures, such as spikes, SRMs, or minimum detection limits, do not apply to grain-size analysis.

Analysis of total volatile solids was performed at the MSL. Total volatile solids are a measure of the fraction of total solids that are lost on ignition at a higher temperature than that used to determine total solids. The TVS measurements are used as an estimate for the amount of organic matter in the total solids. Operationally, TVS are defined by the combustion temperature, and do not always represent the organic content of a sample because some of the more volatile organic material may be lost during drying and some inorganic material may be lost during combustion. To perform TVS analysis, the MSL follows PSEP (1986). First the sample was oven dried to constant weight and then removed, weighed, and combusted at 550°C . The sample was cooled in a desiccator and then reweighed. The amount of sample lost during ignition was then defined as the volatile solids fraction. Quality control measures included two method blanks (one per batch), and two sets of triplicate analysis.

Analysis of TOC was performed by Global Geochem in Canoga Park, California. Total organic carbon is the amount of nonvolatile, partially volatile, volatile, and particulate organic carbon compounds in a sample. Each sediment treatment was dried and ball milled to a fine powder. Before combustion, inorganic carbon in the sample was removed by acidification. The TOC in sediment was then determined by measuring the carbon dioxide released during combustion of the sample (EPA 1986a), reported as percent of dry weight. Quality control measures included five method blanks and one triplicate analysis per batch (two batches).

Total oil and grease and total petroleum hydrocarbons were performed by Analytical Resources Inc., (ARI) at Seattle, Washington. Total oil and grease includes vegetable oils, animal fats, soaps, waxes, and any other carbon-hydrogen material extractable by the solvent Freon. Total petroleum hydrocarbons comprise the nonpolar mineral fraction of total oil and grease that is not removed by silica gel absorption. Infrared spectrophotometry (IR) was used to determine concentrations of oil and grease (Method 413.2, EPA 1979) and petroleum hydrocarbons (Method 418.1, EPA 1979). A 20-g aliquot of sample was dried with anhydrous sodium sulfate, then extracted with Freon. For total oil and grease, sample extracts were scanned from 4000 to 600 cm^{-1} on an infrared spectrophotometer and the peak height measured at 2930 cm^{-1} . Since this wavelength represents the $-\text{CH}_2$ configurations of hydrocarbons, it was the standard used to determine oil and grease. For total petroleum hydrocarbons, silica gel was added to the extract to remove the more polar animal- and vegetable- based oils. The extract was then shaken and allowed to settle. An aliquot was then removed and scanned the same way as the oil and grease sample. The relationship of peak height to oil concentration was determined by regressing the peak height versus a known concentration of fuel oil. Quality control measures include two blanks, a matrix spike/matrix spike duplicate (oil and grease), two matrix spike/matrix spike duplicates (TPH), and one analytical triplicate per batch. Two batches were performed for oil and grease and TPH.

2.4.2. Semivolatile Organic Compounds

Analyses for PAHs in the Oakland Harbor sediment treatments and *M. nasuta* tissues were performed by the MSL in Sequim, Washington, and for *N. caecoides* tissues at Battelle Ocean Sciences (BOS) in Duxbury, Massachusetts. The semivolatile organic compounds analyzed in sediments were the 16 PAHs listed in EPA Method 610. These compounds were extracted by the NOAA status and trends method (Krahn et al. 1988) which involves multiple extractions on an ambient roller using methylene chloride as the extraction solvent. A portion of the extract was used for PAH analysis by gas chromatography/mass spectroscopy in the Selective Ion Mode (GC/MS SIM) following EPA SW-846 Method 8270 (EPA 1986b). Tissue extracts were run through gel permeation chromatography (GPC) prior to analysis to remove any additional interferences.

Quality control measures included at least one method blank per batch. A matrix spike solution consisting of all 16 PAH compounds was added to each sample for both sediment and tissue to assess the accuracy of the measurement. One matrix spike was performed for each batch. A standard reference material (SRM) was used to assess the accuracy of the measurement. This SRM for sediments was National Institute of Science and Technology (NIST) SRM 1941. The SRM for the tissues was NIST SRM 1974. One sample in each batch was analyzed in triplicate to assess precision.

2.4.3 Chlorinated Pesticides and PCBs

The PCB and pesticide analyses for Oakland Harbor sediment and *M. nasuta* tissue samples were performed by the MSL in Sequim, Washington, and for *N. caecoides* tissues at BOS in Duxbury, Massachusetts. Chlorinated pesticides and PCBs in sediments and tissues were quantified by gas chromatography/electron capture detection (GC/ECD) following EPA SW-846 Method 8080 (EPA 1986b).

Chlorinated pesticides and PCBs were extracted simultaneously with the PAH compounds using the ambient roller technique as described for PAHs. The procedure involved multiple methylene chloride extractions. A portion of the methylene chloride extract was solvent-exchanged to hexane, and interferences were removed by passing the extract through a column packed with deactivated alumina and silica by the NOAA status and trends method (Krahn et al. 1988). Most samples required an additional cleanup treatment using HPLC to remove other interferences. Analytical quantification was performed using GC/ECD analysis. Surrogates were added to each sample before extraction to assess extraction efficiency.

Quality control measures included a method blank with each batch. A matrix spiking solution, consisting of either a subset of pesticides or one aroclor, was also added to the appropriate samples before extraction. The matrix spike analyses were conducted with each batch to assess accuracy of the measurements. One sample in each batch was analyzed in triplicate to assess precision.

2.4.4 Metals

Sediment and tissue metals analyses were performed by the Pacific Northwest Laboratory (PNL) in Richland, Washington, and the MSL. Ten metals were measured in sediments and tissues: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), and zinc (Zn). Samples of sediment, *M. nasuta* tissue, and *N. caecoides* tissue were analyzed using a combination of four different methods: 1) energy-dispersive x-ray fluorescence (XRF), following a PNL Standard Operating Procedure; 2) Zeeman graphite-furnace atomic absorption spectroscopy (GFAA), following modified EPA 200.9 (EPA 1991); 3) cold-vapor atomic absorption spectroscopy (CVAA),

according to the method of Bloom and Crecelius (1983); and, 4) inductively coupled plasma mass spectrometry (ICP/MS), following modified EPA 200.8 (EPA 1991). The analytical methods for each sample matrix and corresponding metals for which each method was used are presented in Table 2.4.

To prepare sediment and tissues for analysis, samples were freeze-dried, then blended in a Spex mixer-mill. Approximately 5 g of mixed sample was ground in a ceramic ball mill. The XRF analysis was performed on a 0.5-g aliquot of dried, ground material pressed into a pellet with a diameter of 2 cm. For GFAA, CVAA, and ICP/MS analyses, 0.2-g aliquots of dried homogenous sample went through an acid digestion process to separate and isolate the metals from the matrix.

Quality control measures for metals analyses included analysis of blanks (not applicable to XRF technique), matrix spike, and triplicate analyses for each batch of up to 20 samples, and analysis of at least 1 SRM sample per 20 samples. The SRMs for sediment were SRM 1646, obtained from the National Institute of Science and Technology (NIST), and BEST-1 obtained from the National Research Council of Canada (NRCC). The tissue SRM included an oyster tissue, 1566a, obtained from NRCC.

2.4.5 Butyltins

Butyltins in sediment and *M. nasuta* tissue were analyzed at MSL in Sequim, Washington, and butyltins in *N. caecoides* samples were analyzed at BOS in Duxbury, Massachusetts. Butyltin compounds in sediment and tissues were analyzed using gas chromatography/ flame photometric detection (GC/FPD) following the methods of Unger et al. (1986).

Wet samples were extracted with methylene chloride and tropolone. Triphenyltin was added before extraction as a surrogate compound to assess extraction efficiency. The mono-, di-, and tri-butyltin compounds extracted from the sediment and tissues were derivatized to a less volatile, more thermally stable form (nonionic n-hexyl/or n-pentyl derivatives). The extracts were passed through a florisil liquid chromatography column for cleanup, and the butyltins were quantified by GC/FPD. Concentrations were reported in µg/kg dry weight of mono-, di-, and

TABLE 2.4. Analytical Method and Corresponding Metal for Each Sample Matrix

Sediment				<i>N. caecoides</i> Tissue			<i>M. nasuta</i> Tissue		
XRF	GFAA	CVAA	ICP/MS	XRF	CVAA	ICP-MS	XRF	CVAA	ICP-MS
As	Ag	Hg	Cd	As	Hg	Cr	As	Hg	Cr
Cr	Se			Cu		Ag	Cu		Ag
Cu				Se		Cd	Se		Cd
Ni				Zn		Pb	Zn		Pb
Pb						Ni			Ni
Zn									

tri-butyltin species as tin. The recently certified reference material for butyltins, NRCC SRM PACS-1, was analyzed with the sediment. Selected sediment and tissue samples were spiked with di- and tri-butyltins prior to extraction to assess the accuracy of the procedure. Method blanks, two sets of matrix spike and two sets of triplicates were analyzed.

2.5 DATA ANALYSIS AND INTERPRETATION

The geologic characteristics, sediment chemistry, acute toxicity, and bioaccumulation potential of Oakland Harbor dredged material samples were compared to data from the Deep Off-Shelf area (R-OS). The geologic evaluations and sediment chemistry data are not analyzed statistically, but are presented in both graphical and tabular formats to assist with interpretation. These portray the differences between the dredged material from those of the Deep Off-Shelf reference sediment in their physical and chemical characteristics .

2.5.1 Randomization

All solid-phase and SPP toxicity tests were designed as completely random tests using the discrete uniform random number generator in LOTUS 123 spreadsheet. Organisms were randomly allocated to treatments, and treatments were randomly positioned on water tables. For the SPP tests, *C. stigmaeus*, *H. costata* , and *M. edulis* larvae were randomly allocated to SPP replicates for all concentrations. Special care was taken with *C. stigmaeus* individuals in order to eliminate bias caused by variable mobility of the fish (otherwise, easily caught fish would be used earlier than more mobile fish).

2.5.2 Statistical Analysis of Solid-Phase Tests

Solid-phase acute toxicity data are compared only to data for one reference treatment , using a one-tailed Dunnett's test (Dunnett 1964) with an experiment-wise error rate $\alpha = 0.05$. This test identifies, with 95% confidence, test treatments with greater acute toxicity (mortality) than the reference. The Dunnett's test is the recommended statistical method to apply to dredged material for open-water disposal (EPA/USACE 1991). Dunnett's test is more conservative than the multiple comparison test in that it identifies more statistically significant increases above the reference. However, when Dunnett's test is applied to non-independent data sets, there is increased probability of Type II statistical error (a chance that a difference between treatment and reference means will be identified as statistically significant when it is not). Dunnett's test results are used in combination with the difference in mortality between test and reference treatments to determine compliance with acceptable disposal criteria. Despite unidentifiable Type II errors, the Dunnett's test approach is environmentally more conservative because it results in the identification of potentially a greater number of stations that are unacceptable for unconfined aquatic disposal.

2.5.3 Statistical Analysis of Suspended-Particulate-Phase Tests

Two statistical tests are presented in the Implementation Manual for the interpretation of SPP tests. The first test is a one-sided t-test between survival in control replicates and survival in the 100% SPP replicates. This test is performed only when survival in the 100% SPP is less than control (0% SPP) survival and when control survival is greater than 90% (indicating test validity). Prior to conducting the t-test, angular transformation (arcsine of the square root) of the proportion surviving in test replicates is performed to reduce possible heterogeneity of variance between control and 100% SPP mean survivals. The second test required by the Implementation Manual is an LC50 calculation, the concentration of SPP that is lethal to 50% of the individuals tested. The LC50 values for these tests were calculated using the Trimmed Spearman Karber Method (Finney 1971). The Spearman Karber estimator is appropriate only if there is increasing mortality with increasing concentration and if 50% or greater mortality is observed in test solutions when normalized to control survival. If 50% mortality does not occur in the 100% SPP dilutions for any treatments, then LC50 values are reported as >100% SPP. The same method was used to calculate EC50 values (the concentration at which 50% of the test individuals show a certain effect) for the bivalve SPP test and LC50 values for all reference toxicant tests.

2.5.4 Statistical Analysis of Bioaccumulation

Before statistical analysis of *M. nasuta* and *N. caecoides* tissue concentrations, a visual inspection of the tissue chemistry data was performed. If visual inspection showed that a compound was undetected in the replicate samples in test treatments, or that the mean tissue concentration in the reference treatments was greater than that in the test treatments, no further analysis was performed. If the detected concentration of a compound exceeded that of any reference treatment, statistical analysis was performed. In all cases, detection limits were used in numerical calculations when a compound was undetected.

Like the solid-phase toxicity data, bioaccumulation data were statistically analyzed using Dunnett's test ($\alpha = 0.05$). As opposed to a multiple comparison test, the result of using the Dunnett's test is the identification of Type II errors which detect more statistically significant differences between treatment and reference. Contaminant levels in tissues of *M. nasuta* and *N. caecoides* exposed to potential dredged material test treatments were compared to those exposed to sediment from the Deep Off-Shelf reference area. In addition to statistically significant bioaccumulation, the magnitude of the difference between mean contaminant concentrations found in the test treatment tissues and the mean concentration found in the tissues exposed to the reference station R-OS was reported.

2.6 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES

The QA/QC procedures followed for these studies were consistent with the Implementation Manual and the EPA protocols (PSEP 1986). The procedures followed were documented by Pacific Northwest Laboratory's (PNL) Quality Engineering Division in a QA Plan. A member of PNL's quality engineering staff was present throughout each phase of these studies to ensure that accepted procedures were followed. Data Accumulation Notebooks were assigned to each portion of the study and served as records of day-to-day activities during the research. All entries in the notebooks were signed, dated, and reviewed by both the project manager and the quality assurance engineer. The following discussion summarizes QA/QC procedures followed for the three main portions of this study: sediment sampling, biological testing, and chemical testing.

2.6.1 Sample Tracking and Storage

All sediment samples were accompanied by chain-of-custody forms from the time of collection to receipt at MSL. After sample selection and compositing, a new set of custody forms was initiated for the sediment subsamples requiring chemical analyses. These accompanied the samples to the appropriate laboratory where the forms were signed and returned to the MSL project manager. Custody forms were also initiated for all tissue samples upon completion of the biological testing. These forms accompanied the samples to the appropriate laboratory for chemical analyses.

All sediment collected for these studies was stored in glass, cellulose acetate butyrate containers, or steel drums lined with 9-C-4-A-phenolic epoxy, a noncontaminating coating. Sediment cores and grab samples were stored at 4°C prior to biological testing. Subsamples for chemical analyses were obtained prior to biological testing. These subsamples were stored frozen until chemical analyses were performed. Samples for organic analyses were stored frozen up to 2 months (PSEP 1986). Samples for metals were freeze-dried upon receipt at the laboratory and held up to 6 months (PSEP 1986; EPA/USACE 1991).

Tissue samples were frozen immediately upon completion of the bioaccumulation tests. Samples for organic analyses were stored in precleaned glass jars with Teflon-lined lids and samples for metals analyses were stored in precleaned plastic jars. Samples for organic analyses were held up to 2 months prior to analysis and samples for metals were held up to 6 months prior to analysis.

2.6.2 Sediment and Tissue Chemistry Quality Control Procedures

Chemical testing procedures require that specific QA/QC protocols be followed. QA/QC guidelines specific to this project are provided in the Pacific Northwest Laboratory's (PNL) Quality

Assurance Division as a QA Plan (QAP). These guidelines include the following:

- analysis of a method blank with each batch of samples
- replicate analysis on at least 5% of the samples (triplicate analyses where possible) to assess analytical precision
- analysis of matrix spikes on 5% of the samples (where applicable) with appropriate compounds to assess accuracy
- analysis of standard reference materials (SRMs) at a frequency of 5%, if available for the analytes of interest and sample matrix
- archival of all instrument printouts (e.g., raw data and chromatograms from AA and GC analyses) for future review.

In actual practice, some of the specific guidelines listed in the QAP for analytical precision and accuracy were modified to apply to the most current methods employed by laboratories. The guidelines for detection limits, range of recovery, and relative precision are listed in Table 2.1 for sediments and in Table 2.2 for tissues.

Measurements of accuracy can be determined by analyzing matrix spikes of known concentrations, as well as SRMs that have been certified for the presence of specific parameters. Matrix spikes were analyzed for metals and for organic parameters, including oil and grease, petroleum hydrocarbons, PCBs, pesticides, PAHs, and butyltins. Spikes generally are made up of a subset of the analytes of interest. Spike recoveries were calculated based on the difference between the amount spiked and the amount recovered in the sample, taking into account the amounts already present in the spiked sample. Spikes for metals were analyzed at a frequency of 5%. Spikes for organic compounds were generally analyzed in duplicate at a frequency of 5%. Surrogate compounds were added in known amounts to samples analyzed for PCBs, pesticides, PAHs and butyltins. Surrogate compounds are added to samples prior to extraction, and their recoveries are a measurement of the efficiency or procedural accuracy of the analysis. Analytical accuracy is also measured through the analysis of SRMs. Sediment SRMs were analyzed for metals and for organic compounds. Tissue SRMs were analyzed for metals and PAHs. SRMs for organic compounds in tissue were not available for this study. SRMs are not associated with analysis of TOC, oil and grease and petroleum hydrocarbons, TVS, and grain size.

Measurements of precision were obtained through replicate analysis of selected sediment treatments. Analysis of replicates shows how precise or repeatable a result is. The measurement of precision is the industrial statistic "I", relative percent difference (RPD) for duplicate analyses, and the relative standard deviation (RSD) for triplicate analyses. The "I" statistic is defined as the absolute value of the difference between duplicate measurements, divided by the sum of the duplicates. The RPD is defined as the absolute value of the difference

between two duplicate measurements, divided by the mean of the duplicates, multiplied by 100. The RSD is defined as the sample standard deviation divided by the mean, multiplied by 100. All instrument printouts and other raw data generated using MSL analytical instruments are filed at MSL for future reference. Raw data generated by offsite analytical facilities are retained at those facilities, but can be made available for inspection.

2.6.3 Toxicological Testing Quality Control Procedures

Test organisms were handled carefully during collection and transfer to test containers. Organisms shipped to MSL were gradually equilibrated to ambient surroundings, and kept in their native sediment whenever possible. Animals were fed, if necessary, before biological testing. Information on the collecting and handling of each test species is included in Section 2.1.3.

Selection of species was consistent with the Implementation Manual and involved the use of juvenile forms, burrowing invertebrates, deposit-feeding organisms, and a larval (planktonic) form. Representatives of all test organisms were taxonomically identified by qualified experts at MSL before use in bioassays.

During all bioassay tests, water quality parameters were measured to ensure that acceptable experimental conditions were maintained. These conditions included a stable temperature ($\pm 2.0^{\circ}\text{C}$), minimum DO of 4.0 mg/L, and 16 h of light per day. Salinity was allowed to vary $\pm 2.0\%$, and pH was allowed to vary ± 0.5 units within each test container during the bioassay period. These limits and values are consistent with those outlined in the Implementation Manual. Water quality instruments were calibrated according to the manufacturer's specification or PNL protocols.

3.0 RESULTS

3.1 SEDIMENT COLLECTION AND SAMPLE PREPARATION

Sediment samples were collected between May 3 and May 6, 1993, from selected test treatment locations in Oakland Inner and Outer Harbor; the reference samples from Bay Farm Borrow Area, Alcatraz Island Environs reference area, and Deep Off-Shelf reference area; and the control samples from Sequim Bay, West Beach, and Tomales Bay. All samples were stored in noncontaminating containers, epoxy-coated 5-gal buckets or seasoned coolers, at approximately 4°C until processing at MSL. Channel and reference samples were shipped via refrigerated truck to MSL as soon as all sampling was completed. Core samples were geologically described before being homogenized into samples for sediment chemistry. Composite test treatment samples, reference sediments, and control sediments were homogenized for sediment chemistry and biological toxicity testing. The SPP of each sediment composite was also prepared for biological testing.

3.1.1 Oakland Harbor Intensive Study Core Sampling

Sediment core samples were collected to -44 ft MLLW (-42 ft MLLW plus 2 ft overdepth) from a total of 20 stations in Oakland Harbor: 5 in the Outer Harbor (1 composite), and 15 in the Inner Harbor (4 composites). One 4-in. core and one 12-in. core were collected at each station as described in Section 2.1.1. Sampling information for 4-in.- and 12-in.- core samples is listed in Table 3.1. Station locations and compositing information are shown in Figures 3.1 and 3.2, respectively.

Four composites were planned prior to field sampling and were to be designated IC1-A-COMP, IC1-B-COMP, IC1-C-COMP, and OC4-B COMP. After sampling the first station, IC1-B-1, two distinct layers were observed, a soft, black layer containing shell hash followed by a more compact, grey layer. Based on these two very different sediment types, it was decided to split this station into two separate composites distinguished as IC1-B-COMP (the grey, compact bottom layer) and IC1-B-Special (representing the soft, black top layer). The remaining four stations at IC1-B were also split in a similar manner with the exception of IC1-B-4 which contained only the soft, black mud layer and was consequently only represented in the IC1-B-Special composite. Both composites were then chemically and biologically evaluated.

Three other stations, IC1-A-1, IC1-C-2, and OC4-B-3, received extra chemistry analysis that was not planned prior to field sampling. IC1-A-1 had a blackened area from -37 ft MLLW to -37.4 ft MLLW of the 12-in. core which was collected and set aside for the full suite of chemical analysis. This same station also had a larger sediment section with a wide band of darkened sediment that was evaluated for PAHs only. Material from these areas were also included in the IC1-A-COMP. The remaining two stations IC1-C-1 and OC4-B-3, also had a special chemistry

TABLE 3.1. Sampling Information for Sediment Composites, Oakland Harbor Intensive Study (one 4-in. and one 12-in. core were collected at each station)

Station	California State Plane Coordinates (Zone III)		Latitude (N)	Longitude (W)	Mudline (-ft MLLW)	Core Required (ft)	Volume Contribution to COMP (gal)
	North	East					
IC1-A-1	480,360.66	1,467,489.89	37° 48' 17.638"	122° 20' 35.787"	37.0	7.0	5.9
IC1-A-2	480,053.55	1,467,211.77	37° 48' 14.548"	122° 20' 39.177"	36.4	7.6	7.2
IC1-A-3	479,836.73	1,467,572.36	37° 48' 12.475"	122° 20' 34.631"	36.1	7.9	6.7
IC1-A-4	479,973.22	1,467,804.91	37° 48' 13.869"	122° 20' 31.768"	40.4	3.6	3.1
IC1-A-5	479,654.58	1,467,915.99	37° 48' 10.741"	122° 20' 30.306"	35.4	8.6	7.1
IC1-A-6	479,471.97	1,468,261.68	37° 48' 09.003"	122° 20' 25.954"	36.5	7.5	6.1
IC1-B-1	479,223.40	1,464,976.14	37° 48' 05.905"	122° 21' 06.823"	34.9	9.1	6.4
IC1-B-2	479,165.82	1,465,732.30	37° 48' 05.484"	122° 20' 57.389"	30.4	13.6	8.5
IC1-B-3	479,127.38	1,466,185.07	37° 48' 05.192"	122° 20' 51.739"	32.1	11.9	7.8
IC1-B-4	479,502.56	1,466,449.44	37° 48' 08.952"	122° 20' 48.538"	38.1	5.9	4.0
IC1-B-5	479,100.10	1,466,577.77	37° 48' 04.999"	122° 20' 46.841"	34.5	9.5	6.5
IC1-C-1	478,900.23	1,467,268.37	37° 48' 03.158"	122° 20' 38.188"	35.0	9.0	10.5
IC1-C-2	478,701.56	1,467,799.66	37° 48' 01.298"	122° 20' 31.521"	35.8	8.2	13.0
IC1-C-3	479,603.27	1,468,196.58	37° 48' 10.288"	122° 20' 26.798"	35.2	8.8	8.0
IC1-C-4	479,496.54	1,468,579.92	37° 48' 09.308"	122° 20' 21.996"	39.2	4.8	5.0
IC1-C-3(a)	478,604.43	1,468,197.52	37° 48' 00.415"	122° 20' 26.541"	NA(b)	NA	NA
IC1-C-4(a)	478,493.88	1,468,574.45	37° 47' 59.395"	122° 20' 21.818"	NA	NA	NA
OC4-B-1	480,555.58	1,467,024.64	37° 48' 19.474"	122° 20' 41.631"	41.4	2.6	7.8
OC4-B-2	480,877.91	1,467,598.29	37° 48' 22.772"	122° 20' 34.564"	41.2	2.8	7.8
OC4-B-3	481,526.28	1,468,186.35	37° 48' 29.295"	122° 20' 27.396"	38.6	5.4	8.4
OC4-B-4	481,272.43	1,468,366.03	37° 48' 26.821"	122° 20' 25.096"	38.0	6.0	5.9
OC4-B-5	481,701.62	1,469,006.55	37° 48' 31.188"	122° 20' 17.221"	39.6	4.4	6.2

(a) Planned coordinates for stations IC1-C-3 and IC1-C-4, however these stations were 1000 ft north of intended location due to surveyor error.

(b) NA Not applicable.

FIGURE 3.1. Sampling Stations and Compositing Scheme, Oakland Harbor Intensive Study
 COMP IC1-A, COMP IC1-B, and COMP IC1-B-Special

FIGURE 3.2. Sampling Stations and Compositing Scheme, Oakland Harbor Intensive Study
 COMP IC1-C and COMP OC4-B

sample taken from -35.0 ft MLLW to -35.3 ft MLLW and -38.6 ft MLLW to -40.1 ft MLLW. These areas were also included in the appropriate composite.

3.1.2 Reference and Control Sediment Sampling

Sampling information for reference and control sediment collection is presented in Table 3.2. Surface sediment from the Deep Off-Shelf reference areas was collected using a pipe dredge deployed from F/V Cobra as described in Section 2.1.2. The Deep Off-Shelf reference area is located approximately 50 nautical miles southwest of the Golden Gate Bridge (Figure 3.3), off the continental shelf, in about 4200 ft of water. The Bay Farm Borrow Area and the Alcatraz Island Environs Area sediments were collected by Brezina and Associates using a grab sampler deployed from a 17-ft Boston Whaler. The Bay Farm reference site, located in San Francisco Bay (Figure 3.4), was sampled at four locations and the sediments were composited to form a sample representative of the area. The Alcatraz Environs reference area surrounding Alcatraz Island (Figure 3.5) consisted of eight sediment locations that were composited to form a single composite representative of the area. Three control sediments for use in solid-phase toxicity tests were collected from Sequim Bay, Washington (Figure 3.6), West Beach, Washington (Figure 3.7), and Tomales Bay, California (Figure 3.8), as described in Section 2.1.2. Sequim Bay sediment (C-SB) was used in all solid-phase tests as an experimental control as well as for the native control for the clam, *M. nasuta*. West Beach control sediment (C-WB) was used only as the native control for the amphipod, *R. abronius*. Tomales Bay is the source of native sediment for the polychaete, *N. caecoides*, and was used in both 10-day and 28-day toxicity tests.

3.1.3 Sample Preparation

Oakland Harbor sediment composites, 4-in. cores, reference sediments, and control sediments were processed as soon as they were received at MSL. The composites, consisting of the material between the mudline and -44 ft MLLW from each contributing station for a total of approximately 30 gallons of sediment, were thoroughly homogenized before biological and chemical testing. The 4-in. cores were described by a geologist (Section 2.2.2) before the sediment between the mudline and -44 ft MLLW was removed and homogenized for sediment chemistry. Reference and control sediments were press-sieved through 0.5- or 1.0-mm mesh to remove organisms, and then were thoroughly homogenized before testing. Table 3.3 summarizes the chemical and biological testing strategy for all Oakland Harbor samples.

3.2 GEOLOGIC DESCRIPTION

In this section, the characteristics of the sedimentary deposits in the Oakland Harbor Channel are described according to ASTM Procedure D2488-84: "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" (ASTM 1984). Sediment

TABLE 3.2. Reference and Control Sediment Sampling

<u>Reference Area</u>	<u>Station</u>	<u>Station Location</u>		<u>Depth (ft)</u>	<u>Volume (gal)</u>
		<u>Latitude (N)</u>	<u>Longitude (W)</u>		
Bay Farm	R-BF 2	37°44.26'	122°17.26'	31	10
	R-BF 3	37°44.43'	122°16.77'	38	10
	R-BF 4	37°44.71'	122°16.51'	38	10
	<u>R-BF 5</u>	37°44.62'	122°16.35'	38	<u>10</u>
	TOTAL R-BF				40
Alcatraz Environs	R-AM A	37°49.85'	122°25.98'	64	5
	R-AM B	37°49.98'	122°25.31'	64	5
	R-AM C	37°50.18'	122°25.01'	69	5
	R-AM D	37°49.06'	122°26.40'	66	5
	R-AM F	37°49.46'	122°24.84'	79	5
	R-AM G	37°48.90'	122°25.91'	39	5
	R-AM H	37°49.08'	122°25.59'	48	5
	<u>R-AM I</u>	37°49.25'	122°25.04'	57	<u>5</u>
	TOTAL R-AM				40
Deep Offshore Site	R-OS	37°24.65'	123°15.10'	4200	25
Sequim Bay Control	C-SB	48°03.70'	123°01.50'	25-30	50
Tomaes Bay Control	C-NE	38°13.83'	122°57.67'	intertidal	40
West Beach Control	C-WB	48°23.83'	122°40.00'	15-20	10

characteristics that were logged include dilatancy of silt/clay, toughness of silt/clay, plasticity of silt/clay, sediment type (i.e. engineering classification), color, consistency (i.e. firmness), cementation, sedimentary structure, reaction with hydrochloric acid, maximum particle size and odor. In addition, any other diagnostic features such as the presence of root traces, mollusk shells and/or related detritus, were noted. A detailed description of the materials and methods used for describing the cores is given in Appendix A.

Sediments within San Francisco Bay, of which Oakland Harbor is a part, reflect deposition within both estuarine (i.e., marine) and terrestrial environments. The opening of drainage from the Central Valley to the Pacific Ocean through the valley, now occupied by San Francisco Bay, took place approximately 500,000 years ago (Sloan 1991). Since that time, estuarine deposition has alternated with erosional intervals and deposition of alluvium in response to glacially controlled fluctuations in sea level. During the Wisconsin glaciation (12,000 - 18,000 years ago), waters drained from the Bay and the shoreline lay approximately 30 km west of San Francisco (Sloan 1991). As glaciers melted, the sea began to readvance about 12,000 years ago to form the present bay. The Older Bay Mud (OBM) unit (USACE 1975), which contains both estuarine and terrestrial sediments, was deposited intermittently during the last interglacial period as well as

FIGURE 3.3. Location of Deep Off-Shelf Reference Area (R-OS)

FIGURE 3.4. Location of Bay Farm Borrow Area (R-BF)

FIGURE 3.5. Location of Alcatraz Environs Reference Area (R-AM)

FIGURE 3.6. Location of *M. nasuta* Control (C-SB), Sequim Bay, Washington

FIGURE 3.7. Location of *R. abronius* Control (C-WB), West Beach, Whidbey Island, Washington

FIGURE 3.8. Location of *N. caecoides* Control (C-NE), Tomales Bay, California

TABLE 3.3. Sediment Samples and Testing Strategy, Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Core Size (in.)</u>	<u>Vertical Segment</u>	<u>Mudline (-ft MLLW)</u>	<u>Sediment Chemistry</u>	<u>SPP Testing</u>	<u>Solid-Phase Testing</u>	<u>Bioaccumulation Testing</u>
COMP IC1-A	12	Mudline to -44 ft MLLW	NA^(a)	YES	YES	YES	YES
IC1-A-1	4	Mudline to -44 ft MLLW	-37.0	YES	NO	NO	NO
IC1-A-2	4	Mudline to -44 ft MLLW	43.8	YES	NO	NO	NO
IC1-A-3	4	Mudline to -44 ft MLLW	36.1	YES	NO	NO	NO
IC1-A-4	4	Mudline to -44 ft MLLW	40.4	YES	NO	NO	NO
IC1-A-5	4	Mudline to -44 ft MLLW	35.4	YES	NO	NO	NO
IC1-A-6	4	Mudline to -44 ft MLLW	36.5	YES	NO	NO	NO
COMP IC1-B	12	NA to -44 ft MLLW	NA	YES	YES	YES	YES
IC1-B-1	4	-38.5 to -44 ft MLLW	NA	--- ^(b)	NO	NO	NO
IC1-B-2	4	-42.2 to -44 ft MLLW	NA	---	NO	NO	NO
IC1-B-3	4	-37.5 to -44 ft MLLW	NA	---	NO	NO	NO
IC1-B-5	4	-40.6 to -44 ft MLLW	NA	---	NO	NO	NO
COMP IC1-B Special	12	Mudline to -44 ft MLLW	NA	YES	YES	YES	YES
IC1-B-1	4	Mudline to -38.4 ft MLLW	34.9	---	NO	NO	NO
IC1-B-2	4	Mudline to -42.1 ft MLLW	30.4	---	NO	NO	NO
IC1-B-3	4	Mudline to -37.4 ft MLLW	32.1	---	NO	NO	NO
IC1-B-4	4	Mudline to -44 ft MLLW	32.1	---	NO	NO	NO
IC1-B-5	4	Mudline to -40.5 ft MLLW	34.5	---	NO	NO	NO
COMP IC1-C	12	Mudline to -44 ft MLLW	NA	YES	YES	YES	YES
IC1-C-1	4	Mudline to -44 ft MLLW	35.0	YES	NO	NO	NO
IC1-C-2	4	Mudline to -44 ft MLLW	35.8	YES	NO	NO	NO
IC1-C-3 ^(c)	4	Mudline to -44 ft MLLW	35.2	YES	NO	NO	NO
IC1-C-4 ^(c)	4	Mudline to -44 ft MLLW	39.2	YES	NO	NO	NO
COMP OC4-B	12	Mudline to -44 ft MLLW	NA	YES	YES	YES	YES
OC4-B-1	4	Mudline to -44 ft MLLW	41.4	YES	NO	NO	NO
OC4-B-2	4	Mudline to -44 ft MLLW	41.2	YES	NO	NO	NO
OC4-B-3	4	Mudline to -44 ft MLLW	38.6	YES	NO	NO	NO
OC4-B-4	4	Mudline to -44 ft MLLW	38.0	YES	NO	NO	NO
OC4-B-5	4	Mudline to -44 ft MLLW	39.6	YES	NO	NO	NO
R-OS	grab	NA	NA	YES	YES	YES	YES
R-BF	grab	NA	NA	YES	YES	YES	YES
R-AM	grab	NA	NA	YES	YES	YES	YES
C-SB	grab	NA	NA	NO	NO	YES	YES
C-NE	grab	NA	NA	NO	NO	YES	YES
C-WB	grab	NA	NA	NO	NO	YES	NO

(a) NA Not applicable.

(b) --- One sediment chemistry sample was taken from mudline to project depth for this station.

(c) Sediment treatments IC1-C-3 and IC1-C-4 were 1000 ft north of their intended location due to surveyor error.

older glacial and interglacial periods. In the vicinity of Oakland Harbor, the Younger Bay Mud (YBM) unit consists almost entirely of estuarine deposits. Most of the YBM has probably accumulated within the bay since the last glaciation and continues to form today. However, locally, there is evidence for some subaerial weathering within the YBM unit, suggesting a lower sea level, perhaps during an older glacial advance.

Twenty 4-in. cores were geologically described by an MSL geologist, and the locations of those cores are shown in Figure 1.2 and Figures 3.1 and 3.2. The length of the cores ranged from 2.6 to 13.5 ft. Individual core logs for each of the 20 stations are presented in Appendix B.

Three geologic units are present in San Francisco Bay: Older Bay Mud (OBM), Sand deposits, and Younger Bay Mud (YBM) (USACE 1975). The sediments in this study contained only YBM which is typically composed of soft plastic, minimal organic material, and clayey fine-grained sand.

Although the estuarine sediments of the OBM and YBM units display similar particle-size distribution, they are very different with respect to color and consistency (i.e., firmness). The YBM unit has a soft to very soft consistency and is usually dark gray to black. The OBM unit, in contrast, is firmer and displays a wider range of colors, which are usually lighter shades of gray, brown, and olive. Firm, oxidized, sandy to pebbly sediments, which represent terrestrial deposits referred to as "Merritt sands," are restricted to the OBM unit.

3.2.1 Older Bay Mud (OBM)

The OBM unit is distinguished by its mostly firm consistency, and its color. Color is particularly useful for the identification of terrestrial sediments, which consist of various shades of red, yellow, and brown. These colors are consistent with an oxidizing environment associated with deposition in rivers, streams, and deltas. The presence of deeply penetrating root traces is another indication of terrestrial conditions. The marine portions of the OBM unit, in contrast, consist of drab-colored shades of olive and gray. These colors, along with the presence of whole mollusk shells, are indicative of a low-energy, reducing, estuary-type environment.

3.2.2 Younger Bay Mud (YBM)

The YBM unit consists of mostly soft, dark-colored sediments deposited in an estuarine environment. These deposits began to be laid down as sea level rose following the last ice age, which ended approximately 12,000 years ago (Barry 1983). The YBM forms a continuous blanket across the harbor bottom. USACE (1975) subdivided the YBM unit into a Semi-Consolidated Bay Mud member overlain by a Soft Bay Mud member. The firmness of the YBM unit increases slightly with depth, probably as a result of compaction beneath the weight of the overlying sediments. Some of the firmer portions of the YBM unit at depth may be equivalent to the Semi-Consolidated Bay Mud member.

The sediments from the Oakland Harbor Intensive Study Area are all variations of YBM. Their color is typically dark grey, and their consistency like that of silty clays. The consistency increases from very soft at shallow depths of -35 ft to firm as the the project depth of -44 ft MLLW is reached. The sediment consistency for IC1-C-3, IC1-C-4, OC4-B-1, OC4-B-2, and OC4-B-3 is firmer relative to the other field stations due to the presence of coarse-grained sand particles. Notable is the presence of shell hash composed of oyster and other mollusk shells from at least 13 of the 20 stations sampled.

3.3 SEDIMENT CHEMISTRY

3.3.1 Sediment Conventional Measurements

Sediment conventional measurements are grain size, total organic carbon (TOC), total volatile solids (TVS), oil and grease, and total petroleum hydrocarbons (TPH). Grain size, TOC, and TVS are expressed as percent dry weight of the sample. Oil and grease and TPH concentrations are expressed as mg/kg dry weight. A summary of the Oakland Harbor Intensive Study conventional measurements is presented in Table 3.4. The complete results, including quality assurance/quality control summaries and results are presented in Appendix C, Tables C.1 through C.7.

The grain size results presented in Table 3.4 and Figure 3.9 show that the Oakland Harbor sediment treatments ranged widely in grain size composition. Sediment treatment COMP IC1-A and the IC1-A stations were all predominantly composed of coarse-grained sediment (>87% gravel and sand). COMP IC1-B, COMP IC1-C, IC1-B stations, and IC1-C stations (except IC1-C-3) all contained predominantly fine-grained sediment (>61% silt and clay). COMP OC4-B and the OC4-B stations ranged widely in their grain size composition, with 4 of the 10 sediment treatments having 72% or greater concentrations of fine-grained sediment and 6 of the 10 sediment treatments having 70% or greater concentrations of coarse-grained sediment. The reference sediments R-OS and R-BF were fine-grained (55% and 98% mixture of silt and clay, respectively) and the reference sediment R-AM was coarse-grained (97% sand and gravel).

The concentrations of TOC (Table 3.4 and Figure 3.10) ranged from 0.02% in OC4-B-5 (-42.2 to -44.0 ft MLLW) to 1.39% in the reference sediment R-BF. Generally, the fine-grained sediments (>50% silt and clay) had concentrations of TOC greater than 0.50% dry weight. Five test treatments had concentrations of TOC that were greater than the reference sediment R-OS (0.79% dry weight) and 17 test treatments had concentration of TOC that were greater than the reference sediment R-AM (0.24% dry weight).

The concentrations of TVS (Table 3.4 and Figure 3.11) ranged from 0.27% in OC4-B-5 (-42.2 to -44.0 ft MLLW) to 4.10% in the reference sediment R-BF. Generally, the fine-grained

TABLE 3.4. Conventional Sediment Measurement Results for the Oakland Harbor Intensive Study Sediment Treatments
(Grain Size, TOC, and TVS in percent dry weight; Oil and Grease and TPH in mg/kg dry weight)

Sediment Treatment	Gravel >2000 μ m	Sand 62.5- 2000 μ m	Silt 3.9- 62.5 μ m	Clay <3.9 μ m	TOC (percent)	TVS (percent)	Oil and Grease (mg/kg)	TPH (mg/kg)
COMP IC1-A	0	88	5	7	0.03	0.77	12 U ^(b)	12 U
IC1-A Special Chemistry ^(a)	2	91	4	3	0.05	0.84	12 U	12 U
IC1-A-1	0	91	4	5	0.05	0.78	23	12 U
IC1-A-2	0	92	3	5	0.10	0.63	12 U	12 U
IC1-A-3	0	94	2	4	0.03	0.54	12 U	12 U
IC1-A-4	0	93	4	3	0.06	0.34	12 U	12 U
IC1-A-5	0	87	6	7	0.20	0.61	99	58
IC1-A-6	0	93	3	4	0.05	0.53	12 U	12 U
COMP IC1-B	0	2	51	47	0.67	3.30	18 U ^(c)	18 U ^(c)
COMP IC1-B Special	14 ^(c)	23 ^(c)	29 ^(c)	34 ^(c)	0.73	1.51	170	17 U
IC1-B-1	1	8	50	41	0.65	2.55	92	36
IC1-B-2	14	11	35	40	0.66	2.07	18 U	18 U
IC1-B-3	9	30	28	33	0.58	2.07	61	17
IC1-B-4 ^(d)	13	10	28	49	0.70	1.88	18 U	18 U
IC1-B-5	22	9	35	34	0.67	2.19	20	17 U
COMP IC1-C	0	39	31	30	0.51	2.18	16 U	16 U
IC1-C-1 Top 6 in.	0	23	42	35	0.63	2.09	52	17 U
IC1-C-1	0	3	51	46	0.67	1.90	19	17 U
IC1-C-2	0	1	51	48	0.68	1.70	22	17 U
IC1-C-3	0	93	3	4	0.06	0.35	12 U	12 U
IC1-C-4	0	21	35	44	0.94	2.54	180	76
COMP OC4-B	0	76	10	14	0.22	1.25	94	32
OC4-B-1	0	85	8	7	0.06	0.93	12 U	12 U
OC4-B-2	0	93	3	4	0.06 ^(c)	0.47 ^(c)	12 U ^(c)	12 U ^(c)
OC4-B-3 Special Chemistry	0	23	39	38	0.82	3.42	83	59
OC4-B-3 (-38.6 to -40.1 ft MLLW)	0	21	39	40	0.95	1.95	92	55
OC4-B-3 (-40.1 to -43.7 ft MLLW)	0	96	2	2	0.04	0.34	12 U	12 U
OC4-B-4	0	28	31	41	1.04	2.41	660	600
OC4-B-5 (-39.6 to -44.0 ft MLLW)	0	70	13	17	0.33	1.12	28	32
OC4-B-5 (-39.6 to -42.2 ft MLLW)	0	23	35	42	0.93	2.74	140	69
OC4-B-5 (-42.2 to -44.0 ft MLLW)	0	97	1	2	0.02	0.27	12 U	12 U

TABLE 3.4. (contd)

<u>Sediment Treatment</u>	<u>Gravel >2000 μm</u>	<u>Sand 62.5- 2000 μm</u>	<u>Silt 3.9- 62.5 μm</u>	<u>Clay <3.9 μm</u>	<u>TOC (percent)</u>	<u>TVS (percent)</u>	<u>Oil and Grease (mg/kg)</u>	<u>TPH (mg/kg)</u>
R-OS	0	45	35	20	0.79	2.34	16 U	16 U

- (a) Special Chemistry sample determined in the field due to a particular sediment characteristic.
(b) U Undetected above given concentration.
(c) Mean of replicate measurements.
(d) All of the sediment from this station is represented only in COMP IC1-B Special.

FIGURE 3.9. Grain Size Distribution in Sediment Treatments

sediments (>50% silt and clay) had concentrations of TVS greater than 1.5% dry weight. Six test treatments had concentrations of TVS that were greater than the reference sediment R-OS (2.34% dry weight) and 20 test treatments had concentrations of TVS that were greater than the reference sediment R-AM (0.78% dry weight).

Oil and grease and TPH concentrations are presented in Table 3.4 and Figures 3.12 and 3.13. Sixteen of the 31 Oakland Harbor test treatments had detected concentrations of oil and grease that ranged from 19 mg/kg dry weight in IC1-C-1 to 660 mg/kg dry weight in OC4-B-4.

FIGURE 3.10. Concentrations of TOC in Sediment Treatments

The concentrations of oil and grease in the reference sediments were undetected in R-OS, 41 mg/kg dry weight in R-AM, and 130 mg/kg dry weight in R-BF. Ten of the 31 Oakland Harbor test treatments had detected concentrations of TPH ranging from 17 mg/kg dry weight in IC1-B-3 to 600 mg/kg dry weight in OC4-B-4. All three reference sediments had undetected concentrations of TPH.

3.3.2 Polynuclear Aromatic Hydrocarbons

The Oakland Harbor sediment treatments were analyzed for the 16 priority pollutant PAHs. Complete results of PAH analysis, including quality control data and quality assurance/quality control summaries, are contained in Appendix C, Tables C.8 through C.13.

Sediment Treatments
FIGURE 3.11. Concentrations of TVS in Sediment Treatments

The data are presented as low molecular weight PAHs (LPAH) and high molecular weight PAHs (HPAH) which contributed to the total PAH concentrations in the Oakland Harbor sediment treatments. Figure 3.14 shows the total PAHs for all sediment treatments. Table 3.5 shows the organics concentrations in the test treatments that were above the reference treatment R-OS. In general, HPAHs contributed more than 27% to the total PAHs. Concentrations of LPAH in the test treatments ranged from 6 µg/kg dry weight in IC1-A-1 and IC1-A-6 to 7,260 µg/kg dry weight in IC-C-1 Top 6 in. The concentrations of HPAH in the test treatments ranged from 7 µg/kg dry weight in COMP IC1-A to 16,000 µg/kg dry weight in IC-C-1 Top 6 in. The total PAH concentration range in the test treatments was 15 µg/kg dry weight in COMP IC1-A to

FIGURE 3.12. Concentrations of Oil and Grease in Sediment Treatments

23,260 $\mu\text{g/kg}$ dry weight in IC1-C-1 Top 6 in. Table 3.5 shows the LPAH and HPAH concentrations in the Oakland Harbor sediment treatments; shaded values indicate those that are greater than the reference sediment R-OS. Sixteen test treatments had total PAH concentrations that were greater than the reference sediment R-OS (122 $\mu\text{g/kg}$ dry weight); two test treatments had total PAH concentrations that were greater than the reference sediment R-BF (2159 $\mu\text{g/kg}$ dry weight). The reference sediment R-AM had the second highest total PAH concentration at 5129 $\mu\text{g/kg}$ dry weight.

FIGURE 3.13. Concentrations of TPH in Sediment Treatments

3.3.3 Chlorinated Pesticides and Polychlorinated Biphenyls

The Oakland Harbor sediment treatments were analyzed for the 18 chlorinated pesticides and 4 polychlorinated biphenyls (PCBs as Aroclors). Complete results of pesticide and PCB analysis, including quality control data and quality assurance/quality control summaries, are contained in Appendix C, Tables C.14 through C.20. Six of the 18 pesticides had detectable concentrations in at least one sediment treatment (Table 3.6). Two pesticides, 4,4'-DDD and 4,4'-DDE, were detected in a majority of the sediment treatments and are presented in Figures 3.15 and 3.16. The 15 Oakland Harbor test treatments with detectable concentrations of

FIGURE 3.14. Concentrations of Total PAH in Sediment Treatments

4,4'-DDD ranged from 0.38 $\mu\text{g/kg}$ dry weight in OC4-B-2 to 7.58 $\mu\text{g/kg}$ dry weight in OC4-B-4. The reference sediments R-AM and R-OS had concentrations of 4,4'-DDD that were below the method detection limit. The reference sediment R-BF had a concentration of 4,4'-DDD of 3.70 $\mu\text{g/kg}$ dry weight. Five Oakland Harbor test treatments had concentration of 4,4'-DDD that were greater than R-BF. The 12 Oakland Harbor test treatments with detectable concentrations

TABLE 3.5. Organics and Metals Concentrations in Oakland Harbor Intensive Study Sediment Treatments (shading indicates values greater than the Deep Off-Shelf (R-OS) reference sediment; organics in µg/kg dry weight; metals in mg/kg dry weight)

Sediment Treatment	LPAH	HPAH	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	TBT	DBT
COMP IC1-A	8	7	0.039	3.91	0.1 U(a)	231	10.4	0.026	35.0	7.4	0.12 U	29.1	0.7 U	1.2 U
IC1-A Special Chemistry(b)	9	35	0.039	3.56	0.1 U	212	32.3	0.033	46.9	6.3	0.12 U	33.8	4.8	1.2 U
IC1-A-1	6	36	0.033	3.77	0.1 U	339	10.2	0.018	62.2	6.4	0.13	36.2	0.7 U	1.2 U
IC1-A-2	7	14	0.049	4.25	0.1 U	482	14.2	0.025	39.1	6.0	0.12 U	36.2	0.7 U	1.2 U
IC1-A-3	7	14	0.030	3.11	0.1 U	310	8.8	0.018	31.8	7.7	0.14	26.2	0.7 U	1.2 U
IC1-A-4	19	33	0.026	2.13	0.1 U	249	11.6	0.018	32.9	8.8	0.12 U	24.5	1.4	1.2 U
IC1-A-5	62	348	0.118	5.07	0.119	525	14.9	0.096	44.3	10.1	0.12 U	43.7	0.7 U	1.2 U
IC1-A-6	6	13	0.034	3.78	0.1 U	420	10.4	0.024	31.1	6.6	0.12 U	27.9	0.7 U	1.2 U
COMP IC1-B	31	84	0.117	11.1	0.161	190	50.9	0.081	114	11.1	0.34	107	0.7 U	1.2 U
COMP IC1-B Special	286	1430	0.197	10.8	0.272	191	37.7	0.398	86.8	13.8	0.34	92.2	3.9	1.2 U
IC1-B-1	94	628	0.246	10.7	0.319	187	48.0	0.200	105	19.1	0.20	107	0.7 U	1.2 U
IC1-B-2	138	133	0.090	10.0	0.210	161	44.6	0.073	104	8.4	0.34	92.0	1.8	1.2 U
IC1-B-3	836	3120	0.082	10.0	0.182	216	38.1	0.091	83.2	11.0	0.20	81.6	0.7 U	1.2 U
IC1-B-4(c)	111	60	0.104	10.4	0.238	157	47.4	0.074	110	10.2	0.35	99.4	0.7 U	1.2 U
IC1-B-5	57	46	0.099	10.2	0.240	167	49.0	0.067	108	8.7	0.21	95.9	0.7 U	1.2 U
COMP IC1-C	76	477	0.127	10.2	0.153	299	31.7	0.090	81.6	10.9	0.21	83.1	1.2	1.2 U
IC1-C-1 Top 6 in.	7260	16,000	0.142	11.0	0.171	224	39.9	0.099	95.4	11.0	0.20	93.9	1.1	1.2 U
IC1-C-1	197	348	0.128	11.8	0.202	186	47.6	0.072	105	10.3	0.34	102	0.7 U	1.2 U
IC1-C-2	55	42	0.099	12.6	0.213	190	46.9	0.076	117	11.4	0.21	103	0.7 U	1.2 U
IC1-C-3	44	31	0.037	3.89	0.1 U	331	9.9	0.018	29.3	5.6	0.12 U	25.3	0.7 U	1.2 U
IC1-C-4	312	1480	0.366	13.2	0.266	233	51.5	0.294	100	30.7	0.21	131	3.9	2.0
COMP OC4-B	73	413	0.129	4.43	0.11	433	21.0	0.091	76.1	12.5	0.13	63.5	1.5	1.2 U
OC4-B-1	40	32	0.052	2.65	0.1 U	410	11.5	0.029	70.6	3.8	0.12 U	41.8	0.7 U	1.2 U
OC4-B-2(d)	37	45	0.027	3.25	0.1 U	297	10.9	0.020	53.6	5.2	0.12 U	33.3	0.7 U	1.2 U
OC4-B-3 Special Chemistry	237	1600	0.306	11.6	0.137	287	45.3	0.296	98.8	26.1	0.27	119	4.0	2.1
OC4-B-3 (-38.6 to -40.1 ft MLLW)	274	1530	0.325	10.4	0.169	213	46.6	0.303	92.9	28.4	0.21	120	4.0	2.2
OC4-B-3 (-40.1 to -43.7 ft MLLW)	70	39	0.023	1.43	0.1 U	427	9.0	0.031	58.7	7.0	0.12 U	35.6	0.7 U	1.2 U
OC4-B-4	404	1610	0.603	10.9	0.554	257	54.7	0.480	96.3	44.7	0.27	140	0.8	1.2 U
OC4-B-5 (-39.6 to -44.0 ft MLLW)	242	1020	0.150	8.35	0.121	473	25.3	0.128	76.3	13.6	0.12 U	77.7	4.9	1.4
OC4-B-5 (-39.6 to -42.2 ft MLLW)	237	1310	0.364	12.5	0.19	224	48.4	0.330	92.3	29.2	0.27	128	5.5	2.5
OC4-B-5 (-42.2 to -44.0 ft MLLW)	43	16	0.023	3.21	0.1 U	627	11.5	0.016 U	57.2	6.3	0.12 U	42.3	0.7 U	1.2 U

TABLE 3.5. (contd)

Sediment Treatment	LPAH	HPAH	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	TBT	DBT
R-OS	65	57	0.259	5.33	0.411	197	21.8	0.081	69.4	8.2	0.83	76.3	0.7 U	1.2 U

(a) U Undetected above given concentration.

(b) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(c) All of the sediment from this station is represented only in COMP IC1-B Special.

(d) Mean of replicate measurements.

TABLE 3.6. Detectable Chlorinated Pesticides in Oakland Harbor Sediment Treatments (except 4,4'-DDD and 4,4'-DDE)

<u>Sediment Treatments</u>	<u>Concentrations in $\mu\text{g/kg}$ dry weight</u>			
	<u>Aldrin</u>	<u>4,4'-DDT</u>	<u>Dieldrin</u>	<u>Heptachlor</u>
IC1-A-5	ND(a)	ND	0.57	ND
OC4-B-4	ND	ND	3.31	2.42
OC4-B-5(-39.6 to -42.2 ft MLLW)	0.98	6.79	0.94	ND

(a) ND Not detected.

of 4,4'-DDE ranged from 0.69 $\mu\text{g/kg}$ dry weight in COMP IC1-C to 14.52 $\mu\text{g/kg}$ dry weight in OC4-B-4. Seven test treatments had 4,4'-DDE concentrations that were greater than the reference sediment R-OS (1.18 $\mu\text{g/kg}$ dry weight); 2 test treatments had 4,4'-DDE concentrations that were greater than the reference sediment R-BF (2.81 $\mu\text{g/kg}$ dry weight); and 12 test treatments had 4,4'-DDE concentrations that were greater than the reference sediment R-AM (0.24 $\mu\text{g/kg}$ dry weight).

Four PCB compounds were analyzed in the Oakland Harbor sediment treatments. PCB Aroclor-1242 was undetected in all sediment treatments; PCB Aroclor-1248 was undetected in all sediment treatments except OC4-B-4, which had a concentration of 203 $\mu\text{g/kg}$ dry weight. PCB Aroclor-1254 and Aroclor-1260 are presented graphically in Figures 3.17 and 3.18. Eight of the 31 Oakland Harbor test treatments had detectable concentration of Aroclor-1254 that ranged from 16 $\mu\text{g/kg}$ dry weight in IC1-B-1 to 41 $\mu\text{g/kg}$ dry weight in IC1-A-5. PCB Aroclor-1254 was undetected in the two reference sediments R-AM and R-OS and at a concentration of 24.9 $\mu\text{g/kg}$ dry weight in the reference sediment R-BF. Five of the 31 Oakland Harbor test treatments had detectable concentrations of Aroclor-1260 that ranged from 12.4 $\mu\text{g/kg}$ dry weight in OC4-B-5 (-39.6 to -42.2 ft MLLW) to 230 $\mu\text{g/kg}$ dry weight in OC4-B-4. All three reference sediment treatments had undetected concentrations of PCB Aroclor-1260.

3.3.4 Metals

Ten metals were measured in the Oakland Harbor sediment treatments (Table 3.5). Complete results, including quality control data and quality assurance/quality control summaries, are contained in Appendix C, Tables C.21 and C.22. Silver (Ag) concentrations (Figure 3.19) ranged from 0.023 mg/kg dry weight in OC4-B-3 (-40.1 to -43.7 ft MLLW) and OC4-B-5 (-42.2 to -44.0 ft MLLW) to 0.603 mg/kg dry weight in OC4-B-4. Five Oakland Harbor test treatments had concentrations of Ag that were greater than the reference sediment R-OS (0.259 mg/kg dry weight). One test treatment, OC4-B-4, had a Ag concentration that was greater than the reference sediment R-BF (0.409 mg/kg dry weight). Twenty-one test treatments had Ag concentrations that were greater than the reference sediment R-AM (0.042 mg/kg dry weight).

FIGURE 3.15. Concentrations of 4,4'-DDD in Sediment Treatments

Arsenic (As) concentrations (Figure 3.20) ranged from 1.43 mg/kg dry weight in OC4-B-3 (-40.1 to -43.7 ft MLLW) to 13.2 mg/kg dry weight in IC1-C-4. Seventeen Oakland Harbor test treatments had concentrations of As that were greater than the reference sediment R-OS (5.33 mg/kg dry weight). One test treatment, IC1-C-4, had an As concentration that was greater than the reference sediment R-BF (12.6 mg/kg dry weight). Sixteen test treatments had As concentrations that were greater than the reference sediment R-AM (9.1 mg/kg dry weight).

Concentrations of Cadmium (Cd) ranged from undetected in 12 test treatments to 0.554 mg/kg dry weight in OC4-B-4 (Figure 3.21). One test treatment, OC4-B-4, had a Cd concentration that was greater than the reference sediment R-OS (0.411 mg/kg dry weight). Nine

FIGURE 3.16. Concentrations of 4,4'-DDE in Sediment Treatments

test treatments had Cd concentrations that were greater than the reference sediment R-BF (0.194 mg/kg dry weight). Nineteen test treatments had Cd concentrations that were greater than the reference sediment R-AM where Cd was undetected.

Chromium (Cr) concentrations (Figure 3.22) ranged from 157 mg/kg dry weight in IC1-B-4 to 627 mg/kg dry weight in OC4-B-5 (-42.2 to -44.0 ft MLLW). Twenty-three test treatments had Cr concentrations that were greater than the reference sediment R-OS (197 mg/kg dry weight). Twenty-six test treatments had Cr concentrations that were greater than the reference sediment R-BF (189 mg/kg dry weight). Twenty-four test treatments had Cr concentrations that were greater than the reference sediment R-AM (190 mg/kg dry weight).

FIGURE 3.17. Concentrations of Aroclor-1254 in Sediment Treatments

Concentrations of Copper (Cu) ranged from 8.8 mg/kg dry weight in IC1-A-3 to 54.7 mg/kg dry weight in OC4-B-4 (Figure 3.23). Eighteen Oakland Harbor test treatments had Cu concentrations that were greater than the reference sediment R-OS (21.8 mg/kg dry weight). One test treatment, OC4-B-4, had Cu concentrations that were greater than the reference sediment R-BF (52.5 mg/kg dry weight). Twenty-two test treatments had Cu concentrations that were greater than the reference sediment R-AM (11.5 mg/kg dry weight).

Mercury (Hg) concentrations (Figure 3.24) ranged from undetected in OC4-B-5 (-42.2 to -44.0 ft MLLW) to 0.480 mg/kg dry weight in OC4-B-4. Thirteen test treatments had Hg

FIGURE 3.18. Concentrations of Aroclor-1260 in Sediment Treatments

concentrations greater than the reference sediment R-OS (0.081 mg/kg dry weight). Two test treatments, COMP IC1-B Special and OC4-B-4, had Hg concentrations that were greater than the reference sediment R-BF (0.342 mg/kg dry weight). Nineteen test treatments had Hg concentrations greater than the reference sediment R-AM (0.036 mg/kg dry weight).

Nickel (Ni) concentrations (Figure 3.25) ranged from 29.3 mg/kg dry weight in IC1-C-3 to 117 mg/kg dry weight in IC1-C-2. Nineteen test treatments had Ni concentrations that were greater than the reference sediment R-OS (69.4 mg/kg dry weight). Two test treatments, COMP IC1-B and IC1-C-2, had Ni concentrations that were greater than the reference sediment

Sediment Treatments
FIGURE 3.19. Concentrations of Silver in Sediment Treatments

R-BF (110 mg/kg dry weight). All but six test treatments had Ni concentrations that were greater than the reference sediment R-AM (42.3 mg/kg dry weight).

Concentrations of Lead (Pb) ranged from 3.8 mg/kg dry weight in OC4-B-1 to 44.7 mg/kg dry weight in OC4-B-4 (Figure 3.26). Twenty test treatments had Pb concentrations that were greater than the reference sediment R-OS (8.2 mg/kg dry weight). One test treatment, OC4-B-4, had Pb concentrations that were greater than the reference sediment R-BF (31.5 mg/kg dry weight). Six test treatments had Pb concentrations that were greater than the reference sediment R-AM (15.2 mg/kg dry weight).

Selenium (Se) concentrations (Figure 3.27) were detected in 19 test treatments and ranged from 0.13 mg/kg in IC1-A-1 to 0.35 mg/kg in IC1-B-4. The reference sediment R-OS had

Sediment Treatments
FIGURE 3.20. Concentrations of Arsenic in Sediment Treatments

the highest concentration of Se (0.83 mg/kg dry weight). Five test treatments had Se concentrations that were greater than the reference sediment R-BF (0.28 mg/kg dry weight). The reference sediment R-AM had concentrations of Se that were undetected above the method detection limit.

Zinc (Zn) concentrations (Figure 3.28) ranged from 24.5 mg/kg dry weight in IC1-A-4 to 140 mg/kg dry weight in OC4-B-4. Seventeen test treatments had concentrations of Zn that were greater than the reference sediment R-OS (76.3 mg/kg dry weight). The reference sediment R-BF had the highest concentration of Zn (149 mg/kg dry weight). Twenty-one test treatments had Zn concentrations that were greater than the reference sediment R-AM (36.8 mg/kg dry weight).

FIGURE 3.21. Concentrations of Cadmium in Sediment Treatments

3.3.5 Butyltins

Three organotins (tri-, di-, and mono-butyltin) were measured in the Oakland Harbor sediment treatments. Complete results, including quality control data and quality assurance/quality control summaries, are contained in Appendix C, Tables C.23 and C.24. The results of the tributyltin (TBT) and dibutyltin (DBT) analysis are presented in Table 3.5 and Figures 3.29 and 3.30. The TBT concentrations were detected in 13 sediment treatments and ranged from 0.8 $\mu\text{g/kg}$ dry weight in OC4-B-4 to 5.5 $\mu\text{g/kg}$ dry weight in OC4-B-5 (-39.6 to -42.2 ft MLLW).

Sediment Treatments
FIGURE 3.22. Concentrations of Chromium in Sediment Treatments

Thirteen test treatments had TBT concentrations that were greater than the reference sediment R-OS that was undetected above the method detection limit. Three test treatments had TBT concentrations that were greater than the reference sediment R-BF (4.3 $\mu\text{g/kg}$ dry weight). Twelve test treatments had TBT concentrations that were greater than the reference sediment R-AM (0.8 $\mu\text{g/kg}$ dry weight).

The DBT concentrations were detected in five sediment treatments and ranged from 1.4 $\mu\text{g/kg}$ dry weight in OC4-B-5 (-39.6 to -44.0 ft MLLW) to 2.5 $\mu\text{g/kg}$ dry weight in OC4-B-5 (-39.6 to -42.2 ft MLLW). The two reference sediments R-OS and R-AM had undetected concentrations of DBT. One test treatment, OC4-B-5 (-39.6 to -42.2 ft MLLW) had a DBT concentration that was greater than the reference sediment R-BF (2.3 $\mu\text{g/kg}$ dry weight).

Sediment Treatments
FIGURE 3.23. Concentrations of Copper in Sediment Treatments

3.4 TOXICOLOGICAL TESTING RESULTS

Six toxicological tests were conducted to assess the biological toxicity and bioaccumulation of contaminants from Oakland Harbor Intensive Study sediments. The complete results of water quality monitoring, test results, and the reference toxicant tests, are contained in Appendixes D through K.

Solid-phase toxicity tests were conducted to evaluate the Oakland Harbor test treatments. The appropriate "native" control sediment for each species was also tested. Three species of sensitive marine organisms were exposed for 10 days to the solid-phase treatments: the clam, *M. nasuta*; the polychaete, *N. caecoides*; and the amphipod, *F. abronius*. A 28-day

FIGURE 3.24. Concentrations of Mercury in Sediment Treatments

exposure of *M. nasuta* and *N. caecoides* to the five Oakland Harbor test treatments was conducted to assess bioaccumulation of contaminants in test organism tissues. The results of each solid-phase test were examined to ensure that the test was validated by 90% survival in the native control sediment. The data from the 10-day solid-phase acute toxicity tests were then evaluated by ANOVA and Dunnett's test to determine whether significant differences occurred between the test and reference treatments. A test treatment was considered acutely toxic if it was statistically significantly different from the reference sediment and if the survival of the test organisms exposed to the test treatment was $\geq 10\%$ lower than the reference sediment ($\geq 20\%$ lower than reference for *R. abronius*).

Sediment Treatments
FIGURE 3.25. Concentrations of Nickel in Sediment Treatments

Suspended-particulate-phase toxicity tests were conducted on the five Oakland Harbor test treatments and the three reference sediments. Three concentrations of SPP (10%, 50%, and 100%), were prepared and tested concurrently with a seawater control (0% SPP). Three species of organisms were exposed to the eight sediment treatments prepared as SPP: the mysid shrimp, *H. costata*, the sanddab, *C. stigmaeus*, and planktonic larvae of the bivalve, *M. edulis*. Control survival and water quality data were evaluated to determine test validity. The data for the 0% (control) and 100% SPP treatments were statistically compared using a two-sample t-test. If the result was significant ($\alpha=0.05$), and there was at least 50% reduction in survival relative to the control, an LC50 or EC50 estimate was made using the Trimmed Spearman-Kärber method.

Sediment Treatments
FIGURE 3.26. Concentrations of Lead in Sediment Treatments

3.4.1 10-Day Solid-Phase Static Test with *R. abronius*

The results of the 10-day solid-phase static test with *R. abronius* are presented in Table 3.7 and 3.8. The water quality data, test results, and reference toxicant results are presented in Appendix D. The water quality data for the 10-day test were all within the acceptable ranges, except for the pH measurements in test treatment COMP IC1-B and DO measurements in reference sediment R-BF. These exceedences did not appear to affect the validity of the test due to adequate survival in the sediment treatments. The *R. abronius* test was valid as indicated by the 95% survival in the control treatment (C-WB). The *R. abronius* survival in the test treatments ranged from 26% in COMP IC1-B to 98% in COMP OC4-B. Statistical analyses were performed on the data, and Dunnett's test and ANOVA test results (Tables 3.7 and 3.8) show

Sediment Treatments
FIGURE 3.27. Concentrations of Selenium in Sediment Treatments

that the test treatments COMP IC1-B, COMP IC1-B Special and COMP IC1-C were acutely toxic as defined by statistically significant differences and a >20% difference in organism survival from the reference sediment R-OS. The water quality data for the 96-h static reference toxicant test were all within the acceptable ranges. The reference toxicant exposure resulted in an LC50 to cadmium of 0.79 mg/L (confidence interval [CI] = 0.69-0.90 mg/L). This LC50 is within the Cd range established in ASTM (ASTM 1990) (0.68-1.25 mg/L).

The lower percent survival of *R. abronius* observed in test treatments from COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and reference sediment R-BF may have been related to

FIGURE 3.28. Concentrations of Zinc in Sediment Treatments

high interstitial water concentrations of the non-persistent chemical ammonia. *Acute Toxicity of Ammonia to Four Species of Marine Amphipod* (Kohn et al. 1993) provides a relationship between total ammonia concentrations in water and survival of *R. abronius* after a 4-day exposure period. This relationship permits testing the hypothesis that the observed toxicity at COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and R-BF is predominantly caused by ammonia. The survival of *R. abronius* in these treatments and the interstitial water concentrations of ammonia were plotted against the relationship from Kohn et al. 1993 (Figure 3.31). The comparison showed that the survival of *R. abronius* at COMP IC1-B, COMP IC1-B Special, and R-BF, matched the survival predicted by Kohn et al. 1993. This relationship suggests that

Sediment Treatments
FIGURE 3.29. Concentrations of Tributyltin in Sediment Treatments

total ammonia concentrations present in the interstitial water, influenced the survival of *R. abronius* for three sediment treatments (COMP IC1-B, COMP IC1-B Special, and R-BF). Conversely, the survival of *R. abronius* at test treatment COMP IC1-C was >5% lower than the predicted value indicating that survival at this test treatment was caused not only by ammonia but also by other contaminants present in the sediments.

3.4.2 10-Day Solid-Phase Flow-Through Test with *M. nasuta*

The results of the 10-day solid-phase flow-through test with *M. nasuta* are presented in Table 3.9 and 3.10. The water quality data and test results are presented in Appendix E. The water quality data for the 10-day test were all within the acceptable ranges, except for

Sediment Treatments
FIGURE 3.30. Concentrations of Dibutyltin in Sediment Treatments

temperature measurements that exceeded the acceptable range, but never more than 1°C from the target temperature of 17°C. These exceedences did not appear to affect the validity of the test due to adequate survival in the sediment treatments. The *M. nasuta* test was valid as indicated by the 100% survival in the control treatment (C-SB). Test organism survival for the Oakland Harbor test treatments ranged from 97% in COMP IC1-B Special to 100% in COMP IC1-C. Statistical analysis was performed on the data to compare the test treatments to the reference sediment R-OS (Table 3.9). Results showed no statistically significant differences between organism survival in the test treatments relative to the reference sediment R-OS.

TABLE 3.7. Results of the 10-Day Solid-Phase Static Test with *R. abronius*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	<u>Acutely Toxic</u>
COMP IC1-A	91.0	NS ^(a)
COMP IC1-B	26.0	S ^(b)
COMP IC1-B Special	76.0	S
COMP IC1-C	63.0	S
COMP OC4-B	98.0	NS
R-OS	97.0	NA ^(c)
R-BF	89.0	NA
R-AM	96.0	NA
C-WB	95.0	NA

(a) NS No statistically significant difference from the reference sediment R-OS at $\alpha=0.05$.

(b) S Statistically significantly different from the reference sediment R-OS at $\alpha=0.05$ and >20% lower in survival than R-OS.

(c) NA Not applicable.

3.4.3 10-Day Solid-Phase Flow-Through Test with *N. caecoides*

The results of the 10-day solid-phase flow-through test with *N. caecoides* are presented in Table 3.11 and 3.12. The water quality data and test results are presented in Appendix E. The water quality data for the 10-day test were all within the acceptable ranges, except for temperature measurements that exceeded the acceptable range, but never more than 1°C from the target temperature of 17°C. These exceedences did not appear to affect the validity of the test due to adequate survival in the sediment treatments. The *N. caecoides* test was valid as indicated by the 97% survival in the control treatment (C-NE). *N. caecoides* survival in the test treatments ranged from 81% in COMP IC1-B Special to 94% in COMP IC1-A. Statistical analyses were performed on the data, and Dunnett's test and ANOVA test results (Tables 3.11 and 3.12) show that the test treatment COMP IC1-B Special was acutely toxic because it was statistically significantly different and had a >10% difference in organism survival from the reference sediment R-OS.

TABLE 3.8. ANOVA Results for the 10-Day Solid-Phase Static Test with *R. abronius*

<u>Source of Variation</u>	<u>Sum Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.538	5	0.708	21.341	0.0001
Residual	0.020	24	0.033

FIGURE 3.31. *R. abronius* Proportion Survival vs. Total Ammonia in Interstitial Water

3.4.4 28-Day Solid-Phase Flow-Through Test with *M. nasuta* and *N. caecoides*

The results of the 28-day solid-phase flow-through test with *M. nasuta* and *N. caecoides* are presented in Table 3.13. The water quality data and test results are shown in Appendix F. The water quality data indicate that all parameters were within the acceptable ranges, except for an exceedence of the temperature range in the reference sediment R-OS. This exceedence did not appear to affect the validity of the test due to adequate survival in the sediment treatments. The 28-day *M. nasuta* and *N. caecoides* test was valid as indicated by the 93% survival in the control treatment (C-SB) and 93% survival in the control treatment (C-NE). Survival in the test treatments ranged from 90% in COMP IC1-A to 95% in COMP IC1-B Special for *M. nasuta* and 81% in COMP IC1-C to 93% in COMP IC1-A for *N. caecoides*. Statistical analysis was not conducted on this data as the purpose of the 28-day solid-phase test was to provide results as to the bioaccumulation potential of specific test treatments (Section 3.5).

3.4.5 96-h Suspended-Particulate-Phase Static Test with *C. stigmaeus*

The results of the 96-h suspended-particulate-phase static test with *C. stigmaeus* are presented in Table 3.14. The water quality data, test results, and reference toxicant results are presented in Appendix G. The water quality data indicates that all parameters were within the acceptable range, except for a few instances of temperature, pH, and DO measurements that were exceeded. These exceedences did not appear to affect the validity of the test due to

TABLE 3.9. Results of the 10-Day Solid-Phase Flow-Through Test with *M. nasuta*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	<u>Acutely Toxic</u>
COMP IC1-A	99.0	NS(a)
COMP IC1-B	99.0	NS
COMP IC1-B Special	97.0	NS
COMP IC1-C	100.0	NS
COMP OC4-B	99.0	NS
R-OS	98.3	NA(b)
R-BF	99.0	NA
R-AM	96.0	NA
C-SB	100.0	NA

(a) NS No statistically significant difference from the reference sediment R-OS at $\alpha=0.05$.

(b) NA Not applicable.

adequate survival in the sediment treatments. The *C. stigmaeus* test was valid as indicated by the mean percent survival of 92% in the control (0% SPP) treatment. Table 3.14 indicates that survival in the test treatments ranged from 0% in COMP IC1-B at 100% SPP to 96% in R-BF and R-AM at 0% SPP.

T-tests were performed on all sediment treatments comparing test organism survival in the 0% SPP to the 100% SPP; the data underwent an arc sine square root transformation. Three of the test treatments COMP IC1-B, COMP IC1-B Special, and COMP IC1-C were statistically significantly different from the 0% SPP (Table 3.15) in the *C. stigmaeus* test.

The LC50s for the test treatments were calculated using Trimmed-Spearman Karber (Table 3.14) and ranged from 49% SPP to 100% SPP. The reference toxicant exposure resulted in an LC50 to copper of 1.63 mg/L (CI = 1.26-2.11 mg/L). This response is comparable to other MSL tests conducted with *C. stigmaeus* which showed LC50s of 1.20 mg/L and 1.23 mg/L of Cu.

The low percent survival observed in COMP IC1-B, COMP IC1-B Special, and COMP IC1-C may have been due in part to high concentrations of ammonia in the 100% SPP. To test for ammonia toxicity, a second test was performed with 100% SPP from these three test treatments and a common seawater control. The treatments that were retested in the ammonia toxicity test were identified as COMP IC1-B R, COMP IC1-B Special R, COMP IC1-C R, and

TABLE 3.10. ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with *M. nasuta*

<u>Source of Variation</u>	<u>Sum Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.050	7	0.010	1.014	0.4331
Residual	0.217	22	0.010		

TABLE 3.11. Results of the 10-Day Solid-Phase Flow-Through Test with *N. caecoides*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	<u>Acutely Toxic</u>
COMP IC1-A	94.0	NS(a)
COMP IC1-B	85.0	NS
COMP IC1-B Special	81.0	S(b)
COMP IC1-C	88.0	NS
COMPOC4-B	91.0	NS
R-OS	96.7	NA(c)
R-BF	85.0	NA
R-AM	92.0	NA
C-NE	97.0	NA

(a) NS No statistically significant difference from the reference sediment R-OS at $\alpha=0.05$.

(b) S Statistically significantly different from the reference sediment R-OS at $\alpha=0.05$ and >10% lower in survival than R-OS.

(c) NA Not applicable.

Control R. The ammonia toxicity test was conducted in the same manner as the original test with the addition of ammonia samples that were measured daily in all test chambers. A reference toxicant test with ammonia was also performed using concentrations of ammonia that were similar to the measured ammonia concentrations in the 100% SPP. The LC50 from the ammonia reference toxicant test was calculated at 30.87 mg/L ammonia.

The results of the retest ranged from 0% survival in COMP IC1-B R to 100% survival in R-BF R and Control R. Statistical t-tests were performed on the 100% SPP from the three treatments (COMP IC1-B R, COMP IC1-B Special, and COMP IC1-C R) relative to Control R. Test treatment COMP IC1-C R was not statistically significantly different from the Control R. Test treatments COMP IC1-B R and COMP IC1-B Special R could not be statistically analyzed due to no variance. However, these test treatments were observably different from the 0% SPP (Control R) (Table 3.15).

To determine the effects of total ammonia to *C. stigmaeus*, the survival values from the 100% SPP from COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and R-BF were compared to the survival results obtained from the ammonia reference toxicant test (Figure 3.32). This

TABLE 3.12. ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with *N. caecoides*

<u>Source of Variation</u>	<u>Sum Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.275	5	0.055	2.259	0.0841
Residual	0.536	22	0.024		

TABLE 3.13. Results of the 28-Day Solid-Phase Flow-Through Test with *M. nasuta* and *N. caecoides*

<u>Sediment Treatment</u>	<u><i>M. nasuta</i> Percent Survival</u>	<u><i>N. caecoides</i> Percent Survival</u>
COMP IC1-A	90.0	93.0
COMP IC1-B	93.0	84.0
COMP IC1-B Special	95.0	87.0
COMP IC1-C	94.0	81.0
COMP OC4-B	94.0	89.0
R-OS	83.0	94.0
R-BF	94.0	87.0
R-AM	94.0	91.0
C-SB	93.0	90.0
C-NE	94.0	93.0

relationship shows the observed survival of *C. stigmaeus* exposed to COMP IC1-B and COMP IC1-B Special were similar to the predicted results from the ammonia reference toxicant test suggesting that ammonia may have been responsible for the observed toxicity found in these test treatments. The observed *C. stigmaeus* survival exposed to COMP IC1-C and R-BF were higher than predicted by the reference toxicant test based upon the initial ammonia concentrations. Additional testing is required to narrow the range of ammonia concentrations used in the reference toxicant test in order to better interpret the relationship between ammonia and percent survival.

3.4.6 96-h Suspended-Particulate-Phase Static Test with *H. costata*

The results of the 96-h suspended-particulate-phase static test with *H. costata* are presented in Table 3.16 and 3.17. The water quality data, test results, and reference toxicant results are presented in Appendix H. The water quality data indicate that all parameters were within the acceptable ranges except for an exceedence of one pH measurement. This exceedence did not appear to affect the validity of the test due to adequate survival in the sediment treatments. The *H. costata* test was valid as indicated by the mean percent survival of 98% in the control (0% SPP) treatment. Table 3.16 indicates that survival in the test treatments ranged from 96% to 100%. The results of the t-test showed no statistically significant differences between the 100% SPP and the 0% Control for any test treatments.

The LC50s for the test treatments (Table 3.16) could not be calculated because there was not a 50% reduction in survival of the *H. costata*. The reference toxicant exposure resulted in an LC50 to copper of 68.30 µg/L (CI = 53.71-86.86).

TABLE 3.14. Results of the 96-h Suspended-Particulate-Phase Static Test with *C. stigmaeus*

<u>Sediment Treatment</u>	<u>Percent SPP</u>	<u>Percent Survival</u>	<u>LC50 (Percent SPP)</u>
COMP IC1-A	0	84	
COMP IC1-A	10	82	
COMP IC1-A	50	86	
COMP IC1-A	100	72	>100
COMP IC1-B	0	94	
COMP IC1-B	10	92	
COMP IC1-B	50	62	
COMP IC1-B	100	0	49.0
COMP IC1-B R(a)	100	0	
COMP IC1-B Special	0	92	
COMP IC1-B Special	10	90	
COMP IC1-B Special	50	90	
COMP IC1-B Special	100	18	76.4
COMP IC1-B Special R(a)	100	7	
COMP IC1-C	0	90	
COMP IC1-C	10	84	
COMP IC1-C	50	78	
COMP IC1-C	100	56	>100
COMP IC1-C R(a)	100	87	
COMP OC4-B	0	84	
COMP OC4-B	10	80	
COMP OC4-B	50	92	
COMP OC4-B	100	82	>100
R-BF	0	96	
R-BF	10	90	
R-BF	50	92	
R-BF	100	88	>100
R-BF R(a)	100	100	
R-AM	0	96	
R-AM	10	88	
R-AM	50	86	
R-AM	100	82	>100
Control R(a)	0	100	

(a) R Sediment treatment retested to assess potential ammonia toxicity.

TABLE 3.15. T-Test and LC50 Determinations for the 96-h Static Suspended-Particulate-Phase Test with *C. stigmaeus*

<u>Sediment Treatment</u>	<u>Table t-value</u>	<u>d.f.</u>	<u>Calculated t-value</u>	<u>Statistically Significant</u>	<u>LC50 as Percent SPP</u>
COMP IC1-A	2.752	8	2.0127	NO	>100
COMP IC1-B	2.752	8	18.8457	YES	49.0
COMP IC1-B R	3.163	5	NC ^(a)	NO ^(b)	NA
COMP IC1-B Special	2.306	8	7.2843	YES	76.4
COMP IC1-B Special R	2.571	5	13.5447	NO ^(b)	NA
COMP IC1-C	2.752	8	3.1962	YES	>100
COMP IC1-C R	3.163	5	1.1952	NO	>100
COMP OC4-B	2.752	8	0.2802	NO	>100
R-AM	2.752	8	2.0199	NO	>100
R-BF	2.752	8	1.7622	NO	>100
R-BF R	3.163	5	NC	NO	NA

(a) NC Not Calculated

(b) Statistical significance could not be determined due to no variance among replicates; the 100% SPP is observably different from the 0% SPP.

3.4.7 72-h Suspended-Particulate-Phase Static Test with *M. edulis*

The results of the 72-h suspended-particulate-phase static test with *M. edulis* are presented in Table 3.18. The water quality data, test results, and reference toxicant data are presented in Appendix I. The water quality data indicate that all parameters were within the acceptable ranges, except for a few exceedences of temperature and pH measurements. These exceedences did not appear to affect the validity of the test due to adequate survival in the sediment treatments. The *M. edulis* test was validated by the mean percent survival of 90% in the control (0% SPP) treatment. The mean percent survival was calculated by adding the normal D-shaped, the abnormal larvae, and the other larvae and dividing the total by the average initial stocking density of 280 embryos/10 mL for SPP Test 1 and 240 embryos/10 mL for Test 2. Survival in the test treatments ranged from 25% in COMP IC1-B Special (100% SPP) to 99% in COMP IC1-B Special (10% and 50% SPP) and COMP OC4-B (0% SPP) (Table 3.18).

Statistical t-tests were performed on the 100% SPP from the sediment treatments relative to the 0% control. Two treatments, COMP IC1-B Special and COMP OC4-B, were statistically significantly different from the controls (Table 3.19). The LC50s for the test treatments (Table 3.19) ranged from 79.9% SPP in COMP IC1-B Special to 100% SPP in all the other sediment treatments.

Normal development is more useful for assessing larval toxicity because it represents the organisms most likely to survive to adulthood. The percentage of normal embryos was calculated by dividing the normal D-shaped larvae by the average stocking density (280 embryos/10 mL for Test 1 and 240 embryos/10 mL for Test 2). The percentage of normal larvae in the test

FIGURE 3.32. *C. stigmaeus* Proportion Survival vs. Total Ammonia in the 100% Suspended-Particulate-Phase Samples

treatments ranged from 0% in COMP IC1-B (100% SPP) and COMP IC1-B Special (100% SPP) to 99% in COMP IC1-B Special (50% SPP). Survival of *M. edulis* in the 0% and 100% SPP was compared using a two sample t-test. The t-test (Table 3.20) shows that there were statistically significant differences in survival for COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and COMP OC4-B relative to the control. The EC50s for the *M. edulis* test treatments ranged from 21.4% SPP to >100% SPP.

A reference toxicant test was conducted using copper sulfate to estimate the sensitivity of *M. edulis*. The LC50 for copper for Test 1 was 14.46 µg/L and for Test 2 was 15.02 µg/L. These LC50s are within the estimated MSL control ranges of 7.54 to 16.07 µg/L of copper and indicate appropriate organism sensitivity. The EC50 for copper sulfate for Test 1 was 7.11 µg/L and for Test 2 was 5.08 µg/L, which are similar to the MSL control range of 5.68 µg/L to 7.58 µg/L for *M. edulis*.

3.5 TISSUE BIOACCUMULATION

M. nasuta and *N. caecoides* were tested in a 28-day bioaccumulation test by exposing these organisms to the test, reference and control sediment treatments. The tissues of *M. nasuta* and *N. caecoides* exposed to the test and reference sediments were analyzed for PAHs,

TABLE 3.16. Results of the 96-h Suspended-Particulate-Phase Static Test with *H. costata*

<u>Sediment Treatment</u>	<u>Percent SPP</u>	<u>Percent Survival</u>	<u>LC50 (Percent SPP)</u>
COMP IC1-A	0	96	
COMP IC1-A	10	98	
COMP IC1-A	50	96	
COMP IC1-A	100	96	>100
COMP IC1-B	0	100	
COMP IC1-B	10	96	
COMP IC1-B	50	100	
COMP IC1-B	100	98	>100
COMP IC1-B Special	0	100	
COMP IC1-B Special	10	100	
COMP IC1-B Special	50	98	
COMP IC1-B Special	100	98	>100
COMP IC1-C	0	98	
COMP IC1-C	10	100	
COMP IC1-C	50	98	
COMP IC1-C	100	96	>100
COMP OC4-B	0	100	
COMP OC4-B	10	98	
COMP OC4-B	50	100	
COMP OC4-B	100	98	>100
R-OS	0	96	
R-OS	10	98	
R-OS	50	98	
R-OS	100	92	>100
R-BF	0	96	
R-BF	10	98	
R-BF	50	96	
R-BF	100	92	>100
R-AM	0	98	
R-AM	10	96	
R-AM	50	96	
R-AM	100	98	>100

chlorinated pesticides, PCBs, metals, and organotins. The control sediment treatment tissue samples were not submitted for chemical analysis, and were archived in case future testing proved necessary. Complete tissue chemistry results in wet and dry weight, quality control data, and quality assurance/quality control summaries for these analysis are presented in Appendixes J and K.

Tissue chemistry results from these analyses, summarized in the following section, were statistically analyzed using Dunnett's test ($\alpha = 0.05$) for comparison of all test treatment means

TABLE 3.17. T-Test and LC50 Determinations for the 96-h Static Suspended-Particulate-Phase Test with *H. costata*

<u>Sediment Treatment</u>	<u>Table t-value</u>	<u>d.f.</u>	<u>Calculated t-value</u>	<u>Statistically Significant</u>	<u>LC50 as Percent SPP</u>
COMP IC1-A	2.752	8	1.0000	NO	>100
COMP IC1-B	2.752	8	1.0000	NO	>100
COMP IC1-B Special	2.752	8	1.0000	NO	>100
COMP IC1-C	2.752	8	0.6325	NO	>100
COMP OC4-B	2.752	8	1.0000	NO	>100
R-AM	2.752	8	0.0000	NO	>100
R-BF	2.752	8	1.2649	NO	>100
R-OS	2.752	8	0.0000	NO	>100

relative to the reference treatment R-OS. If a contaminant was detected (no U or J qualifier) in tissues exposed to any replicate test treatment, and if the mean tissue concentration of the test replicates was greater than the mean tissue value of the reference treatment, a statistical comparison between test treatment and reference treatment concentrations was made. Reference treatments were used regardless of whether the values were detected or undetected. If a value was undetected (U flag), the detection limit value was used in the statistical analysis. If a compound was detected below the method detection limit (J flag), then the associated value was used for statistical analysis. Background (preexposure) concentrations were not included in the statistical analysis. The background tissues were taken from *M. nasuta* held in clean sediment and then allowed to depurate prior to subsampling the tissue for chemical analysis. The purpose of the background tissues was to determine whether *M. nasuta* were exposed to contaminants prior to biological testing. Mean contaminant concentrations and the results of the statistical comparisons are presented in the following sections.

3.5.1 Polynuclear Aromatic Hydrocarbon Bioaccumulation in *M. nasuta*

Complete results for the 16 PAHs analyzed in *M. nasuta* tissues including quality control data and quality assurance/quality control summaries are reported in Appendix J, Tables J.1 through J.12. The PAH data in this Appendix are reported on both a wet and dry weight basis in µg/kg. A summary of the dry weight mean concentrations of LPAH and HPAH compounds in *M. nasuta* for test and reference treatment concentrations is presented in Table 3.21 and 3.22.

The PAH tissue concentrations in test treatments were similar to the Deep Off-Shelf reference site for seven of the 16 PAHs analyzed. Three of the PAHs were undetected in the majority of test treatments and were not statistically analyzed. The remaining six PAHs were detected in the test treatments and were statistically analyzed relative to the reference treatment R-OS.

TABLE 3.18. Results of the 72-h Suspended-Particulate-Phase Static Test with *M. edulis*

<u>Sediment Treatment</u>	<u>Percent SPP</u>	<u>Mean Percent Survival</u>	<u>Mean Percent Normal</u>
COMP IC1-A	0	87	78
COMP IC1-A	10	89	78
COMP IC1-A	50	78	70
COMP IC1-A	100	88	78
COMP IC1-B	0	79	72
COMP IC1-B	10	83	76
COMP IC1-B	50	66	21
COMP IC1-B	100	65	0
COMP IC1-B Special	0	98	97
COMP IC1-B Special	10	99	98
COMP IC1-B Special	50	99	99
COMP IC1-B Special	100	25	0
COMP IC1-C	0	79	73
COMP IC1-C	10	80	73
COMP IC1-C	50	79	70
COMP IC1-C	100	80	45
COMP OC4-B	0	99	98
COMP OC4-B	10	95	95
COMP OC4-B	50	83	72
COMP OC4-B	100	81	56
R-OS	0	85	79
R-OS	10	79	71
R-OS	50	81	74
R-OS	100	80	72
R-BF	0	98	98
R-BF	10	95	95
R-BF	50	96	95
R-BF	100	96	95
R-AM	0	96	96
R-AM	10	99	98
R-AM	50	94	94
R-AM	100	93	92

The results of Dunnett's test for the LPAH compounds (Table 3.21) indicate that concentrations of anthracene in *M. nasuta* tissues exposed to test treatment COMP OC4-B were statistically significantly different from the tissues exposed to the reference R-OS. Dunnett's test for the HPAH compounds (Table 3.22) indicates that 5 of the 10 HPAH compounds chemically analyzed had statistically significant elevations in the *M. nasuta* tissues in at least one of the test treatments. Benzo(a)anthracene was statistically significantly different in the tissues exposed to COMP OC4-B at a magnification of <2 times the tissues exposed to the reference sediment

TABLE 3.19. T-Test and LC50 Determinations for the 72-h Static Suspended-Particulate-Phase Test with *M. edulis*

<u>Sediment Treatment</u>	<u>Table t-value</u>	<u>d.f.</u>	<u>Calculated t-value</u>	<u>Statistically Significant</u>	<u>LC50 as Percent SPP</u>
COMP IC1-A	2.752	8	-0.0783	NO	>100
COMP IC1-B	2.752	8	1.7094	NO	>100
COMP IC1-B Special	2.752	8	12.0992	YES	79.9
COMP IC1-C	2.752	8	-0.1256	NO	>100
COMP OC4-B	2.752	8	2.4881	YES	>100
R-AM	2.752	8	0.7244	NO	>100
R-BF	2.752	8	1.0425	NO	>100
R-OS	2.752	8	0.9616	NO	>100

R-OS. Fluoranthene, pyrene, chrysene, and benzo(k)fluoranthene were statistically significantly different in *M. nasuta* tissues exposed to at least one of the following test treatments:

COMP IC1-B Special, COMP IC1-C, or COMP OC4-B at a magnification of ≥ 2 times but ≤ 10 times the reference R-OS. ANOVA data for those comparisons are presented in Table 3.23.

3.5.2 Chlorinated Pesticide and Polychlorinated Biphenyl Bioaccumulation in *M. nasuta*

The complete results, including quality control data and quality assurance/quality control summaries, for the 19 pesticides analyzed, is located in Appendix J, Table J.13 through J.22. The pesticide results are reported in both a wet and dry weight basis in $\mu\text{g/kg}$. Concentrations of pesticides and PCBs in *M. nasuta* tissues were either undetected or detected below the method detection limit for all compounds except dieldrin, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, heptachlor and Aroclor-1254. The data for these compounds were analyzed statistically and the results of Dunnett's test are presented in Table 3.24. Concentrations of 4,4'-DDD, 4,4'-DDT, and dieldrin in tissues exposed to COMP OC4-B were statistically significantly different and at a magnitude of ≥ 2 times but < 5 times the reference treatment R-OS. *M. nasuta* tissues exposed to COMP OC4-B were statistically significantly different for Aroclor-1254 when compared to tissues

TABLE 3.20. T-Test and EC50 Determinations for the 72-h Static Suspended-Particulate-Phase Test with *M. edulis*

<u>Sediment Treatment</u>	<u>Table t-value</u>	<u>d.f.</u>	<u>Calculated t-value</u>	<u>Statistically Significant</u>	<u>EC50 as Percent SPP</u>
COMP IC1-A	2.752	8	0.0154	NO	>100
COMP IC1-B	2.752	8	23.2250	YES	21.4
COMP IC1-B Special	2.752	8	17.7414	YES	71.1
COMP IC1-C	2.752	8	10.7912	YES	87.1
COMP OC4-B	2.752	8	2.3637	YES	>100
R-AM	2.752	8	0.7536	NO	>100
R-BF	2.752	8	0.9001	NO	>100
R-OS	2.752	8	1.4684	NO	>100

TABLE 3.21. Mean Low Molecular Weight PAH Concentrations in the Tissues of *M. nasuta* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)			
	<u>Naphthalene</u>	<u>Fluorene</u>	<u>Phenanthrene</u>	<u>Anthracene</u>
R-OS	21.44	23.31	21.70	33.03 U(a)
COMP IC1-A	21.26	20.81 U	23.26	33.75 U
COMP IC1-B	20.79	19.11 U	19.19	30.99 U
COMP IC1-B Special	21.23	21.92	23.14	34.45
COMP IC1-C	20.26	18.67 U	21.74	33.22
COMP OC4-B	21.61	20.22 U	24.73	44.81

(a) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

exposed to the reference treatment R-OS and at a magnitude of ≥ 10 times the reference treatment R-OS. ANOVA data for these comparisons are in Table 3.23.

3.5.3 Metals Bioaccumulation in *M. nasuta*

The complete results of the metals analysis, including quality control data and quality assurance/ quality control summaries, are reported in Appendix J, Tables J.23 through J.25. The concentrations of metals are reported in mg/kg wet and dry weight. The results of Dunnett's test and the mean tissue concentration of metals in the tissues of *M. nasuta*, expressed in mg/kg dry weight, are presented in Table 3.25. In general, the concentrations of metals in *M. nasuta* tissues exposed to the test treatments were similar to the concentrations found in the tissues exposed to the reference treatment R-OS. Concentrations of Ni and/or Pb in *M. nasuta* tissues were statistically significantly different in the test treatments COMP IC1-B, COMP IC1-B Special, COMP IC1-C and COMP OC4-B when compared to the reference treatment R-OS. ANOVA data for these comparisons are presented in Table 3.23.

3.5.4 Butyltins Bioaccumulation in *M. nasuta*

Complete butyltins results, including quality control data and quality assurance/quality control summaries, are reported in $\mu\text{g/kg}$ wet and dry weight and are presented in Appendix J, Tables J.26 and J.27. Mean butyltin concentrations ($\mu\text{g/kg}$ dry weight) in *M. nasuta* tissues exposed to test and reference treatments are summarized in Table 3.26. Tributyltin was statistically significantly different in the tissues exposed to COMP IC1-B Special and COMP OC4-B at a magnitude of ≥ 2 times but < 5 times the tissues exposed to the reference sediment R-OS. Dibutyltin concentrations in *M. nasuta* tissues were undetected at or near the

TABLE 3.22. Mean High Molecular Weight PAH Concentrations in the Tissues of *M. nasuta* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)								
	Fluor-anthene	Benzo(a)-anthracene	Pyrene	Chrysene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Benzo(a)-pyrene	Indeno-(1,2,3-c,d)pyrene	Benzo(g,h,i)perylene
R-OS	37.95	44.55 B(a)	17.48 U(b)	9.59	53.73	12.22 U	27.20	40.22 U	35.85 U
COMP IC1-A	40.95	49.48 B	17.86 U	9.99	37.63	12.49 U	18.64	41.09 U	36.62 U
COMP IC1-B	34.83	43.38 B	16.40 U	9.10 U	21.90	11.46 U	22.28	37.73 U	33.63 U
COMP IC1-B Special	42.92	46.84 B	20.55	10.95	68.45	52.96	29.51	35.09	34.23 U
COMP IC1-C	41.07	49.88 B	39.00	11.30	66.79	50.88	28.32	36.87 U	32.86 U
COMP OC4-B	83.86	58.41 B	167.94	30.86	99.24	62.25	45.56	38.62	39.70

(a) B Analyte detected in blank at >5 times the MDL.

(b) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

TABLE 3.23. ANOVA Results for Chemical Parameters in Tissues of *M. nasuta* Compared to the Deep Off-Shelf Reference (R-OS)

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
<u>PAHs</u>						
Naphthalene	0.015	0.328	5	23	0.214	0.9530
Fluorene	0.008	0.391	1	7	0.141	0.7183
Phenanthrene	0.185	0.270	5	23	3.157	0.0258
Anthracene	0.302	0.354	3	15	4.277	0.0227
Fluoranthene	2.470	0.245	5	23	46.422	0.0001
Benzo(a)anthracene	0.276	0.157	5	23	8.060	0.0002
Pyrene	15.263	0.358	3	15	212.963	0.0001
Chrysene	4.725	0.523	4	19	42.933	0.0001
Benzo(b)fluoranthene	17.973	16.238	5	23	5.092	0.0028
Benzo(k)fluoranthene	7.270	0.072	3	15	502.758	0.0001
Benzo(a)pyrene	2.485	2.407	5	23	4.749	0.0040
Indeno(1,2,3-c,d)pyrene	0.063	0.958	2	11	0.363	0.7039
Benzo(g,h,i)perylene	0.021	0.053	1	7	2.830	0.1364
<u>Chlorinated Pesticides</u>						
4,4'-DDD	6.568	2.983	5	23	10.130	0.0001
4,4'-DDE	15.737	16.271	4	19	4.594	0.0092
4,4'-DDT	5.969	1.360	3	15	21.952	0.0001
Dieldrin	2.444	0.027	1	7	628.771	0.0001
Heptachlor	0.049	0.373	1	7	0.923	0.3686
<u>Polychlorinated Biphenyls</u>						
Aroclor-1254	11.782	0.064	1	7	1279.284	0.0001
<u>Metals</u>						
Silver	0.323	3.328	5	23	0.446	0.8117
Arsenic	0.068	0.482	5	23	0.646	0.6669
Cadmium	0.963	2.367	5	23	1.871	0.1387
Chromium	0.379	1.535	5	23	1.135	0.3704
Copper	0.074	0.827	5	23	0.412	0.8356
Mercury	0.063	0.280	5	23	1.035	0.4207
Nickel	0.794	0.618	5	23	5.905	0.0012
Lead	0.952	0.781	5	23	5.606	0.0016
Selenium	0.100	1.280	5	23	0.360	0.8706
Zinc	0.159	0.522	5	23	1.401	0.2611
<u>Organotins</u>						
Tributyltin	4.132	1.289	5	23	14.921	0.0001
Dibutyltin	0.172	1.390	1	7	0.864	0.3836
Monobutyltin	2.851	5.809	5	23	2.258	0.0827

TABLE 3.24. Mean Pesticide and PCB Concentrations in the Tissues of *M. nasuta* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)					
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Heptachlor	Aroclor-1254
R-OS	3.48 U(a)	9.05	3.26 U	2.37 U	1.11 U	20.74 U
COMP IC1-A	6.59	1.06 U	3.33 U	2.42 U	1.14 U	21.19 U
COMP IC1-B	4.30	2.42	3.05 U	2.22 U	1.04 U	19.45 U
COMP IC1-B Special	3.63	6.99	4.24	2.26 U	1.06 U	19.80 U
COMP IC1-C	5.17	4.67	4.49	2.17 U	1.02 U	19.01 U
COMP OC4-B	13.67	16.80	13.45	6.77	1.34	208.42 E (b)

(a) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

(b) E Value is an estimate; most similar Aroclor pattern is 1254.

MDL for four of the five test treatments and in the reference treatment R-OS. ANOVA data for these comparisons are presented in Table 3.23.

3.5.5 Polynuclear Aromatic Hydrocarbon Bioaccumulation in *N. caecoides*

The complete results of the 16 PAH compounds analyzed, including quality control data and quality assurance/quality control summaries, are reported in Appendix K, Tables K.1 through K.12. The PAH concentrations are reported in $\mu\text{g/kg}$ wet and dry weight. The LPAH compounds naphthalene, acenaphthene, phenanthrene, and anthracene were analyzed statistically using Dunnett's test. The results showed no statistically significant differences between the test treatments and the reference treatment R-OS. Tables 3.27 presents the mean concentrations of HPAH compounds in *N. caecoides* that were exposed to the Oakland Harbor test treatments and the reference treatment R-OS. The results of Dunnett's test for the HPAH compounds indicate that *N. caecoides* tissue concentrations were statistically significantly elevated in test treatments COMP IC1-B Special, COMP IC1-C, and COMP OC4-B when compared to the reference treatment R-OS. Concentrations of pyrene in *N. caecoides* tissues exposed to COMP IC1-B Special and COMP IC1-C were statistically significantly different and at a magnitude of ≥ 2 but < 5 times the reference treatment R-OS. The concentrations of pyrene in *N. caecoides* tissues exposed to COMP OC4-B were statistically significantly different and at a magnitude of ≥ 10 times the reference treatment R-OS. ANOVA data for these comparisons are presented in Table 3.28.

TABLE 3.25. Mean Metals Concentrations in the Tissues of *M. nasuta* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-OS	0.250	25.6	0.264	2.03	12.3	0.098	4.37	0.813	1.93	86.2
COMP IC1-A	0.211	26.2	0.254	2.95	13.0	0.085	5.10	0.927	1.80	85.3
COMP IC1-B	0.290	26.1	0.373	2.68	14.4	0.089	7.05	1.236	1.87	89.2
COMP IC1-B Special	0.310	28.6	0.462	2.78	13.6	0.093	6.25	1.329	1.67	100.9
COMP IC1-C	0.252	27.6	0.288	2.61	13.3	0.089	4.91	1.149	1.65	90.6
COMP OC4-B	0.264	24.8	0.320	3.01	12.9	0.089	4.66	1.334	1.95	103.5

TABLE 3.26. Mean Butyltins Concentrations in the Tissues of *M. nasuta* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	<u>(concentrations in $\mu\text{g/kg}$ dry weight)</u>	
	<u>Tributyltin</u>	<u>Dibutyltin</u>
R-OS	11.72	34.07 U(a)
COMP IC1-A	16.33	34.81 U
COMP IC1-B	12.53	31.96 U
COMP IC1-B Special	25.80	32.54 U
COMP IC1-C	14.77	31.23 U
COMP OC4-B	27.14	28.67

(a) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

3.5.6 Chlorinated Pesticide and Polychlorinated Biphenyl Bioaccumulation in *N. caecoides*

Complete *N. caecoides* tissue chemistry data in both wet and dry weight, quality control data, and quality assurance/quality control summaries are contained in Appendix K, Tables K.13 through K.25. Concentrations of pesticides and PCBs in *N. caecoides* tissues were either undetected or detected below the method detection limit for all compounds except 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and Aroclor-1254. The dry weight data for these compounds were analyzed statistically using Dunnett's test (Table 3.29). *N. caecoides* tissues exposed to test treatments COMP IC1-B Special and COMP IC1-C were statistically significantly different for 4,4'-DDD and at a magnitude of <2 times the reference treatment R-OS. The concentrations of 4,4'-DDD in *N. caecoides* tissues exposed to COMP IC1-A and COMP OC4-B were statistically significantly different and at a magnitude of ≥ 2 but <5 times the concentrations found in the reference treatment R-OS. The concentrations of 4,4'-DDE and Aroclor-1254 in *N. caecoides* tissues exposed to COMP OC4-B were statistically significantly different and at a magnitude of ≥ 2 but <5 times the concentrations found in the tissues exposed to the reference treatment R-OS. ANOVA data for those comparisons are presented in Table 3.28.

3.5.7 Metals Bioaccumulation in *N. caecoides*

Appendix K, Tables K.26 through K.28, contain the entire metals results, including quality control data and quality assurance/quality control summaries, in both wet and dry weight reported as mg/kg. The results of Dunnett's test and the mean concentrations of metals in the tissues of *N. caecoides*, expressed in mg/kg dry weight, are presented in Table 3.30. The concentration of As, Cd, Ni, and Pb (with the exception of COMP IC1-B Special) in *N. caecoides* tissues

TABLE 3.27. Mean High Molecular Weight PAH Concentrations in the Tissues of *N. caecoides* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)				
	Fluor-anthene	Pyrene	Chrysene	Benzo(b) fluor-anthene	Benzo(k) fluor-anthene
R-OS	1.72 J(a)	2.61 J	22.63 UJ(b)	22.07 UJ	16.51 UJ
COMP IC1-A	1.77 J	2.92 J	1.26 J	18.02 UJ	8.41 UJ
COMP IC1-B	2.77 J	3.60 J	1.68 J	31.68 UJ	10.29 UJ
COMP IC1-B Special	3.04 J	8.86 J	7.58 UJ	11.90 UJ	7.47 UJ
COMP IC1-C	15.51 UJ	10.94 J	1.57 J	30.56 UJ	14.27 UJ
COMP OC4-B	5.10 J	35.29	7.47 J	16.62 UJ	7.76 UJ

(a) J Analyte detected below method detection limits (MDL), but above instrument detection limit (IDL).

(b) UJ Analyte was either undetected or detected below method detection limit in all replicates; value is mean of detected values and dry weight detection limits.

exposed to the test treatments were statistically significantly different for at least one of the test treatments relative to the reference treatment R-OS. These statistically significant elevations of metals in the *N. caecoides* tissues were at a magnification of <2 times the concentrations found in the reference treatment R-OS; concentrations of Pb in *N. caecoides* tissues exposed to COMP IC1-B Special were at a magnification of ≥ 2 times but <5 times the concentrations in the reference treatment R-OS. The ANOVA data for this statistical comparison are presented in Table 3.28.

3.5.8 Butyltins Bioaccumulation in *N. caecoides*

Complete butyltin results, including quality control data and quality assurance/quality control summaries, are reported in $\mu\text{g/kg}$ wet and dry weight and are presented in Appendix K, Tables K.29 and K.30. The concentrations of butyltins were either undetected or detected below the method detection limit in all the sediment treatments. The mean *N. caecoides* tissue concentrations in the test treatments were well below the concentrations found in the reference treatment R-OS, therefore, no statistical analysis was performed.

TABLE 3.28. ANOVA Results for Chemical Parameters in Tissues of *N. caecoides* Compared to the Deep Off-Shelf Reference (R-OS)

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
PAHs						
Naphthalene	1.183	6.466	5	23	0.842	0.5342
Acenaphthene	0.101	11.737	1	7	0.061	0.8127
Phenanthrene	0.218	2.033	5	23	0.493	0.7784
Anthracene	2.655	42.834	2	11	0.341	0.7184
Fluoranthene	5.315	12.881	5	23	1.898	0.1338
Pyrene	25.062	2.452	5	23	47.024	0.0001
Chrysene	11.650	22.933	5	23	2.337	0.0744
Benzo(b)fluoranthene	11.347	66.363	5	23	0.787	0.5700
Benzo(k)fluoranthene	0.896	64.907	5	23	0.063	0.9969
Chlorinated Pesticides						
Alpha-BHC	1.429	20.504	2	11	0.383	0.6903
Beta-BHC	1.371	4.090	1	7	2.347	0.1694
Gamma-BHC	0.058	2.089	1	7	0.195	0.6724
4,4'-DDD	6.390	2.017	5	23	14.575	0.0001
4,4'-DDE	1.181	0.059	1	7	140.751	0.0001
4,4'-DDT	1.347	15.148	3	15	0.445	0.7246
Dieldrin	3.464	24.116	4	19	0.682	0.6129
Polychlorinated Biphenyls						
Aroclor-1254	2.643	2.400	3	15	5.506	0.0094
Metals						
Silver	0.330	0.713	5	23	2.133	0.0976
Arsenic	0.241	0.242	5	23	4.580	0.0048
Cadmium	0.703	1.082	5	23	2.986	0.0321
Chromium	0.379	1.097	5	23	1.590	0.2026
Copper	0.260	0.639	5	23	1.874	0.1382
Mercury	0.359	0.406	5	23	4.071	0.0086
Nickel	0.286	1.027	5	23	1.281	0.3059
Lead	2.291	1.492	5	23	7.066	0.0004
Selenium	0.423	1.943	5	23	1.002	0.4386
Zinc	0.027	0.103	5	23	1.195	0.3426

TABLE 3.29. Mean Pesticide and PCB Concentrations in the Tissues of *N. caecoides* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)			
	<u>4,4'-DDD</u>	<u>4,4'-DDE</u>	<u>4,4'-DDT</u>	<u>Aroclor-1254</u>
R-OS	1.43 J(a)	3.31 J	8.62 U(b)	82.26 U
COMP IC1-A	2.89	1.70 J	5.56 UJ(c)	52.11 UJ
COMP IC1-B	1.99	1.00 J	8.01 U	76.40 U
COMP IC1-B Special	2.80	2.23 J	4.63 UJ	74.11
COMP IC1-C	2.39 J	2.01 J	9.20 U	86.63 UJ
COMP OC4-B	6.57	6.87	4.92 UJ	171.40

(a) J Analyte detected below method detection limits (MDL), but above instrument detection limit (IDL).

(b) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

(c) UJ Analyte was either undetected or detected below method detection limit in all replicates; value is mean of detected values and dry weight detection limits.

TABLE 3.30. Mean Metals Concentrations in the Tissues of *N. caecoides* Exposed to Oakland Harbor Sediments (bold type indicates value is statistically significantly greater than R-OS when compared by Dunnett's test; box indicates value is $\geq$ two < fivefold magnification of treatment mean compared to R-OS mean; shaded box indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in mg/kg dry weight)									
	<u>Ag</u>	<u>As</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Hg</u>	<u>Ni</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>
R-OS	0.073	21.1	0.62	0.442	10.3	0.086	2.64	0.352	1.73	174
COMP IC1-A	0.096	23.4	0.99	0.500	13.3	0.071	3.47	0.402	1.29	167
COMP IC1-B	0.067	26.2	0.80	0.446	10.6	0.076	3.01	0.564	1.42	169
COMP IC1-B Special	0.072	25.0	0.87	0.642	12.3	0.060	3.14	0.746	1.35	178
COMP IC1-C	0.073	28.8	0.98	0.555	11.6	0.063	2.82	0.652	1.42	182
COMP OC4-B	0.072	25.4	0.73	0.504	13.1	0.074	2.92	0.627	1.82	179

4.0 DISCUSSION

In this section, the analyses and evaluations of Oakland Harbor sediments relative to the reference sediment (R-OS) are discussed relative to the Tier II and Tier III guidelines given in *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual)* (EPA/USACE 1991). Potential water-column effects of dredged material disposal are evaluated for compliance with the limiting permissible concentration (LPC) as set forth under Tier II. According to the 1991 *Implementation Manual*, "the purpose of Tier II is to provide a reliable, rapid screen for potential impact and thereby eliminate the need for further testing." Tier III guidelines for determination of compliance with criteria for ocean disposal, defined under CFR 40, Section 227.13(c) located in Appendix A of the 1991 *Implementation Manual*, include assessments of water column toxicity, deposited sediment (solid-phase) toxicity, and deposited sediment bioaccumulation. Physical characterization and sediment chemistry analysis of Oakland Harbor sediments are used in support of toxicity tests and bioaccumulation results to evaluate appropriate disposal options.

4.1 SEDIMENT CHARACTERISTICS

Geologic evaluations show that sediment from the Oakland Harbor Intensive Study Area is composed of unconsolidated YBM. Sediments in this area are transported and redistributed by current action that results in the vertical stratification of sediment deposits with minimal vertical mixing. Physical and chemical analyses were performed on sediments from mudline to -44 ft MLLW. Mudline elevations of the 20 sampling stations ranged from -30.4 ft to -41.4 ft MLLW. The grain size distribution of Oakland Harbor sediment varied widely. The majority of stations comprising COMP IC1-A and COMP OC4-B were coarse-grained sand with low concentrations of TOC and TVS; the stations comprising COMP IC1-B, COMP IC1-B Special, and COMP IC1-C were fine-grained with high concentrations of TOC and TVS. The oil and grease and TPH concentrations in the test treatments varied from low concentrations in COMP IC1-A to higher concentrations in COMP OC4-B. The reference sediment R-OS was composed of fine-grained material and the concentrations of TOC, TVS, oil and grease, and TPH were similar to the other fine-grained sediment treatments. The majority of test treatments had total PAH, 4,4'-DDD, Aroclor-1254, Aroclor-1260, As, Cr, Cu, Hg, Ni, Pb, and Zn concentrations that were greater than the concentrations in the reference sediment R-OS.

4.2 TIER III EVALUATIONS

4.2.1 Deposited Sediment (Solid-Phase) Acute Toxicity

Deposited sediment toxicity was determined by exposing three species of marine organisms (*R. abronius*, *M. nasuta*, and *N. caecoides*) to test sediment treatments in 10-day

solid-phase tests. If the difference in survival between proposed dredged material (test treatments) and the reference treatment is statistically significantly different, and the difference in survival exceeds 10% (20% for *R. abronius*), then the test material does not comply as stated in Appendix A of the 1991 Implementation Manual. The solid-phase tests for Oakland Harbor sediments (Table 4.1) show acute toxicity to *R. abronius* exposed to test treatment COMP IC1-B, COMP IC1-B Special, and COMP IC1-C when compared to the reference sediment R-OS using Dunnett's test. There were no statistically significant differences in acute toxicity between test treatments and the reference sediment R-OS for *M. nasuta*. Test treatment COMP IC1-B Special was acutely toxic to *N. caecoides* relative to the reference sediment R-OS. The Oakland Harbor test treatment COMP IC1-A did not show statistically significant acute toxicity for any test species relative to the reference sediment R-OS.

4.2.2 Water Column Effects

Estimates of toxicity in the water column were also evaluated by exposing three sensitive marine species (*C. stigmaeus*, *H. costata*, and *M. edulis*) to three concentrations of SPP and a control (0% SPP). The results of the t-test analysis showed statistically significant toxicity to *C. stigmaeus* for test treatments COMP IC1-B, COMP IC1-B Special, and COMP IC1-C (Table 4.2). Test treatments COMP IC1-B R and COMP IC1-B R Special could not be statistically analyzed due to no variance. However, these treatments are observably different from the 0% SPP (Control R). The LC50 was calculated for COMP IC1-B at 49.0% SPP and COMP IC1-B Special at 76.4% SPP. The t-test results for *H. costata* showed no statistically significant toxicity to any of the test treatments and no LC50 could be calculated. The LC50 t-test results for *M. edulis* showed statistically significant toxicity to test treatments COMP IC1-B Special and COMP OC4-B relative to the control. The LC50 for COMP IC1-B Special was 79.9% SPP. The EC50 t-test results for *M. edulis* showed statistically significant toxicity to test treatments COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and COMP OC4-B relative to the control. The EC50 values that could be calculated were: 21.4% SPP for COMP IC1-B, 71.1% SPP for COMP IC1-B Special, and 87.1% SPP for COMP IC1-C.

Under 1991 Implementation Manual guidelines, the limiting permissible concentration (LPC) of dissolved plus suspended contaminants cannot exceed 0.01 of the acutely toxic concentration (LC50) at the boundaries of the disposal site after allowing 4 hours for initial mixing. The LPC values should be entered into a numerical mixing model to determine the contaminant concentrations present in the water column at the disposal site.

The percent normal value is probably more indicative of the test treatment toxicity than the percent survival because normality refers to those test organisms that should survive to adulthood. The most environmentally protective approach would be to base the LPC on the EC50 results for *M. edulis* larvae. As with the LPC calculations using LC50 values, the EC50 for

TABLE 4.1. Comparison of Oakland Harbor Solid-Phase Acute Toxicity to the Deep Off-Shelf Reference R-OS (bold type indicates mean survival statistically significantly lower than the reference based on Dunnett's test; shading indicates $\geq 10\%$ difference between treatment and reference and for *M. nasuta* and *N. caecoides*, $\geq 20\%$ difference for *R. abronius*)

<u>Sediment Treatment</u>	<u>Mean Percent Survival in 10-day Solid-Phase Test</u>		
	<u><i>R. abronius</i></u>	<u><i>M. nasuta</i></u>	<u><i>N. caecoides</i></u>
COMP IC1-A	91.0	99.0	94.0
COMP IC1-B	26.0	99.0	85.0
COMP IC1-B Special	76.0	97.0	81.0
COMP IC1-C	63.0	100.0	88.0
COMP OC4-B	98.0	99.0	91.0
Reference R-OS	97.0	98.3	96.7
<i>R. abronius</i> Control	95.0	NA ^(a)	NA
<i>M. nasuta</i> Control	NA	100.0	NA
<i>N. caecoides</i> Control	NA	NA	97.0

(a) NA Not applicable.

M. edulis larval abnormality requires application of the Addams model (Schroeder and Palermo 1990) to predict contaminant concentrations at the edge of the mixing zone.

4.2.3 Deposited Sediment Bioaccumulation

The potential for bioaccumulation of contaminants was evaluated through 28-day solid-phase exposures of *M. nasuta* and *N. caecoides* to Oakland Harbor sediments followed by chemical analysis of the tissues. The tissue contaminant concentrations were compared to existing Food and Drug Administration (FDA) limits and were statistically compared to the tissues exposed to the reference sediment R-OS. Compliance criteria for bioaccumulation are not as well-defined as for water column or deposited sediment toxicity. If any statistically significant bioaccumulation is detected, other considerations such as the number of elevated compounds, the number of species showing elevated contaminant levels, the magnitude of increase in contaminant concentrations, the degree or magnitude of the elevations relative to tissues exposed to reference sediment, and related sediment toxicity, are examined.

M. nasuta and *N. caecoides* tissue contaminant concentrations were one to three orders of magnitude below the FDA action limits after exposure to Oakland Harbor sediments (Table 4.3). Although the majority of contaminants were not elevated in *M. nasuta* and *N. caecoides* tissues, statistically significant elevations of several contaminants were detected when compared to tissues exposed to the Deep Off-Shelf reference sediment R-OS using Dunnett's test (Table 4.4).

TABLE 4.2. Suspended-Particulate-Phase Toxicity Test Results (bold type indicates mean survival in 100% SPP statistically significantly lower than control in t-test, $\alpha = 0.05$)

Sediment Treatment	<u>Sanddab <i>C. stigmaeus</i></u>			<u>Mysid <i>H. costata</i></u>			<u>Mussel Larvae <i>M. edulis</i></u>		
	<u>Mean Survival (%)</u>		<u>LC50 as</u>	<u>Mean Survival (%)</u>		<u>LC50 as</u>	<u>Mean Survival (%)</u>		<u>LC50 as</u>
	<u>0% SPP</u>	<u>100% SPP</u>	<u>% SPP</u>	<u>0% SPP</u>	<u>100% SPP</u>	<u>% SPP</u>	<u>0% SPP</u>	<u>100% SPP</u>	<u>% SPP</u>
COMP IC1-A	84.0	72.0	>100	96.0	96.0	>100	87.0	81.0	>100
COMP IC1-B	94.0	0.0	49.0	100.0	98.0	>100	79.0	65.0	>100
COMP IC1-B R	100.0	0.0(a)	NC(b)	NA(c)	NA	NA	NA	NA	NA
COMP IC1-B Special	92.0	18.0	76.4	100.0	98.0	>100	98.0	25.0	79.9
COMP IC1-B Special R	100.0	7.0(a)	NC	NA	NA	NA	NA	NA	NA
COMP IC1-C	90.0	56.0	>100	98.0	96.0	>100	79.0	80.0	>100
COMP IC1-C R	100.0	87.0	>100	NA	NA	NA	NA	NA	NA
COMP OC4-B	84.0	82.0	>100	100.0	98.0	>100	99.0	81.0	>100
R-OS	NA	NA	NA	96.0	92.0	>100	85.0	80.0	>100

(a) Statistical significance could not be determined due to no variance among replicates; the 100% SPP is observably different from the 0% SPP.

(b) NC Not calculable.

(c) NA Not applicable.

One low-molecular-weight PAH (anthracene), five high molecular weight PAHs [fluoranthene, benzo(a)anthracene, pyrene, chrysene, benzo(k)fluoranthene], three pesticides (4,4'-DDD, 4,4'-DDT, and dieldrin), one PCB (Aroclor-1254), and two metals (Ni and Pb) were elevated in *M. nasuta* tissues exposed to at least one of the test treatments relative to the reference sediment R-OS (Table 4.4). The PCB Aroclor-1254 was elevated in *M. nasuta* tissues at a magnitude of ≥ 10 times the concentrations present in tissues exposed to the reference sediment R-OS.

One high-molecular-weight PAH (pyrene), two pesticides (4,4'-DDD and 4,4'-DDE), one PCB (Aroclor-1254), and four metals (As, Cd, Ni, and Pb) were elevated in *N. caecoides* tissues exposed to at least one of the test treatments relative to the reference sediment R-OS. Only pyrene was elevated at a magnitude of ≥ 10 times the tissue levels exposed to the reference sediment R-OS. Butyltins were not statistically significantly elevated in *N. caecoides* tissues exposed to any of the test treatments relative to the tissues exposed to the reference sediment R-OS.

4.3 TOTAL AMMONIA INFLUENCE TO THE OBSERVED ACUTE TOXICITY OF *R. abronius* AND *C. stigmaeus*

Statistically significant acute toxicity was observed in test treatments COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and R-BF for the solid-phase acute toxicity test with *R. abronius*. The concentrations of total ammonia in the interstitial water for these treatments were compared to data provided by Kohn et. al. 1993, which predicts *R. abronius* toxicity as a function

TABLE 4.3. Comparison of FDA Action Levels With Contaminant Levels in *M. nasuta* and *N. caecoides* Exposed to Oakland Harbor Sediments

<u>Contaminant</u>	<u>FDA Action Level (mg/kg wet weight)</u>	<u>Maximum Concentration (mg/kg wet weight)</u>	
		<u><i>M. nasuta</i></u>	<u><i>N. caecoides</i></u>
Benzene Hexachloride (BHC)(a)	0.3	0.0005 U(b)	0.0009
Chlordane	0.3	0.030 U	0.025 U
DDT + DDE	5.0	0.0048	0.0013
Dieldrin + Aldrin	0.3	0.001	0.0001
Endrin	0.3	0.0005 U	0.001 U
Heptachlor + Heptachlor Epoxide	0.3	0.0003	0.0013 U
Toxaphene	5.0	0.030 U	0.025 U
PCBs	2.0	0.037 E(c)	0.031

(a) Total BHCs (alpha-, beta-, delta-, and gamma-BHC).

(b) U Undetected above given concentration.

(c) E Analyte was an estimated value of Aroclor-1254.

of the concentrations of total ammonia. The observed proportion survival of *R. abronius* in test treatments COMP IC1-B and COMP IC1-B Special, and the reference sediment R-BF were comparable to the results from Kohn et al. 1993 using similar ammonia concentrations. These results suggest that total ammonia may be responsible for the observed toxicity of *R. abronius* to these sediment treatments. The observed survival of *R. abronius* at COMP IC1-C was lower than predicted based on Kohn et al. 1993, and indicates that factors in addition to ammonia contributed to the toxicity at COMP IC1-C.

Statistically significant toxicity was also observed at test treatments COMP IC1-B, COMP IC1-B Special, and COMP IC1-C for the *C. stigmaeus* SPP test. The results of the *C. stigmaeus* retest were compared to the dose response curve from the ammonia reference toxicant test. This comparison shows a similar response in *C. stigmaeus* survival exposed to COMP IC1-B and COMP IC1-B Special and a higher than expected response for COMP IC1-C and R-BF relative to the ammonia reference toxicant test. Further studies measuring the effects of ammonia to *C. stigmaeus* need to be performed in order to better interpret the role of ammonia as a toxicant using both solid-phase and SPP tests.

Ammonia is highly toxic to many aquatic organisms (EPA 1989). However, it is not persistent in natural aquatic systems because microbial communities in the marine environment rapidly oxidize ammonia to less toxic nitrate and nitrite compounds (Sverdrup et al. 1942). Static laboratory test conditions using sediment that is stored and manipulated prior to testing are likely to maximize conditions that are conducive to the formation of ammonia. Therefore, it is appropriate to measure ammonia and to determine its role in organism toxicity when other persistent toxic

TABLE 4.4. Summary of Statistically Significant Acute Toxicity and Bioaccumulation for Oakland Harbor Sediment Treatments Relative to the Reference Sediment R-OS

Sediment Treatment	Acute Toxicity	<i>M. nasuta</i> Bioaccumulation					<i>N. caecoides</i> Bioaccumulation				
		PAH	pesticides	PCB	Metals	TBT	PAH	pesticides	PCB	Metals	TBT
COMP IC1-A	---(a)	---	---	---	---	---	---	DDD	---	Cd, Ni	---
COMP IC1-B	R(b),C(c)	---	---	---	Ni,Pb	---	---	---	---	As,Pb	---
COMP IC1-B R	---	NA(d)	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IC1-B Special	R,N(e), C, B(f)	HPAH	---	---	Ni, Pb	TBT	HPAH	DDD	---	As, Cd, Pb	---
COMP IC1-B Special R	---	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IC1-C	R,C	HPAH	---	---	Pb	---	HPAH	DDD	---	As, Cd, Pb	---
COMP IC1-C R	---	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP OC4-B	B	LPAH,HPAH	DDD,DDT,Diel	1254	Pb	TBT	HPAH	DDD,DDE	1254	As, Pb	---

(a) No statistically significant acute toxicity or bioaccumulation.

(b) R Acutely toxic to *R. abronius* in the 10-day solid-phase test.

(c) C Statistically significantly different to *C. stigmaeus* in the 96-h SPP test.

(d) NA Not Applicable.

(e) N Acutely toxic to *N. caecoides* in the 10-day solid-phase test.

(f) B Statistically significantly different to *M. edulis* in the 72-h SPP test.

chemicals, whose discharge in the aquatic environment are controlled by international, federal and state legislation, do not appear to be controlling toxicity of test sediments.

4.4 CONCLUSIONS AND RECOMMENDATIONS

Based on a Tier III evaluation of the results of this study, there is enough information to determine suitable disposal options for all of the test treatments. Only one of the test treatments (COMP IC1-A) was not acutely toxic for any solid-phase test and there was no statistically significant toxicity in the SPP tests. Bioaccumulation of at least one parameter in tissues of either *M. nasuta* or *N. caecoides* was observed in every test treatment relative to the reference sediment R-OS. Sediment chemistry, acute toxicity and bioaccumulation data for each Oakland Harbor test treatment is summarized in the following paragraphs.

Proposed dredged material from Oakland Harbor was evaluated based on four criteria: 1) concentrations and magnifications of contaminants in the test sediment treatments relative to the reference sediment; 2) calculable LC50 values for organisms exposed to dissolved and suspended material in the water column relative to a control (0% SPP); 3) solid-phase acute toxicity of the test treatments compared to the reference sediment; and, 4) concentrations and magnifications of contaminants in the tissues of both *M. nasuta* and *N. caecoides* tissues exposed to the test treatments relative to the tissues exposed to the reference sediment. The matrix in Figure 4.1 presents the results of these evaluations.

In addition to summarizing bioaccumulation results, Figure 4.1 shows the number of contaminants elevated above R-OS and the acute toxicity of the test treatments relative to the reference sediment R-OS. These comparisons are related to ocean disposal criteria for each test treatment. The following paragraphs present an overview of the results for each test treatment relative to the reference sediment R-OS to assist the USACE, EPA and other resource agencies in evaluating suitable disposal options for areas IC-1 and OC-4.

COMP IC1-A represents approximately 215 thousand cubic yards of potential dredged material. Mudline depths in this area ranged from -35.4 ft MLLW to -40.4 ft MLLW. Sediment from this area is considerably more coarse-grained (>87% sand and gravel) than the reference sediment R-OS and has lower TOC and TVS concentrations. In general, sediments from COMP IC1-A have lower levels of PAHs, pesticides, PCBs, metals and butyltins relative to sediments from R-OS. There was no acute toxicity of COMP IC1-A for any solid-phase test and there was no statistically significant toxicity or calculable LC50s in the SPP tests. There was no statistically significant bioaccumulation in *M. nasuta* tissues exposed to COMP IC1-A relative to the reference sediment R-OS. One pesticide (4,4'-DDD) and two metals (Cd and Ni) were

Sediment Treatments	Sediment Chemistry				Toxicity		Significant Bioaccumulation					Bioaccumulation $\geq 2 < 5$ times					Bioaccumulation $\geq 5 < 10$ times					Bioaccumulation ≥ 10 times				
	sediment LPAH > R-OS	sediment HPAH > R-OS	# of sediment Pesticide and PCB > R-OS	# of sediment Metals > R-OS	# of sediment Butyltins > R-OS	species associated with SPP toxicity	species with solid-phase acute toxicity	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	
COMP IC1-A				1						1		2	2		1											
COMP IC1-B			1	5		C	R					2	2													
COMP IC1-B Special			2	6	1	C,B,R,N		1	1	1	2	3	1	1	1					1	1					
COMP IC1-C			1	7	1		R	2	1	1	1	3														
COMP OC4-B			2	4	1			1	5	1	3	2	1	1	2	3	2	1	1	1	2					

✓ Total LPAH or HPAH with detected values above the reference R-OS

C Calculable LC50 values in the *C. stigmatosus*

B Calculable LC50 values in the *M. edulis*

R Acute Toxicity in the *R. abronius* 10-day test

N Acute Toxicity in the *N. caecoides* 10-day test

☒ Number of Compounds Bioaccumulating in *M. nasuta* Tissues

☒ Number of Compounds Bioaccumulating in *N. caecoides* Tissues

FIGURE 4.1. Matrix of Sediment Chemistry, Significant Acute Toxicity, and Bioaccumulation for Oakland Harbor Sediment Relative to the Deep Off-Shelf Reference R-OS

statistically significantly different and at a magnitude of <5 times in the *N. caecoides* tissues exposed to COMP IC1-A relative to the reference sediment R-OS.

Test treatment COMP IC1-B represents approximately 300 thousand cubic yards of potential dredged material. Mudline depths in this area ranged from -37.5 ft to -44.0 ft MLLW. Sediment from this area was divided into two test treatments, COMP IC1-B and COMP IC1-B Special. The bottom layer of sediment, consisting of consolidated, grey, coarse-grained sediment, was allocated to COMP IC1-B. The concentrations of TOC and TVS in COMP IC1-B sediment are similar to the reference sediment R-OS. The concentrations of LPAHs, pesticides and PCBs were lower in sediment from COMP IC1-B than the reference sediment R-OS. Concentrations of total HPAH, one pesticide (4,4'-DDD), and five metals were greater in COMP IC1-B sediments than the reference sediment R-OS. Sediments from COMP IC1-B were acutely toxic for *R. abronius* (solid-phase test) and statistically significantly different for *C. stigmaeus* (SPP test). An LC50 value of 49% SPP was calculated for *C. stigmaeus*. Bioaccumulation of metals was seen in both *M. nasuta* (Ni and Pb) and *N. caecoides* (As and Pb) at concentrations <2 times those observed in the tissues exposed to the reference sediment R-OS.

COMP IC1-B Special is the top layer of sediments from the area designated as IC1-B. Mudline depths for this composite ranged from -30.4 ft MLLW to -34.9 ft MLLW. These sediments consisted of soft, black, unconsolidated, fine-grained material. This composite has a lower TOC and TVS concentration and a higher oil and grease concentration than the reference sediment R-OS. Total PAH concentrations, one pesticide (4,4'-DDD), one PCB (Aroclor 1254), six metals, and tributyltin were elevated in sediments from COMP IC1-B Special relative to reference sediment R-OS. Sediment from COMP IC1-B Special was acutely toxic to *R. abronius* and *N. caecoides* (solid-phase test). The SPP results for *C. stigmaeus* were statistically significantly different from the control but no LC50 could be calculated. *M. edulis* were statistically significantly different from the control and an LC50 of 79.9% SPP was calculated. Statistically significant bioaccumulation for COMP IC1-B Special was observed in *M. nasuta* tissues for benzo(k)fluoranthene, Ni, Pb and TBT at magnifications <5 times that of tissues exposed to the reference sediment R-OS. *N. caecoides* tissues exposed to COMP IC1-B Special were statistically significantly different for pyrene, 4,4'-DDD, As, Cd, and Pb at a magnification of < 5 times the tissues exposed to the reference sediment R-OS.

COMP IC1-C represents approximately 140 thousand cubic yards of potential dredged material. Mudline depth in this area ranged from -35.0 ft MLLW to -39.2 ft MLLW. The sediment from COMP IC1-C is mainly fine-grained (61% silt and clay) and has lower concentrations of TOC and TVS compared to the reference sediment R-OS. COMP IC1-C had higher concentrations of total PAH, one pesticide (4,4'-DDD), seven metals, and tributyltin in the sediment relative to the reference sediment R-OS. COMP IC1-C was acutely toxic to

R. abronius (solid-phase test) and was statistically significantly different for *C. stigmaeus* (SPP test). An LC50 value could not be calculated for *C. stigmaeus*. Concentrations of pyrene, benzo(k)fluoranthene, and Pb in *M. nasuta* tissues exposed to COMP IC1-C were statistically significantly elevated relative to the reference sediment R-OS. *N. caecoides* tissues were statistically significantly elevated for pyrene, 4,4'-DDD, As, Cd, and Pb relative to tissues exposed to the reference sediment R-OS. In all cases, these statistically significant elevations were <5 times the tissue concentrations of the reference sediment R-OS.

COMP OC4-B represents approximately 90 thousand cubic yards of proposed dredged material. The mudline depths in this area ranged from -38.0 ft MLLW to -41.4 ft MLLW. The composition of sediment in this area is mainly coarse-grained sand with lower TOC and TVS concentrations than the reference sediment R-OS. COMP OC4-B had the only detectable concentration of TPH at 32 mg/kg. The sediment from COMP OC4-B had a higher total PAH concentration than the reference sediment R-OS. One pesticide (4,4'-DDD), one PCB (Aroclor-1254), four metals (Cr, Hg, Ni and Pb), and tributyltin were statistically significantly elevated in COMP OC4-B sediment relative to the reference sediment R-OS. COMP OC4-B was statistically significantly different to *M. edulis* larvae but did not have a calculable LC50. *M. nasuta* tissues exposed to COMP OC4-B were statistically significantly elevated for PAHs, pesticides, PCBs, metals, and butyltins relative to the tissues exposed to the reference sediment R-OS. Two HPAHs [pyrene and benzo(k) fluoranthene] and one PCB (Aroclor-1254) were statistically significantly elevated and at a magnification of ≥ 5 times in *M. nasuta* tissues relative to the reference sediment R-OS. *N. caecoides* tissues exposed to COMP OC4-B were statistically significantly elevated for HPAHs, pesticides, PCBs, and metals relative to the tissues exposed to the reference sediment R-OS. One HPAH (pyrene) was statistically significantly different and at a magnification of ≥ 10 times in *N. caecoides* tissues relative to the reference sediment R-OS.

The purpose of this study was to conduct comprehensive evaluations, including chemical, biological, and bioaccumulation testing, of sediments in the polygon areas designated IC-1 and OC4-B. This information was required by the EPA and the USACE in evaluating the suitability of sediments in these areas for unconfined aquatic disposal.

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APPENDIX A

MATERIALS AND METHODS USED FOR
THE DESCRIPTION OF SEDIMENT CORES

APPENDIX A

MATERIALS AND METHODS USED FOR THE DESCRIPTION OF SEDIMENT CORES

A.1 MATERIALS

The following is a checklist of items and materials used for the examination and description of sediment cores.

- ASTM Procedure D 2488-84
- Stainless-steel knife
- Hand lens (10X magnification)
- 10 N Hydrochloric acid (HCl)
- Ruler (scaled in 0.1-foot increments)
- Blank log forms (see Figure A.1)
- Clipboard
- AGI Data Sheets
- Munsell Color Charts

In addition, the charts and/or reference materials listed in Table A.1, and included in this appendix, are used for the description of specific sediment characteristics.

A.2 METHODS

Descriptions of the physical, chemical, and biological features preserved in sediments aid in the interpretation of the types of geologic processes active both during and after the sediment was deposited. A total of 17 sediment characteristics, outlined in ASTM (1984), are commonly used to describe inorganic soils. These are listed in Table A.2.

Moisture condition was not routinely logged because of the saturated nature of the sediments. Furthermore, since particles were rarely larger than coarse sand, neither were angularity, particle shape, range in particle size, and hardness logged. For this reason, these sediment characteristics were not included in the log form used for the description of Port of Oakland Berthing Program sediments (Figure A.1). However, in the few instances where these characteristics did apply, they were described under the "COMMENTS" column.

Page of

TABLE A.1. Charts and Other Reference Materials Used to Provide Standardized Descriptions of Sediment Characteristics

<u>CHART/REFERENCE</u>	<u>PURPOSE</u>	<u>FIGURE #</u>
• Percentage Estimate Chart	Estimate percentage of individual particles or constituents	A.2
• Roundness Scale	Roundness of sand and coarser particles	A.3A
• Sorting Chart	Estimate of grading	A.3B
• Particle Shape	Reference to describe particle shape	A.4
• Munsell Soil Color Charts	Soil color	A.5
• Unified Soil Classification System	Method for designating sediment type	A.6, A.7
• Grain-size Scales	Range of particle sizes; maximum particle size	A.8, A.9
• Lithologic Symbols	Graphic patterns for lithologic log	A.10, A.11

TABLE A.2. Sediment Characteristics Identified in ASTM Procedure D2488-84

1) angularity *	10) sediment classification type (i.e., lithology)
2) <u>particle shape</u> *	11) <u>range of particle sizes</u> *
3) color	12) maximum particle size
4) odor	13) <u>hardness</u> *
5) <u>moisture condition</u>	14) dry strength **
6) HCl reaction	15) dilatancy **
7) consistency (i.e., firmness)	16) toughness **
8) cementation *	17) plasticity **
9) structure	

* Applies to coarse-grained sediment (sand and larger particles)

** Applies to fine-grained sediment of mostly silt and/or clay

Features not generally logged for this study are underlined

The definition of "soil" from the engineers standpoint (ASTM, 1984), includes any unconsolidated sediment. The geologic definition of soil is slightly different and restricts soils to those sedimentary deposits that have undergone alteration near the land's surface by either physical, chemical, and/or biological processes; therefore, in a strict sense, not all sediments are soils. For the purposes of this discussion, however, "soils" and "sediments" will be used synonymously.

It is sometimes helpful to provide an estimate of the relative proportions of different constituents in sediments (e.g. light- versus dark-colored minerals). This is made easier and more accurate by using a percentage estimate chart, which provides a graphic reference with varying concentrations of a particular constituent (Figure A.2).

The criteria used to describe each of the 17 sediment characteristics identified in ASTM (1984) are discussed below.

FIGURE A.2. Comparison Chart Used to Estimate the Percentages of Constituents (from AGI 1982)

FIGURE A.3. Charts Used to Visually Estimate (A) Roundness/Sphericity and (B) Sorting/Grading

A.2.1 Angularity

The angularity of sedimentary particles is a reflection of the sedimentary environment and the amount of time that has elapsed before deposition and burial. A chart showing how to classify the angularity of sedimentary particles is presented in Figure A.3A. A range of angularity may be stated, such as: subrounded to rounded.

A.2.2 Shape

Shapes of sedimentary particles often reflect the internal characteristics (e.g., preferential parting) of the material or sometimes the type of sedimentary environment. For example gravel clasts deposited in high-energy environments, such as beaches and river bottoms, are often worn flat.

According to Figure A.4, gravel-sized clasts may be described in one of four ways. First, if the ratio of the clast's width to thickness is >3 , it is classified as flat. Second, if the ratio of the clast's length to width is >3 , the clast is elongate. Third, if both criteria apply the clast is both flat and elongate. And last, if none of the criteria apply, then shape is not mentioned. Indicate the fraction of the clasts that have the shape, such as: one-third of gravel clasts are flat. Particle shape did not apply to most of the sediments logged during this project and the few pebbles that were observed were neither flat nor elongate.

FIGURE A.4. Criteria Used to Describe Particle Shape of Pebbles and Large Gravels (From ASTM 1984)

A.2.3 Color

Color may be useful in identifying materials of similar geologic origin. For example, color was often a useful criteria for differentiating Younger Bay Mud from Older Bay Mud. Sediment color was determined by comparing the wet sediment with standard sediment colors given in Munsell (1975). The advantage to using the Munsell soil color system is that it provides a consistent, standardized method for describing color and subjectivity is minimized.

The Munsell color notation consists of three simple variables that combine to describe all colors known in the Munsell soil color system. The three variables are: hue, value, and chroma (Figure A.5). The hue notation indicates the relation of the sediment color with respect to red, yellow, green, blue and purple; the value notation indicates its lightness, and the chroma notation indicates its strength (i.e., intensity).

Color can be described either by the Munsell notation (e.g. 5YR 5/3; hue=5YR, value=5, chroma=3) or by its equivalent color name (e.g. reddish brown). Both the color name and Munsell notation were recorded on core logs (see Appendix B). Only rarely was there not a reasonable match between the true color of the core sediment and one of the colors on a Munsell color chart.

A.2.4 Odor

Odors may indicate the presence of contaminants or be the result of the geochemical environment. Odors most frequently noted were that of petroleum hydrocarbons and the smell of rotten eggs (an indication of the presence of hydrogen sulfide). Both of these odors were restricted to the Younger Bay Mud unit. Petroleum odors may be the result of contamination of the sediments by shipping spills or industrial waste, or perhaps are derived from decaying organic matter present in these sediments. Hydrogen sulfide is a common natural by-product in chemically reducing environments such as the Oakland Harbor estuary.

FIGURE A.5. Example of a Page from the Munsell Soil Color for Hue 7.5YR

A.2.5 Moisture Condition

Moisture condition is described as either dry, moist, or wet according to the following criteria:

DRY	Absence of moisture, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table (i.e., saturated)

All the sediments logged for this project were taken from below sea level and did not lose any significant moisture between the time they were drilled and logged. Therefore, they are all classified as wet.

A.2.6 HCl Reaction

The reaction (i.e., effervescence) of sedimentary material, as a result of adding hydrochloric acid, is an indication of the presence of calcium carbonate. Calcium carbonate in sediments may be derived from a variety of sources including: 1) physical disintegration of preexisting carbonate rocks (e.g., limestone, marble), 2) biogenic precipitation (e.g., shell, bone), and 3) soil development. In the last example, calcium carbonate concentrations, often referred to as caliche or calcrete, may accumulate over time near the land's surface in arid climates. Where calcium carbonate concentrations occur in combination with other evidence for soil development, such as root traces and oxidation, then a pedogenic (soil forming) origin is favored. Criteria for describing the reaction with 10 N HCl are as follows:

NONE	No visible reaction
WEAK	Some reaction, with bubbles forming slowly
STRONG	Violent reaction, with bubbles forming immediately

A solution of 10 N HCl is obtained by slowly adding one part of concentrated hydrochloric acid to three parts of distilled water.

A.2.7 Consistency

Consistency is a measure of the firmness or consolidation of sedimentary material. In general, there is a direct relationship between consistency and age of the deposit (i.e., older deposits are usually more firm because of compaction and/or cementation). Consistency is most applicable to fine-grained sediments and least applicable on sediments that contain significant amounts of gravel. The criteria used to determine consistency are as follows:

VERY SOFT	Penetrometer penetrates soil greater than 4 cm
SOFT	Penetrometer penetrates soil 2.0 to 4.0 cm
FIRM	Penetrometer penetrates soil 0.25 to 2.0 cm
HARD	Penetrometer penetrates soil less than 0.25 cm

The penetrometer used for sediment core descriptions consists of a 6-in. nail spike attached to a clay brick for a total mass of 2.0 kg; the nail spike is marked in centimeter increments to quantify the amount of soil penetration.

A.2.8 Cementation

Often sedimentary particles are held together with a binding cement. Three common natural cements are calcium carbonate (lime), silica, and iron-oxide compounds. Particles cemented with calcium carbonate effervesce in the presence of hydrochloric acid (see Section A.2.6 above). Sediments cemented with iron oxide are usually some shade of red, yellow, or brown. Usually there is a relationship between consistency (Section A.2.7) and cementation, in that strongly cemented deposits are also hard to very hard. Criteria used to describe the degree of cementation are:

WEAK	Crumbles or breaks with handling or light finger pressure
MODERATE	Crumbles or breaks with considerable finger pressure
STRONG	Will not crumble or break with finger pressure

A.2.9 Structure

Structures are features that originate within the layers of sediment or at the sediment/water interface in response to various physical, biologic

and/or chemical processes. Structures may be classified into two categories: primary and secondary. Primary structures form as the sediment is being deposited (e.g., lamination, stratification). Secondary structures form after deposition, often as a result of compaction or other stresses (e.g., fissured, slickensided), biologic activity (e.g., root traces, mottling), and soil development (e.g., homogeneous, blocky, mottled). The following are some common structures observed in sedimentary deposits.

PRIMARY STRUCTURES

STRATIFIED	Alternating layers of varying material or color with layers at least 6 mm thick
LAMINATED	Alternating layers of varying material or color with the layers less than 6 mm thick
LENSED	Inclusion of small pockets of different sediment type, such as small lenses of sand scattered through a mass of clay. (This type of structure may also be secondary).

SECONDARY STRUCTURES

FISSURED	Breaks along definite planes of fracture with little resistance to fracturing
SLICKENSIDED	Fracture planes appear polished or glossy, sometimes striated
BLOCKY	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
MOTTLED	Variation in color of sediments as represented by localized spots or blotches of color or shades of color
HOMOGENEOUS	Same color and appearance throughout

A.2.10 Sediment Classification Type

The classification method used in this study is the Unified Soil Classification System, which consists of a two-letter designation for most soils (i.e., unconsolidated sediments). A simplified version of the Unified Soil Classification System is presented in Figure A.6, while a more-detailed breakdown is presented in Figure A.7.

Major Divisions		Group Symbols	Description
Coarse-Grained Sediments More than half of particles are larger than very fine sand	≥50% Gravel	Clean Gravels	GW Well-graded (i.e., poorly sorted) gravels, gravel-sand mixtures, little or no fines
		GP	Poorly graded (i.e., well sorted) gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines	GM Silty gravels, gravel-sand-silt mixtures
			GC Clayey gravels, gravel-sand-clay mixtures
	≥50% Sands	Clean Sands	SW Well-graded sands, gravelly sands, little or no fines
			SP Poorly graded sands, gravelly sands, little or no fines
		Sands with Fines	SM Silty sands, sand-silt mixtures
			SC Clayey sands, sand-clay mixtures
Fine-Grained Sediments More than half of particles are smaller than very fine sand	Silts and Clays	Low Liquid Limit	ML Silts and very fine sands, silty or clayey fine sands, or clayey silts, with slight plasticity
			CL Clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		High Liquid Limit	MH Silts or fine sandy silts with moderate plasticity
			CH Clays of high plasticity, fat clays

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FIGURE A.6. Abbreviated Form of the Unified Soil Classification System
(From AGI 1982)

FIGURE A.7. Detailed Flow Chart For the Classification of Coarse- and Fine-Grained Soils Using the Unified Soil Classification System

According to the Unified Soil Classification System, coarse-grained sediments are classified based on grain-size distribution and grading (i.e., sorting), while fine-grained sediments are classified on the basis of grain size and liquid limit vs. plasticity.

Particle-size distribution may be determined with precision using laboratory methods (e.g., sieving of sand and coarser particles; pipette or hydrometer analysis of silt and clay). Because these methods are expensive and time-consuming, it is more desirable to estimate grain size using rapid visual-manual techniques described below. For example, sand and coarser particles are most easily identified via comparison with standard charts of grain size (Figures A.8 and A.9). Fine-grained soils, consisting of mostly silt and/or clay, on the other hand, are identified based on manual tests of their dry strength, dilatancy, toughness, and plasticity (Figure A.10).

In the Unified Soil Classification System, the first letter of the sediment-type symbol represents the predominant grain-size interval, be it gravel (G), sand (S), silt (M), or clay (C). For coarse-grained sediments, the first letter (i.e., G or S) may be followed by a descriptor of grading, either W (well graded) or P (poorly graded), or a secondary grain-size descriptor (M or C). The definition of grading is opposite that of sorting, a common geologic term. For example, a clean, well-sorted sand, consisting of particles over a narrow range in grain size, is referred to as poorly graded in the Unified Soil Classification System and would receive the designation "SP". The relationship between grading and sorting is shown graphically in Figure A.3B. The second letter in the fine-grained soil designation consists of either L (low liquid limit) or H (high liquid limit).

The lithology column on the geologic log (Figure A.1) essentially represents a graphic display of sediment type, which can be utilized for quick easy reference and comparison between different cores and thus make interpretations easier. Examples of lithologic symbols in common use are presented in Figure A.11. Additional symbols may be used as long as they are graphically representative of the feature and are specifically defined and identified in a key that accompanies lithologic logs.

Grade Limits			inches	U.S. Standard Sieve Series	Grade Name		
phi	mm	mm					
-12	4096 -	- - - -	161.3	- - -	- - - - very large	Boulders	GRAVEL
-11	2048 -	- - - -	80.6	- - -	- - - - large		
-10	1024 -	- - - -	40.3	- - -	- - - - medium		
-9	512 -	- - - -	20.2	- - -	- - - - small		
-8	256 -	- - - -	10.1	- - -	large	Cobbles	
-7	128 -	- - - -	5.0	- - -	- - - - small		
-6	64 -	- - - -	2.52	63 mm -	very coarse	Pebbles	
-5	32 -	- - - -	1.26	31.5 mm	- - - - coarse		
-4	16 -	- - - -	0.63	16 mm -	- - - - medium		
-3	8 -	- - - -	0.32	8 mm -	- - - - fine		
-2	4 -	- - - -	0.16	No. 5 -	- - - - very fine		
-1	2 -	- - - -	0.08	No. 10 -	very coarse	Sand	SAND
0	1 -	- - - -	0.04	No. 18 -	- - - - coarse		
+1	1/2 -	0.500 -	- - -	No. 35 -	- - - - medium		
+2	1/4 -	0.250 -	- - -	No. 60 -	- - - - fine		
+3	1/8 -	0.125 -	- - -	No. 120	- - - - very fine		
+4	1/16 -	0.062 -	- - -	No. 230	coarse	Silt	MUD
+5	1/32 -	0.031 -	- - -	- - -	- - - - medium		
+6	1/64 -	0.016 -	- - -	- - -	- - - - fine		
+7	1/128 -	0.008 -	- - -	- - -	- - - - very fine		
+8	1/256 -	0.004 -	- - -	- - -	coarse	Clay Size	
+9	1/512 -	0.002 -	- - -	- - -	- - - - medium		
+10	1/1024	0.001 -	- - -	- - -	- - - - fine		
+11	1/2048	0.0005 -	- - -	- - -	- - - - very fine		
+12	1/4096	0.00025					

FIGURE A.8. Grain-size Scale Used to Determine Sedimentary Particle Size

FIGURE A.9. Comparison Chart Used to Distinguish Among Sand to Pebble-size Particles (From AGI 1982). For larger particles, refer to Figure A.8; for smaller particles, refer to Sections A.2.13 and A.2.16 in this Appendix

Sediment Type	Dry Strength					Dilatancy			Toughness			Plasticity			
	None	Low	Medium	High	Very High	None	Slow	Rapid	Low	Medium	High	Nonplastic	Low	Medium	High
ML (Silt)	■						■		■			■			
MH (Elastic Silt)		■					■		■				■		
CL (Lean Clay)			■				■			■				■	
CH (Fat Clay)				■			■				■				■

FIGURE A.10. Identification of Inorganic Fine-grained Soils From Manual Tests

Lithology:

Clay
Silty clay to clayey silt
Silt
Sandy silt to silty sand
Sand
Pebbles
Mollusk shells
Concentrated organic matter
Iron-oxide concentrations
Root traces

FIGURE A.11. Lithologic Symbols Used on Core Log Forms

A.2.11 Range of Particle Sizes

For gravel- and sand-sized particles, the range of particle sizes within each component is defined. For example, 20% fine to coarse gravel, 40% fine to coarse sand. The sizes of particles corresponding to the different size components are presented in Figures A.8 and A.9.

A.2.12 Maximum Particle Size

Maximum particle size is significant because it gives a general indication of the amount of turbulence or energy associated with deposition. If the maximum particle size is sand, it should be described as either fine, medium, or coarse sand. If the maximum particle size is in the gravel range, the largest particle is measured and its width recorded along the narrowest axis. The sizes of particles corresponding to the different size components are presented in Figures A.8 and A.9.

The maximum grain size observed for the Younger Bay Muds ranged from silt to medium sand, while the Older Bay Mud usually ranged from fine sand to coarse sand. The largest particles observed anywhere were fine pebbles in the Older Bay Mud unit.

A.2.13 Dry Strength

Dry strength, along with dilatancy, toughness, and plasticity are physical characteristics used to distinguish fine-grained inorganic soils, consisting of mostly silt and/or clay. Basically, the more clay present in a soil the greater its dry strength (Figure A.10). To perform a manual test of dry strength enough material must be selected in order to mold into a ball about 1 in. in diameter. Mold the material until it has the consistency of putty, adding water if necessary. From the molded material, make at least three test specimens each about 1/2 in. in diameter. Allow the test specimens to dry in air, sun or by artificial means, as long as the temperature does not exceed 60°C (ASTM, 1984). The criteria for determining dry strength are as follows:

NONE	The dry specimen crumbles into powder with mere pressure of handling
LOW	The dry specimen crumbles into powder with light finger pressure

MEDIUM	The dry specimen breaks into pieces or crumbles with considerable finger pressure
HIGH	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface
VERY HIGH	The dry specimen cannot be broken between the thumb and a hard surface

Dry strength was determined for Port of Oakland Berthing Program cores by sampling selected intervals and allowing the samples to air dry overnight. Dry strength was determined the next day and noted in the comments column of the geologic log.

A.2.14 Dilatancy

Dilatancy is a measure of how easily a soil gives up water when shaken. For example, some clays have the ability to absorb and retain large amounts of water into their crystal lattice. "Fat" clays tend to retain their water even under stress whereas "lean" clays and silt tend to release water when shaken.

To test for dilatancy select enough material to mold into a ball about 1/2 in. in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky consistency. Smooth the soil ball in the palm of the hand with a blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction. Specimens with high dilatancy will quickly yield water when shaken and absorb water when squeezed. The criteria for describing dilatancy are:

NONE	No visible change in the specimen
SLOW	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
RAPID	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing

The range of dilatancy for the different fine-grained sediment types is shown in Figure A.10. From this figure it is apparent that dilatancy decreases with decreasing grain size.

A.2.15 Toughness

After completion of the dilatancy test, shape the same specimen into an elongated pat and roll by hand on a smooth surface or between the palms into a thread about 1/8 in. (3 mm) in diameter. (If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation.) Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about 1/8 in. The thread will crumble at a diameter of 1/8 in. when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles. Note the toughness of the material during kneading and classify into one of the following categories.

- LOW Only slight pressure is required to roll the thread near the plastic limit. The thread and lump are weak and soft
- MEDIUM Medium pressure is required to roll the thread to near the plastic limit. The thread and lump have medium stiffness.
- HIGH Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

The range of toughness for the different fine-grained sediment types is shown in Figure A.10. From this figure it is apparent that toughness increases with a decrease in particle size.

A.2.16 Plasticity

On the basis of observations made during the toughness test, describe the plasticity of the material according to the following criteria:

NONPLASTIC A 1/8 in. thread cannot be rolled at any water content

- LOW The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.

MEDIUM The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.

HIGH It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

The range of plasticity for the different fine-grained sediment types is shown in Figure A.10. From this figure it is apparent that an increase in plasticity accompanies a decrease in grain size.

A.3 REFERENCES

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APPENDIX B
CORE DATA LOGS

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-A-1

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface	Depth Below Mudline	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl	Maximum Particle Size	Odor	Samples	Comments
-37.0	0		NA	NA	NA	SW	2.5Y4/2 dark grayish brown	VS	N	H	N	CS	Fishy S		grains SA - qtz, fsp, rock frags. few shell frags.
-38.0	1							S					N		
-39.0	2						2.5Y5/4 lt olive brown	F				MS			
-40.0	3														SR grains of qtz, fsp, rock frags, iron oxide coatings
-41.0	4														
-42.0	5							H							
-43.0	6							S							
-43.8	6.8														

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-A-2

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-35.5	0	NA	NA	NA	SC	5Y3/1 v. dark gray	VS	N	H	N	MS	N			few shell frags.
-36.5	1				↓ SP SC		↓ S								grains SA, rock frags, qtz, fsp, iron oxide, green grains, little muscovite
-37.5	2				↓ SC		↓ F				↓ CS				
-38.5	3				↓ SP		↓ S				↓ MS				much drier
-39.5	4						↓ H								
-40.5	5														
-41.5	6														
-42.5	7														
-43.5	8														
-43.7															

Project: Oakland Harbor Intensive Study

Logger: PJ White

Date: 5-11-93

Page 1 of 1OH INTENSIVE

Project: Oakland Harbor Intensive Study

Page 1 of 1

OH INTENSIVE

B.4

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-A-5

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface	Depth Below Mudline	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-35.4	0	R	M	M	CL	5Y3/1 v. dark gray	VS	N	H	N	Z	S	HCl		upper 1' of core very disrupted some fines lost?
-36.4	1	NA	NA	NA	SP	5Y4/1 dk gray	S	N			MS				
-37.4	2				SP		F								SP w/ few CL layers - sand SA -
-38.4	3				CL										decayed organic matter?
-39.4	4						S				few CS				same lith. as other IC1-A cores
-40.4	5														▲ = clasts of CL
-41.4	6						F								2" layer of CL
-42.4	7				SP	2.5Y4/4 olive brown						N			drier OBM?
-43.4	8														
-44.0															

Project: Oakland Harbor Intensive Study

Page 1 of 1

OH INTENSIVE

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-B-1

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-34.9	0	R	M	M	CL	2.5Y4/2 dk gr brown	VS	N	H	N	Z	S w/ HCl			6" layer of lighter colored mud
-35.9	1					5Y3/1 v dark gray									few shell frags.
-36.9	2														gas hole
-37.9	3					2.5YN3/ v dark gray									shell material
-38.9	4					2.5YN4/ dk gray	S								abundant shell material whole shells
-39.9	5														numerous gas holes, otherwise featureless
-40.9	6														
-41.9	7														
-42.9	8														
-43.9	9														

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-B-2

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-30.4	0	R	M	M	CL	5Y5/1 gray	VS	N	H	S on shell frags	Z, shell frags up to ~1"	N			10-25% / 30% shell hash - oyster & other mollusc shells. Some whole shells up to ~1", still articulated, filled w/ mud.
-31.4	1														
-32.4	2														
-33.4	3														
-34.4	4														
-35.4	5														Hash has fragments of all sizes
-36.4	6														
-37.4	7														
-38.4	8														
-39.4	9														
-40.4	10														few gas holes
-41.4	11														
-42.4	12														
-43.4	13														
-44.0															

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-B-3

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-32.1	0		R	M	M	SC	5Y5/1 gray	VS	N	Grossly S - faint bedding	No HCl used	MS	faint S - N		alternating layers of SC & CL, shell hash ~10-20%, some whole shells, articulated
-33.1	1					CL	(SC layers are 5Y3/1 v dark gray)								
-34.1	2														
-35.1	3														
-36.1	4					CL			H			Z, shells up to ~1"			No sand, ~20% shell hash, shells up to ~1"
-37.1	5														
-38.1	6														Archive sample of sediment w/ shell hash Sample 47A
-39.1	7														
-40.1	8														
-41.1	9							S				Z			few shell fragments - archive sample of CL w/ no shell hash.
-42.1	10														Slightly firmer Sample 47B
-43.1	11														
-43.5															

Project: Oakland Harbor Intensive Study

Page 1 of 1B.10

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-B-5

Logger: PJ White

Date: 5-11-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-34.5	0	R	M	M	CL	5Y5/1 gray	VS	N	H	S on shell material	Z, shells up to 1 1/2-2"	N	↑ composite chemistry		Shell hash 20-25% abundant whole oyster shells
-35.5	1														
-36.5	2														
-37.5	3														
-38.5	4														
-39.5	5														
-40.5	6														
-41.5	7														
-42.5	8						S			N	Z				Few shell fragments, firmer & drier
-43.5	9														
-44.0															

Page 1 of 1B.12

Project: Oakland Harbor Intensive Study

Logger: PJ White

Date: 5-12-93

Page 1 of 1OH INTENSIVE

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: IC1-C-3

Logger: PJ White

Date: 5-12-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-35.2	0		NA	NA	NA	SW	5Y3/1 v dark gray	S	N	H	N	MS	N		Little CL in upper 1"
-36.2	1							F							sand from MS → Z
-37.2	2							H							
-38.2	3														Grains SA - SR, dark minerals, qtz, fsp, green mins., little FeO ₃
-39.2	4														
-40.2	5														
-41.2	6														drier
-42.2	7														
-43.2	8														
-44.0	8.8														

Project: Oakland Harbor Intensive Study

Page 1 of 1

B.16

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: OC4-B-3

Logger: PJ White

Date: 5-12-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-38.6	0	NA	NA	NA	CL	5Y3/1 v. dark gray	VS	N	H	NA	FS	faint S	chem	1.5' of CL over SW	
-39.6	1				SW	2.5Y4/4 olive brown	F				MS	N	chem		
-40.6	2														sand SR, MS → VFS, grains of qtz, fsp, dark mins, grain mins, many grains coated with FeO ₃
-41.6	3														
-42.6	4														
-43.6	5														
-43.7															Geology side of core archived, core not disturbed during description.

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: OC4-B-4

Logger: PJ White

Date: 5-12-93

Page 1 of 1

[illegible]OH INTENSIVE

B.19

Core Data Log

Project: Oakland Harbor Intensive Study

Core #: OC4-B-5

Logger: PJ White

Date: 5-12-93

Page 1 of 1

Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Samples	Comments
-39.6	0	NA	NA	NA	CL	5Y3/1 v. dark gray	VS	N	H	NA	MS	N			Variable % of sand in CL; mostly CL
-40.6	1				SC										
-41.6	2														
-42.2					SW	5Y4/4 olive	F?				MS				
-42.6	3														zone of altered SW- not sampled
-43.6	4														SR/SA grains, many FeO ₃ coated
-44.0															OBM?
															Geology side of core archived so sediment not disturbed during description

APPENDIX C

SEDIMENT CHEMISTRY AND QUALITY ASSURANCE DATA

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Grain Size
LABORATORY: Soil Technologies, Bainbridge Island, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
ASTM D-2217 & D-422	NA	NA	≤20%	NA

METHOD Grain size was measured for 16 fractions using a combination of sieve and pipette techniques following ASTM Methods D-2217 for wet sieving and D-422 modified. Tabular results are presented as fractional percent for each category.

HOLDING TIMES Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately 4°C until analysis.

DETECTION LIMITS NOT APPLICABLE

METHOD BLANKS NOT APPLICABLE

MATRIX SPIKES NOT APPLICABLE

REPLICATES Two sample were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs for the 4 fractions (gravel, sand, silt and clay) ranged from were 2% to 24%. Two RSD value exceeded the target precision goal of ≤20%.

SRMs NOT APPLICABLE

REFERENCES

ASTM (American Society for Testing and Materials). 1985. *Standard Method for Wet Preparation of Soil Samples for Particle-size Analysis*. Method D-2217. American Society for Testing and Materials, Philadelphia.

ASTM (American Society for Testing and Materials). 1972. *Determination of Soil Constants and Standard Method for Particle-size Analysis of Soils (16 fractions)*. Method D-422. American Society for Testing and Materials, Philadelphia.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Total Volatile Solids (TVS)
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
EPA 160.4	NA	NA	≤20%	0.1%

METHOD TVS was analyzed according to EPA method 160.4 (EPA 1979) by heating dried solids to 550°C for 1 h and measuring the weight percent lost during this process.

HOLDING TIMES Samples were received on 5/13/93 in good condition. Samples were logged into Battelle's log-in system and stored at approximately 4°C until analysis.

DETECTION LIMITS Target detection limits of 0.1% by weight were met.

METHOD BLANKS TVS was not detected in the blanks.

MATRIX SPIKES NOT APPLICABLE

REPLICATES One sample was analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs were 19% and 21%. One RSD value exceeded the target precision goal of ≤20%.

SRMs NOT APPLICABLE

REFERENCES

EPA (U.S. Environmental Protection Agency). 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600-4-79-020 Method 160.4, Environmental Monitoring and Support Laboratory, Cincinnati.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Total Organic Carbon (TOC)
LABORATORY: Global Geochemistry, Canoga Park, California
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
	EPA 1986	NA	NA	≤10%	0.1%
METHOD	TOC was analyzed using EPA TOC method (EPA 1986). Samples were dried and ball milled prior to analysis using a carbon analyzer.				
HOLDING TIMES	Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately 4°C until analysis.				
DETECTION LIMITS	Target detection limits of 0.1% by weight were met.				
METHOD BLANKS	TOC was detected in the blanks below the method detection limit of 0.1%.				
MATRIX SPIKES	NOT APPLICABLE				
REPLICATES	Two sample were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs were 2% and 17%. One RSD value exceeded the target precision goal of ≤10%.				
SRMs	One standard reference material, MESS-1, obtained from the National Council of Canada (NRCC) was analyzed in triplicate. Although not certified for TOC, frequent analysis at MSL indicated on estimated value of 2.3%. Values obtained at MSL ranged from 2.39% to 2.46 %, indicating acceptable accuracy of this method.				

REFERENCES

EPA (U.S. Environmental Protection Agency). 1986. *Determination of Total Organic Carbon in Sediment*. Environmental Protection Agency Region 11, Environmental Sciences Division, Monitoring Management Branch, Edison, New Jersey.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Oil and Grease
LABORATORY: Analytical Resources Incorporated, Seattle, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
413.2	50% - 150%	NA	≤20%	20 mg/kg

METHOD Oil and grease was analyzed using EPA Method 413.2. A 20-g sample was dried and extracted with freon. The samples were then analyzed using infrared spectrophotometry.

HOLDING TIMES Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately 4°C until analysis. The 30-day holding time specified in the QA/QC Plan was met for all sediment samples.

DETECTION LIMITS The target detection limit of 20 mg/kg were met for all sediment samples.

METHOD BLANKS Two method blanks were analyzed with the sediment samples. The blank levels were 16 mg/kg and undetected at 10 mg/kg, which are below the target detection limit of 20 mg/kg.

MATRIX SPIKES Two samples were spiked with oil and grease. Matrix spike recoveries were 115% and 116%, both recoveries were within the QA/QC range. Precision was measured by comparing the relative percent difference (RPD) between matrix spike and matrix spike duplicate recoveries. The calculated RPD was 1%, indicating excellent precision.

REPLICATES One sample was analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSD was 9%, indicating acceptable precision.

SRMs NOT APPLICABLE

REFERENCES

EPA (U.S. Environmental Protection Agency). 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600-4-79-020 Method 413.2, Environmental Monitoring and Support Laboratory, Cincinnati.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Total Petroleum Hydrocarbons (TPH)
LABORATORY: Analytical Resources Incorporated, Seattle, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
418.1	50% - 150%	NA	≤20%	20 mg/kg

METHOD TPH was analyzed using EPA Method 418.1. A 20-g sample was dried and extracted with freon and silica gel was added to remove the animal greases and vegetable oils. The samples were then analyzed using infrared spectrophotometry.

HOLDING TIMES Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately 4°C until analysis. The 30-day holding time specified in the QA/QC Plan was met for all sediment samples.

DETECTION LIMITS The target detection limit of 20 mg/kg were met for all sediment samples except R-BF which was undetected at 32 mg/kg.

METHOD BLANKS Two method blanks were analyzed with the sediment samples. The blank levels were undetected at 10 mg/kg, which are below the target detection limit of 20 mg/kg.

MATRIX SPIKES Two samples were spiked with TPH. Matrix spike recoveries ranged from 131% and 143% which is within the QA/QC range. Precision was measured by comparing the relative percent difference (RPD) between matrix spike and matrix spike duplicate recoveries. The calculated RPD were 3% and 6%, indicating excellent precision.

REPLICATES Three samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSD could not be calculated because all of the triplicate values were undetected.

SRMs NOT APPLICABLE

REFERENCES

EPA (U.S. Environmental Protection Agency). 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600-4-79-020 Method 418.1, Environmental Monitoring and Support Laboratory, Cincinnati.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH)
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
GC/MS	40% - 120%	≤30%	≤30%	20µg/kg

METHOD

Sediment samples were extracted with methylene chloride using a roller under ambient conditions following SOP MSL-042, Extraction and Clean-up of Sediment, which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (Krahn et al. 1988). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) in the selected ion mode (SIM) following SOP MSL-M-043, Identification and Quantification of Polynuclear Aromatic Hydrocarbons by GC/MS which is based on EPA method 8270 (EPA 1986).

HOLDING TIMES

Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately -20°C until extraction. Samples were extracted in two batches: 5/17/93 and 5/21/93. Extracts were analyzed by GC/MS from 5/24 through 5/30/93, which is within the established holding time of 40 days (EPA 1986).

DETECTION LIMITS

Target detection limits of 20 µg/kg dry wt. were met for all PAH compounds. Actual detection limits determined from multiplying the standard deviation of seven spiked replicates by the student t-value and ranged from 1.0 to 7.3 µg/kg.

METHOD BLANKS

Two method blanks were analyzed with the sediment samples. Nine out of 16 compounds were detected at levels well below the target detection limit in at least one of the two method blanks. Only naphthalene and phenanthrene were detected slightly greater than five times the MDL. Since none of the values were above the target detection limit of 20 µg/kg, no data was flagged and no other corrective actions were taken.

QA/QC SUMMARY (contd)

SURROGATES

Five isotopically labeled compounds were added prior to extraction to assess the efficiency of the method. These were d8-naphthalene, d8-acenaphthene, d12-chrysene, d10-pyrene and d14-dibenzo(a,h)-anthracene. Recoveries of all surrogates, ranging from 51% to 109%, are within the quality control limits of 40% to 120%.

MATRIX SPIKES

Two samples were spiked with all PAH compounds. Matrix spike recoveries for the first samples were mainly outside of the quality control range of 40% to 120%. This was probably attributed to uncertainty in the native values for the sample spiked (see "Replicates"), and high levels of PAHs found in the sample relative to the spiking level.

Matrix spike recoveries for the second sample were acceptable, ranging from 48% to 78%, which is within the range of recovery.

REPLICATES

Two samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs for batch 1 ranged from 33% to 70%. All values were outside of the target precision goal of $\leq 30\%$. The reason for these elevated RSDs may be due to sample non-homogeneity.

The RSDs for batch 2 were generally acceptable. The RSDs ranged from 4% to 38% with only 3 compounds exceeding the target precision goal of $\leq 30\%$. Levels of the compounds which exceeded the RPD limit in batch 2 were all below the target detection limit of 20 $\mu\text{g/kg}$.

SRMs

The SRM 1941, a marine sediment obtained by the National Institute for Science and Technology, was analyzed with each batch. Ten of the 16 PAH compounds analyzed are certified. Of these, all compounds with the exception of benzo(b)fluoranthene were detected within 30% of the certified mean. Benzo(b)fluoranthene often coelutes with other benzofluoranthenes which cannot be isolated by GC/MS. In fact, the certification provided by NIST for the benzofluoranthenes does not include the quantifications performed using MS. If our values are compared to those that NIST obtained from the MS, the comparison is similar.

Additional Note:

Two compounds are flagged to indicate that the ion ratio for that compound was outside of the QC range. This is due primarily to low levels of the compound of interest. Because the confirmation ion is present at only a fraction of the level of the parent ion, when the native level of the compound is low, the amount of error in the concentration measurement of the confirmation ion increases. The compound is actually quantified from the parent ion only so most likely this will not effect the quality of the data, but it may be an indication of some sort of interference.

REFERENCES

Krahn et al. 1988. "New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants." NOAA Technical Memorandum NMFS F/NWC-153.

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA-955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Chlorinated Pesticides
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
GC/ECD	40% - 120%	≤30%	≤30%	2.0 - 30µg/kg

METHOD Sediment samples were extracted with methylene chloride using a roller under ambient conditions following SOP MSL-M-079, "Extraction and Clean-up of Sediment" which is based on EPA method 3510 and 8080 (EPA 1986) and NOAA status and trends methodology (Krahn et al. 1988). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were analyzed using gas chromatography/electron capture detection (GC/ECD) following SOP MSL-M-044, "Analysis of PCBs and Chlorinated Pesticides by GC/ECD" based on EPA method 8080 (1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately -20°C until extraction. Samples were extracted in two batches on 5/17 and 5/21/93. Extracts were analyzed by GC/ECD on 5/21 and 6/10/93, within the established holding time of 40 days (EPA 1986).

DETECTION LIMITS Target detection limits were met for all samples. Detection limits reported are based on an MDL study involving low level spikes of seven replicate extractions. The MDLs are defined as three times the standard deviation of the mean recovery.

METHOD BLANKS Two method blanks were analyzed with the sediment samples. No pesticides were detected in the blanks.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the method. Surrogate recoveries ranged from 58% to 108%, which are within the QC guidelines of 40% to 120%.

MATRIX SPIKES One sample from each batch was spiked with a subset of six pesticides. Matrix spike recoveries ranged from 87% to 99%, within the laboratory QC recovery limit (40% to 120%).

QA/QC SUMMARY (contd)

REPLICATES

One sample from each batch was extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. No pesticides were detected in any of the replicates; therefore, no RSD values were calculated.

SRMs

NOT APPLICABLE

REFERENCES

Krahn et al. 1988. "New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants." NOAA Technical Memorandum NMFS F/NWC-153.

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA-955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: PCB Aroclors
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
GC/ECD	40% - 120%	≤30%	≤30%	20 µg/kg

METHOD Sediment samples were extracted with methylene chloride using a roller under ambient conditions following SOP MSL-M-079, "Extraction and Clean-up of Sediment" which is based on EPA method 3510 and 8080 (EPA 1986) and NOAA status and trends methodology (Krahn et al. 1988). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were analyzed using gas chromatography/electron capture detection (GC/ECD) following SOP MSL-M-044, "Analysis of PCBs and Chlorinated Pesticides by GC/ECD" based on EPA method 8080 (1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES Samples were received on 5/13/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately -20°C until extraction. Samples were extracted in two batches on 5/17 and 5/21/93. Extracts were analyzed by GC/ECD on 5/21 and 6/10/93, within the established holding time of 40 days.

DETECTION LIMITS Target detection limits of 20 ng/g (dry weight) were met for all samples. Detection limits reported are based on an MDL study involving low level spikes of seven replicate extractions. The MDLs, defined as three times the standard deviation of the mean recovery were below 20 ng/g.

METHOD BLANKS Two method blanks were analyzed with the sediment samples. No PCBs were detected in the blanks.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries ranged from 58% to 108%, within the range of recovery.

MATRIX SPIKES One sample from each batch was spiked with Aroclor 1254. Matrix spike recoveries ranged from 108% to 110%, which is within the range of recovery.

QA/QC SUMMARY (contd)

REPLICATES

One sample from each batch was extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. No PCBs were detected in any of the replicates; therefore, no RSD values were calculated.

SRMs

NOT APPLICABLE

REFERENCES

Krahn et al. 1988. "New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants." NOAA Technical Memorandum NMFS F/NWC-153.

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA-955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Arsenic	XRF	NA	≤30%	≤20%	2.5
Cadmium	ICP/MS	75-125	≤30%	≤20%	0.1
Chromium	XRF	NA	≤30%	≤20%	33
Copper	XRF	NA	≤30%	≤20%	5.5
Lead	XRF	NA	≤30%	≤20%	6.2
Mercury	CVAA	75-125	≤30%	≤20%	0.01
Nickel	XRF	NA	≤30%	≤20%	7.5
Selenium	GFAA	75-125	≤30%	≤20%	0.1
Silver	GFAA	75-125	≤30%	≤20%	0.02
Zinc	XRF	NA	≤30%	≤20%	7.8

METHOD

A total of 10 metals was analyzed for the project: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se) and zinc (Zn). Six metals, As, Cr, Cu, Ni, Pb, and Zn, were analyzed by energy diffusive x-ray fluorescence (XRF) following the method of Sanders (1992). Two metals, Ag and Se, were analyzed using Zeeman graphite furnace atomic absorption (GFAA) spectrometry following the EPA Method 200.9 (EPA 1991). Mercury was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). Cadmium was analyzed by inductively coupled plasma/mass spectrometry (ICP/MS) following SOP MSL-M-025, Metals and Trace Elements in Sediment and Tissue by ICP/MS which is based on EPA method 200.8 (EPA 1991).

HOLDING TIMES

Samples were received on 5/13/93 in good condition, placed into Battelle's log-in system, and frozen to -80°C and subsequently freeze dried within approximately 7 days of sample receipt. Samples were all analyzed within 180 days of collection. Mercury was analyzed within the 28-day holding time. The following summarizes the specific dates of each analysis:

<u>Task</u>	<u>Date Performed</u>
Sample Digestion	5/21/93
XRF Analysis	5/26/93 6/1/93
GFAA (Ag)	6/01/93
ICP/MS (Cd)	5/28/93
GFAA (Se)	5/27/93
CVAA (Hg)	5/27/93 & 6/9/93

QA/QC SUMMARY (contd)

DETECTION LIMITS	Target detection limits were met for all metals except Se and Hg. The actual detection limit for Se was 0.12 mg/kg which slightly exceeded the target limit of 0.10 mg/kg; the actual detection limit for Hg was 0.016 mg/kg which exceeded the target detection limit of 0.01 mg/kg.
METHOD BLANKS	One method blank was analyzed with each batch for Ag, Cd, Se and Hg. Silver was the only compound detected in the blank and were detected below the target detection limit; therefore, no data was flagged and no corrective actions were taken. Results for these metals are blank corrected. Method blanks are not analyzed by XRF; therefore, no blank results are reported for XRF metals.
MATRIX SPIKES	Two samples were spiked with Ag, Cd, Hg and Se. Matrix spike recoveries ranged from 81% to 107%, which is within the QC limits of 75% to 125%. Samples for XRF are analyzed whole and cannot be spiked.
REPLICATES	Two samples were extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs ranged from 1% to 26% for cases where the metal was detected in all three replicates. All RSDs were within the precision limits of $\leq 20\%$ with the exception of As and Pb. These values were flagged and RSDs only slightly exceeded the target precision goal of $\leq 20\%$.
SRMs	The SRM 1646 (an estuarine sediment obtained from the National Institute for Standards and Technology), was analyzed with each batch for all metals. All results were within 30% of the certified value with the exception of Hg which is historically found at a concentration higher than the certified value. The SRM BEST-1 (an estuarine sediment obtained from the National Research Council of Canada, NRCC), was also analyzed for Hg. The recovery was well within the QC range for precision.

REFERENCES

- Bloom, N. S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Marine Chemistry* 21:337-390.
- EPA (U.S. Environmental Protection Agency). 1991. *Methods for the Determination of Metals in Environmental Samples*. EPA-600/4-91-010 Method 200.8, 200.9, Environmental Services Division, Monitoring Management Branch.
- Sanders, R.W. 1992. *Procedures and Quality Control for Energy Dispersive X-Ray Fluorescence Spectroscopy Using the BFP Approach with the Kevex 0810A System*. PNL-SOP #7-40.48, Battelle, Pacific Northwest Laboratory, Richland, Washington.

QA/QC SUMMARY

PROGRAM Oakland Harbor Intensive Study
PARAMETER Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Unger 1986	40% - 120%	≤30%	≤30%	10 µg/kg

METHOD Butyltin analyses were performed according to the method of Unger et al. (1986). Sediment samples were extracted with methylene chloride using a roller under ambient conditions followed by derivatization using a Grignard reagent to change to a form compatible with gas chromatography. Sample extracts were then cleaned by passing through a florisil column. Extracts were analyzed using gas chromatography/flame photometric detection (GC/FPD).

HOLDING TIMES Samples were received on 5/13/93 in good condition and were placed into Battelle's log-in system and stored at approximately -20°C until extraction. Samples were extracted in two batches: 5/14/93 and 6/2/93. Extracts were analyzed by GC/FPD from 5/21/93 through 6/5/93.

DETECTION LIMITS Target detection limits of 10 µg/kg dry weight were met for all butyltin compounds. Actual detection limits ranged from 0.7 to 1.3 µg/kg (dry weight) for non-detected analytes. These detection limits represent quantitation limits (LOQs) defined as 10 times the standard deviation of results from seven replicate low level matrix spikes.

METHOD BLANKS One method blank was analyzed with the sediment samples. No butyltins were detected in the blanks.

SURROGATES One compound, triphenyltin chloride, is added prior to extraction to assess the efficiency of the method. This compound also is used as an internal standard as all data is corrected for the recovery of the compound. Sample recoveries ranged from 81% to 114%, which is within the QC limits of 40% to 120%.

MATRIX SPIKES Two samples spiked with mono-, di-, and tributyltin. Matrix spike recoveries ranged from 89% to 98% for the tri- and dibutyltins, which is within the QA/QC recovery range of 40% to 120%. The recovery for monobutyltin ranged from 32% to 40%.

QA/QC SUMMARY (contd)

REPLICATES

Two samples were extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. No butyltins were detected in all of the replicates; therefore, no RSDs were calculated.

SRMs

The SRM PACS-1, a marine sediment obtained from the National Research Council of Canada (NRCC) was analyzed with each batch. Tri- and di-butyltin results for both analyses were within 30% of the certified mean.

REFERENCES

Unger, M.A., W.G. Macintyre, J. Reaves and R.J. Huggett. 1986. "GC Determination of Butyltins in Natural Waters by Flame Photometric Detection of Hexyl Derivatives with Mass Spectrometric Confirmation." *Chemosphere*. 15(4):461-470.

TABLE C.1. Summary of Sediment Grain Size Including Quality Control Data, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Total Percent			
		Gravel >2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 63 μm	Clay <3.9 μm
COMP IC1-A	1	0	88	5	7
IC1-A-1 Special Chemistry ^(a)	2	2	91	4	3
IC1-A-1	2	0	91	4	5
IC1-A-2	1	0	92	3	5
IC1-A-3	1	0	94	2	4
IC1-A-4	2	0	93	4	3
IC1-A-5	2	0	87	6	7
IC1-A-6	2	0	93	3	4
COMP IC1-B	2	0	2	51	47
COMP IC1-B Special Replicate 1	2	14	23	29	34
COMP IC1-B Special Replicate 2	2	12	22	29	37
COMP IC1-B Special Replicate 3	2	16	23	30	31
IC1-B-1	1	1	8	50	41
IC1-B-2	2	14	11	35	40
IC1-B-3	2	9	30	28	33
IC1-B-4 ^(b)	2	13	10	28	49
IC1-B-5	1	22	9	35	34
COMP IC1-C	2	0	39	31	30
IC1-C-1 Top 6 in.	1	0	23	42	35
IC1-C-1	2	0	3	51	46
IC1-C-2	1	0	1	51	48
IC1-C-3	2	0	93	3	4
IC1-C-4	2	0	21	35	44
COMP OC4-B	1	0	76	10	14
OC4-B-1	1	0	85	8	7
OC4-B-2	2	0	93	3	4
OC4-B-3 Special Chemistry	2	0	23	39	38
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	0	21	39	40
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	0	96	2	2
OC4-B-4	1	0	28	31	41
OC4-B-5 (-39.6 to -44.0 ft MLLW)	1	0	70	13	17
OC4-B-5 (-39.6 to -42.2 ft MLLW)	1	0	23	35	42
OC4-B-5 (-42.2 to -44.0 ft MLLW)	1	0	97	1	2
R-AM Replicate 1	1	4	93	1	2
R-AM Replicate 2	1	3	94	1	2
R-AM Replicate 3	1	2	94	1	3
R-BF	1	0	2	36	62
R-OS	1	0	45	35	20

TABLE C.1. (contd)

Sediment Treatment	Analytical Batch	Total Percent			
		Gravel >2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 63 μm	Clay <3.9 μm
<u>Quality Control Data</u>					
<u>Analytical Replicates</u>					
COMP IC1-B Special Replicate 1	2	14	23	29	34
COMP IC1-B Special Replicate 2	2	12	22	29	37
COMP IC1-B Special Replicate 3	2	16	23	30	31
RSD		14%	3%	2%	9%
R-AM Replicate 1	1	4	93	1	2
R-AM Replicate 2	1	3	94	1	2
R-AM Replicate 3	1	2	94	1	3
RSD		24% ^(c)	0%	0%	24% ^(c)

- (a) Special Chemistry sample determined in the field due to a particular sediment characteristic.
- (b) All of the sediment from this station is represented in COMP IC1-B Special only.
- (c) Value exceeds relative precision goal of $\leq 20\%$.

TABLE C.2. Sediment Grain Size Results (Percent Dry Weight), Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Percent at Size Fraction															
		phi	3350-	2000-	1000-	250-	125-	62.5-	4	4.5	5	5.5	6	7	8	9	10
		μm	2000	1000	250	125	62.5	48	31.2	23	15.6	7.8	3.9	1.9	0.9	0.4	<0.4
COMP IC1-A	1	0	0	0	35	45	8	2	0	1	0	1	1	1	1	1	4
IC1-A-1 Special Chemistry ^(a)	2	0	2	2	40	45	4	1	0	1	0	1	1	0	1	0	2
IC1-A-1	2	0	0	0	35	49	7	1	0	1	0	1	1	1	1	0	3
IC1-A-2	1	0	0	0	35	51	6	1	0	0	1	1	0	1	1	1	2
IC1-A-3	1	0	0	0	40	48	6	0	1	0	0	1	0	1	1	0	2
IC1-A-4	2	0	0	0	48	32	13	1	1	1	0	0	1	0	1	0	2
IC1-A-5	2	0	0	0	38	41	8	1	1	1	1	1	1	1	1	2	3
IC1-A-6	2	0	0	0	28	52	13	1	0	1	0	1	0	1	1	0	2
COMP IC1-B	2	0	0	0	0	1	1	6	6	9	7	12	11	10	9	7	21
COMP IC1-B Special Replicate 1	2	11	3	3	11	5	4	4	3	4	4	6	8	6	6	6	16
COMP IC1-B Special Replicate 2	2	10	2	3	10	5	4	3	5	3	4	6	8	6	6	6	19
COMP IC1-B Special Replicate 3	2	13	3	3	11	5	4	4	2	4	6	7	7	6	6	5	14
IC1-B-1	1	1	0	0	1	2	5	9	8	7	7	11	8	8	6	7	20
IC1-B-2	2	11	3	4	4	2	1	5	3	4	5	9	9	9	8	6	17
IC1-B-3	2	8	1	1	15	11	3	3	4	4	4	7	6	7	6	5	15
IC1-B-4 ^(b)	2	11	2	3	4	2	1	2	1	3	4	8	10	11	10	8	20
IC1-B-5	1	19	3	4	3	1	1	4	5	5	4	9	8	7	5	7	15
COMP IC1-C	2	0	0	0	14	20	5	4	4	4	5	7	7	6	5	5	14
IC1-C-1 Top 6 in.	1	0	0	1	11	9	2	6	7	6	6	10	7	8	5	5	17
IC1-C-1	2	0	0	0	1	1	1	5	7	8	7	13	11	10	7	7	22
IC1-C-2	1	0	0	0	0	1	0	4	6	8	7	15	11	11	7	7	23
IC1-C-3	2	0	0	0	32	48	13	1	1	0	0	1	0	1	1	0	2
IC1-C-4	2	0	0	0	6	11	4	5	5	6	4	7	8	8	10	7	19
COMP OC4-B	1	0	0	0	29	41	6	1	2	1	1	2	3	2	2	3	7
OC4-B-1	1	0	0	0	32	47	6	1	1	2	1	1	2	1	2	0	4
OC4-B-2	2	0	0	0	38	48	7	1	0	0	1	0	1	1	0	1	2
OC4-B-3 Special Chemistry	2	0	0	0	7	13	3	6	7	7	4	8	7	8	7	6	17
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	0	0	0	7	11	3	5	6	7	6	8	7	7	8	7	18
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	0	0	0	33	55	8	1	0	0	0	1	0	1	0	0	1
OC4-B-4	1	0	0	0	8	15	5	5	4	5	3	6	8	8	7	8	18
OC4-B-5 (-39.6 to -44.0 ft MLLW)	1	0	0	0	22	40	8	1	2	2	2	3	3	4	3	3	7
OC4-B-5 (-39.6 to -42.2 ft MLLW)	1	0	0	0	10	11	2	4	6	4	5	8	8	10	6	7	19
OC4-B-5 (-42.2 to -44.0 ft MLLW)	1	0	0	0	29	57	11	1	0	0	0	0	0	1	0	0	1

TABLE C.2. (contd)

Sediment Treatment	Analytical Batch	Percent at Size Fraction																
		phi							4	4.5	5	5.5	6	7	8	9	10	11
		μm	3350- 2000	2000- 1000	1000- 250	250- 125	125- 62.5	62.5- 48	48- 31.2	31.2- 23	23- 15.6	15.6- 7.8	7.8- 3.9	3.9- 1.9	1.9- 0.9	0.9- 0.4	0.4	<0.4
R-AM Replicate 1	1	1	3	5	74	13	1	0	0	1	0	0	0	0	1	0	1	
R-AM Replicate 2	1	1	2	5	76	12	1	0	0	1	0	0	0	0	1	0	1	
R-AM Replicate 3	1	0	2	5	76	12	1	0	1	0	0	0	0	1	0	0	2	
R-BF	1	0	0	0	1	0	1	3	4	6	4	9	10	13	10	11	28	
R-OS	1	0	0	0	2	4	39	16	6	4	2	5	2	3	3	2	12	

(a) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(b) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.3. Quality Control Data for Sediment Grain Size Analysis, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Percent at Size Fraction															
		phi															
		μm	3350-	2000-	1000-	250-	125-	62.5-	48-	31.2-	23-	15.6-	7.8-	3.9-	1.9-	0.9-	0.4-
		>3350	2000	1000	250	125	62.5	48	31.2	23	15.6	7.8	3.9	1.9	0.9	0.4	<0.4
<u>Analytical Replicates</u>																	
COMP IC1-B Special Replicate 1	2	11	3	3	11	5	4	4	3	4	4	6	8	6	6	6	16
COMP IC1-B Special Replicate 2	2	10	2	3	10	5	4	3	5	3	4	6	8	6	6	6	19
COMP IC1-B Special Replicate 3	2	13	3	3	11	5	4	4	2	4	6	7	7	6	6	5	14
RSD		14%	22% ^(a)	0%	5%	0%	0%	16%	46% ^(a)	16%	25% ^(a)	9%	8%	0%	0%	10%	15%
R-AM Replicate 1	1	1	3	5	74	13	1	0	0	1	0	0	0	0	1	0	1
R-AM Replicate 2	1	1	2	5	76	12	1	0	0	1	0	0	0	0	1	0	1
R-AM Replicate 3	1	0	2	5	76	12	1	0	1	0	0	0	0	1	0	0	2
RSD		122% ^(a)	0%	0%	0%	0%	0%	0%	122% ^(a)	122% ^(a)	0%	0%	0%	122% ^(a)	122% ^(a)	0%	41% ^(a)

(a) Value exceeds relative precision goal of $\leq 20\%$.

TABLE C.4. Sediment Total Volatile Solids (TVS), Total Organic Carbons (TOC), and Total Percent Solids, Oakland Harbor Intensive Study

Sediment Treatment	Analytical TVS Batch	TVS (percent dry weight)	Analytical TOC/Solids Batch	TOC (percent dry weight)	Total Percent Solids
COMP IC1-A	1	0.77	1	0.03	81
IC1-A-1 Special Chemistry ^(a)	1	0.84	2	0.05	82
IC1-A-1	1	0.72	2	0.05	82
IC1-A-2	1	0.63	1	0.10	83
IC1-A-3	1	0.54	1	0.03	84
IC1-A-4	1	0.34	2	0.06	85
IC1-A-5	1	0.61	2	0.20	79
IC1-A-6	1	0.53	2	0.05	84
COMP IC1-B Replicate 1	1	3.30	2	0.67	57
COMP IC1-B Replicate 2	NA ^(b)	NA	2	0.66	NA
COMP IC1-B Special Replicate 1	1	1.51	2	0.73	59
COMP IC1-B Special Replicate 2	NA	NA	2	NA	59
COMP IC1-B Special Replicate 3	NA	NA	2	NA	60
IC1-B-1	1	2.55	1	0.65	59
IC1-B-2	2	2.07	2	0.66	56
IC1-B-3	2	2.07	2	0.58	63
IC1-B-4 ^(c)	2	1.82	2	0.70	56
IC1-B-5	2	2.19	1	0.67	60
COMP IC1-C	1	2.18	2	0.51	63
IC1-C-1 Top 6 in.	1	2.09	1	0.63	59
IC1-C-1	2	1.90	2	0.67	58
IC1-C-2	2	1.70	1	0.68	57
IC1-C-3	2	0.35	2	0.06	83
IC1-C-4	2	2.54	2	0.94	50
COMP OC4-B	1	1.25	1	0.22	73
OC4-B-1	2	0.93	1	0.06	82
OC4-B-2 Replicate 1	2	0.36	2	0.05	82
OC4-B-2 Replicate 2	2	0.52	2	0.06	NA
OC4-B-2 Replicate 3	2	0.55	2	0.07	NA
OC4-B-3 Special Chemistry	1	3.42	2	0.82	54
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	1.95	2	0.95	53
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	0.34	2	0.04	81
OC4-B-4	2	2.41	1	1.04	56
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	1.12	1	0.33	69
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	2.74	1	0.93	54
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	0.27	1	0.02	83

TABLE C.4. (contd)

<u>Sediment Treatment</u>	<u>Analytical TVS Batch</u>	<u>TVS (percent dry weight)</u>	<u>Analytical TOC/Solids Batch</u>	<u>TOC (percent dry weight)</u>	<u>Total Percent Solids</u>
R-AM Replicate 1	1	0.66	1	0.24	81
R-AM Replicate 2	1	0.73	1	0.25	81
R-AM Replicate 3	1	0.95	1	0.24	81
R-BF	2	4.10	1	1.39	31
R-OS	2	2.34	1	0.79	55

- (a) Special Chemistry sample determined in the field due to a particular sediment characteristic.
- (b) NA Not applicable.
- (c) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.5. Quality Control Data for Sediment, Total Volatile Solids (TVS), Total Organic Carbons (TOC), and Total Percent Solids, Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Analytical TVS Batch</u>	<u>TVS (percent dry weight)</u>	<u>Analytical TOC/Solids Batch</u>	<u>TOC (percent dry weight)</u>	<u>Total Percent Solids</u>
<u>Method Blanks</u>					
Blank 1	1	0.00	1	0.003	NA ^(a)
Blank 2	2	0.00	1	0.005	NA
Blank 3	NA	NA	1	0.005	NA
Blank 4	NA	NA	2	0.004	NA
Blank 5	NA	NA	2	0.005	NA
<u>Standard Reference Material</u>					
Certified Value	NA	NC ^(b)	NA	2.3 ^(c)	NC
MESS-1	NA	NA	1	2.39	NA
MESS-1 Replicate 1	NA	NA	2	2.41	NA
MESS-1 Replicate 2	NA	NA	2	2.46	NA
<u>Analytical Duplicates</u>					
COMP IC1-B	1	3.30	2	0.67	57
COMP IC1-B	NA	NA	2	0.66	NA
RPD		NA		2%	NA
I-STAT		NA		0.01	NA
<u>Analytical Replicates</u>					
OC4-B-2 Replicate 1	2	0.36	2	0.05	82
OC4-B-2 Replicate 2	2	0.51	2	0.06	NA
OC4-B-2 Replicate 3	2	0.55	2	0.07	NA
RSD		21% ^(d)		17% ^(e)	NA
COMP IC1-B Special Replicate 1	1	1.51	2	0.73	59
COMP IC1-B Special Replicate 2	NA	NA	2	NA	60
COMP IC1-B Special Replicate 3	NA	NA	2	NA	59
RSD		NA		NA	1%

TABLE C.5. (contd)

<u>Sediment Treatment</u>	<u>Analytical TVS Batch</u>	<u>TVS (percent dry weight)</u>	<u>Analytical TOC/Solids Batch</u>	<u>TOC (percent dry weight)</u>	<u>Total Percent Solids</u>
R-AM Replicate 1	1	0.66	1	0.24	81
R-AM Replicate 2	1	0.73	1	0.25	81
R-AM Replicate 3	1	0.95	1	0.24	81
RSD		19%		2%	0%

(a) NA Not applicable.

(b) NC Not certified.

(c) Mess-1 is not certified for TOC, but frequent analyses at MSL indicate an estimated value of 2.3%.

(d) Value exceeds relative precision goal of $\leq 20\%$.

(e) Value exceeds relative precision goal of $\leq 10\%$.

**TABLE C.6. Sediment Oil and Grease and Total Petroleum Hydrocarbons (TPH)
Results, Oakland Harbor Intensive Study**

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>TPH (mg/kg dry weight)</u>
Target DL ^(a)		20	20
Achieved DL		12-18	12-32
COMP IC1-A	1	12 U ^(b)	12 U
IC1-A-1 Special Chemistry ^(c)	2	12 U	12 U
IC1-A-1	2	23	12 U
IC1-A-2	1	12 U	12 U
IC1-A-3	1	12 U	12 U
IC1-A-4	2	12 U	12 U
IC1-A-5	2	99	58
IC1-A-6	2	12 U	12 U
COMP IC1-B Replicate 1	2	18 U	18 U
COMP IC1-B Replicate 2	2	NA ^(d)	18 U
COMP IC1-B Replicate 3	2	NA	18 U
COMP IC1-B Special	2	170	17 U
IC1-B-1	1	92	36
IC1-B-2	2	18 U	18 U
IC1-B-3	2	61	17
IC1-B-4 ^(e)	2	18 U	18 U
IC1-B-5	1	20	17 U
COMP IC1-C	2	16 U	16 U
IC1-C-1 Top 6 in.	1	52	17 U
IC1-C-1	2	19	17 U
IC1-C-2	1	22	17 U
IC1-C-3	2	12 U	12 U
IC1-C-4	2	180	76
COMP OC4-B	1	94	32
OC4-B-1	1	12 U	12 U
OC4-B-2 Replicate 1	2	12 U	12 U
OC4-B-2 Replicate 2	2	NA	12 U
OC4-B-2 Replicate 3	2	NA	12 U
OC4-B-3 Special Chemistry	2	83	59
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	92	55
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	12 U	12 U
OC4-B-4	1	660	600
OC4-B-5 (-39.6 to -44.0 ft MLLW)	1	28	32
OC4-B-5 (-39.6 to -42.2 ft MLLW)	1	140	69
OC4-B-5 (-42.2 to -44.0 ft MLLW)	1	12 U	12 U
R-AM Replicate 1	1	41	12 U
R-AM Replicate 2	1	NA	12 U
R-AM Replicate 3	1	NA	12 U
R-BF	1	130	32 U
R-OS	1	16 U	16 U

TABLE C.6. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>TPH (mg/kg dry weight)</u>
QC Sample Replicate 1 ^(f)	1	400	NA
QC Sample Replicate 2 ^(f)	1	480	NA
QC Sample Replicate 3 ^(f)	1	450	NA

- (a) DL Detection limit.
 (b) U Undetected above given concentration.
 (c) Special Chemistry sample determined in the field due to a particular sediment characteristic.
 (d) NA Not applicable.
 (e) All of the sediment from this station is represented in COMP IC1-B Special only.
 (f) QC sample is a non-project related sample that was used as the QC sample for that analytical batch.

TABLE C.7. Quality Control Data for Sediment Oil and Grease and Total Petroleum Hydrocarbons (TPH) Analysis, Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>TPH (mg/kg dry weight)</u>
<u>Method Blanks</u>			
Blank	1	16	10 U ^(a)
Blank	2	10 U	10 U
<u>Matrix Spikes</u>			
OC4-B-2 ^(b)	2	12 U	12 U
OC4-B-2 MS	2	NA ^(c)	168
Concentration Recovered		NA	168
Amount Spiked		NS ^(d)	121
Percent Recovery		NA	139%
OC4-B-2 ^(b)	2	12 U	12 U
OC4-B-2 MSD	2	NA	173
Concentration Recovered		NA	173
Amount Spiked		NS	121
Percent Recovery		NA	143%
MS/MSD RPD		NA	3%
MS/MSD I-STAT		NA	0.01
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	12 U	12 U
OC4-B-3 (-40.1 to -43.7 ft MLLW) MS	2	140	NA
Concentration Recovered		140	NA
Amount Spiked		122	NS
Percent Recovery		115%	NA
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	12 U	12 U
OC4-B-3 (-40.1 to -43.7 ft MLLW) MSD	2	142	NA
Concentration Recovered		142	NA
Amount Spiked		122	NS
Percent Recovery		116%	NA
MS/MSD RPD		1%	NA
MS/MSD I-STAT		0.00	NA
R-AM ^(b)	1	41	12 U
R-AM MS	1	NA	160
Concentration Recovered		NA	160
Amount Spiked		NS	122
Percent Recovery		NA	131%
R-AM ^(b)	1	41	12 U
R-AM MSD	1	NA	169
Concentration Recovered		NA	169
Amount Spiked		NS	122
Percent Recovery		NA	139%
MS/MSD RPD		NA	6%
MS/MSD I-STAT		NA	0.03

TABLE C.7. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>TPH (mg/kg dry weight)</u>
<u>Analytical Replicates</u>			
COMP IC1-B Replicate 1	2	18 U	18 U
COMP IC1-B Replicate 2	2	NA	18 U
COMP IC1-B Replicate 3	2	NA	18 U
RSD		NA	NA
OC4-B-2 Replicate 1	2	12 U	12 U
OC4-B-2 Replicate 2	2	NA	12 U
OC4-B-2 Replicate 3	2	NA	12 U
RSD		NA	NA
R-AM Replicate 1	1	41	12 U
R-AM Replicate 2	1	NA	12 U
R-AM Replicate 3	1	NA	12 U
RSD		NA	NA
QC Sample Replicate 1(e)	1	400	NA
QC Sample Replicate 2(e)	1	480	NA
QC Sample Replicate 3(e)	1	450	NA
RSD		9%	NA

- (a) U Undetected above given concentration.
 (b) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.
 (c) NA Not applicable.
 (d) NS Not spiked.
 (e) QC sample is a non-project related sample that was used as the QC sample for that analytical batch.

TABLE C.8. Total Polynuclear Aromatic Hydrocarbons (PAHs) Found in Sediment Treatments, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	$\mu\text{g/kg dry weight}$		Total PAHs
		Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	
COMP IC1-A	1	8	7	15
IC1-A-1 Special Chemistry ^(a)	1	9	35	44
IC1-A-1	1	6	36	42
IC1-A-2	1	7	14	21
IC1-A-3	1	7	14	21
IC1-A-4	1	19	33	52
IC1-A-5	1	62	348	410
IC1-A-6	1	6	13	19
IC1-A-8270	2	63	38	101
COMP IC1-B	1	31	84	115
COMP IC1-B Special	1	286	1430	1716
IC1-B-1	1	94	628	722
IC1-B-2	2	138	133	271
IC1-B-3	2	836	3120	3956
IC1-B-4 ^(b)	2	111	60	171
IC1-B-5	2	57	46	103
COMP IC1-C	1	76	477	553
IC1-C-1 Top 6 in.	1	7260	16000	23260
IC1-C-1	2	197	348	545
IC1-C-2	2	55	42	97
IC1-C-3	2	44	31	75
IC1-C-4	2	312	1480	1792
COMP OC4-B	1	73	413	486
OC4-B-1	2	40	32	72
OC4-B-2 Replicate 1	2	30	60	90
OC4-B-2 Replicate 2	2	40	34	74
OC4-B-2 Replicate 3	2	41	40	81
OC4-B-3 Special Chemistry	1	237	1600	1837
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	274	1530	1804
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	70	39	109
OC4-B-4	2	404	1610	2014
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	242	1020	1262
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	237	1310	1547
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	43	16	59
R-AM Replicate 1	1	2190	4430	6620
R-AM Replicate 2	1	815	2100	2915
R-AM Replicate 3	1	1110	4740	5850
R-BF	2	379	1780	2159
R-QS	2	65	57	122

(a) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(b) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.9. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs) in Sediment, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	LPAHs ($\mu\text{g/kg}$ dry weight)					
		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Target DL ^(a)		20	20	20	20	20	20
Achieved DL		2.14	2.29	1.09	1.68	2.18	2.77
COMP IC1-A	1	3.37 ^(b)	2.29 U ^(c)	1.09 U	1.68 U	4.17	2.77 U
IC1-A-1 Special Chemistry ^(d)	1	3.66 ^(b)	2.29 U	1.09 U	1.68 U	5.71	2.77 U
IC1-A-1	1	2.05 ^(b)	2.29 U	1.09 U	1.68 U	3.67 ^(b)	2.77 U
IC1-A-2	1	3.11 ^(b)	2.29 U	1.09 U	1.68 U	3.59 ^(b)	2.77 U
IC1-A-3	1	3.39 ^(b)	2.29 U	1.09 U	1.68 U	3.79	2.77 U
IC1-A-4	1	3.00 ^(b)	2.29 U	4.59	4.31 ^(b)	6.77	2.77 U
IC1-A-5	1	10.50 ^(b)	3.70 ^(b)	4.27	5.51	28.70	9.68
IC1-A-6	1	2.86 ^(b)	2.29 U	1.09 U	1.68 U	3.10 ^(b)	2.77 U
IC1-A-8270	2	35.10	8.76	4.62	1.68 U	10.10	3.99
COMP IC1-B	1	5.78 ^(b)	2.29 U	1.09 U	6.69	12.80	5.71 ^(b)
COMP IC1-B Special	1	24.50	13.90	19.60	18.20	162.00	49.00
IC1-B-1	1	15.50	5.51 ^(b)	5.58	8.22	43.60	15.20
IC1-B-2	2	59.30	11.60	9.38	7.95	41.60	8.18
IC1-B-3	2	121.00	109.00	17.00	42.00	468.00	79.10
IC1-B-4 ^(e)	2	49.80	10.80	6.62	6.58	30.90	6.41
IC1-B-5	2	19.90	5.99	3.80	5.71	16.90	5.13
COMP IC1-C	1	9.27	3.99	4.86	6.96	36.50	14.00
IC1-C-1 Top 6 in.	1	184.00	565.00	192.00	350.00	4780.00	1190.00
IC1-C-1	2	36.80	15.40	7.23	10.90	97.80	28.70
IC1-C-2	2	18.50	6.26	3.71	5.21	16.60	4.66
IC1-C-3	2	16.60	6.01	3.06	1.68 U	14.80	3.25
IC1-C-4	2	55.50	22.20	14.80	18.90	154.00	46.60
COMP OC4-B	1	12.00	4.81 ^(b)	5.02	8.04	30.40	12.50
OC4-B-1	2	16.20	5.86	2.86	1.68 U	11.00	3.58
OC4-B-2 Replicate 1	2	8.46	3.70	1.86	2.27	9.06	4.32
OC4-B-2 Replicate 2	2	16.30	5.61	2.79	1.68 U	11.30	3.53
OC4-B-2 Replicate 3	2	16.60	5.30	2.97	1.68 U	12.40	3.64
OC4-B-3 Special Chemistry	1	32.60	13.40	13.30	15.90	123.00	38.60
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	57.40	19.30	15.00	17.10	129.00	36.20
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	32.00	8.25	4.83	1.68 U	21.10	4.20
OC4-B-4	2	96.80	22.30	19.70	28.60	171.00	65.60
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	40.30	16.50	14.50	16.20	119.00	35.10
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	48.30	17.70	12.80	14.70	107.00	36.10
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	18.40	5.91	3.24	1.68 U	12.10	3.24
R-AM Replicate 1	1	77.90	73.70	121.00	176.00	1230.00	512.00
R-AM Replicate 2	1	38.70	49.40	36.30	77.30	415.00	198.00
R-AM Replicate 3	1	69.20	34.20	97.60	43.00	724.00	141.00
R-BF	2	109.00	28.10	19.10	20.70	164.00	37.70
R-OS	2	23.50	6.52	3.66	4.03	22.50	4.67

(a) DL Detection limit.

(b) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(c) U Undetected above given concentration.

(d) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(e) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.10. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs) in Sediment, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	HPAHs ($\mu\text{g}/\text{kg}$ dry weight)									
		Fluor-anthene	Pyrene	Benzo(a)-anthracene	Chrysene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Benzo(a)pyrene	Indeno-(1,2,3-cd)pyrene	Dibenzo-(a,h)anthracene	Benzo-(g,h,i)perylene
Target DL ^(a)		20	20	20	20	20	20	20	20	20	20
Achieved DL		2.95	2.37	1.19	2.18	1.00	2.19	2.37	4.64	6.69	7.26
COMP IC1-A	1	3.66 ^(b)	2.37 U ^(c)	3.46 ^(b)	2.18 U ^(b)	1.00 U ^(b)	2.19 U ^(b)	2.37 U	4.64 U	6.69 U	7.26 U
IC1-A-1 Special Chemistry ^(d)	1	6.28	3.89	4.50 ^(b)	2.77 ^(b)	7.92 ^(b)	5.69 ^(b)	4.20 ^(b)	4.64 U	6.69 U	7.26 U
IC1-A-1	1	4.19 ^(b)	2.86 ^(b)	4.02 ^(b)	2.13 ^(b)	6.94 ^(b)	5.10 ^(b)	3.64 ^(b)	4.64 U	6.69 U	7.26 U
IC1-A-2	1	3.56 ^(b)	2.37 U	3.73 ^(b)	2.18 U	6.89 ^(b)	2.19 U	2.37 U	4.64 U	6.69 U	7.26 U
IC1-A-3	1	3.53 ^(b)	2.37 U	3.76 ^(b)	2.18 U ^(b)	6.86 ^(b)	2.19 U ^(b)	2.37 ^(b)	4.64 U	6.69 U	7.26 U
IC1-A-4	1	7.30	4.40	4.30 ^(b)	2.34 ^(b)	6.66 ^(b)	4.93 ^(b)	3.14 ^(b)	4.64 U	6.69 U	7.26 U
IC1-A-5	1	44.5	66.0	23.1	23.1	48.5	17.3	42.7	40.8	6.69 U	42.2
IC1-A-6	1	3.10 ^(b)	2.37 U	3.33 ^(b)	2.18 U	6.10 ^(b)	2.19 U	2.37 U	4.64 U	6.69 U	7.26 U
IC1-A-8270	2	11.0	10.9	3.14	2.07	4.05	4.02	2.45	4.64 U	6.69 U	7.26 U
COMP IC1-B	1	11.5	11.2	7.22	6.70	14.2	8.01 ^(b)	7.39	7.75	6.69 U	10.1
COMP IC1-B Special	1	237	295	114	111	167	55.8	159	139	18.9	136
IC1-B-1	1	74.7	93.8	35.7	36.4	70.4	24.1	58.3	172	7.88	55.0
IC1-B-2	2	28.3	30.5	8.92	8.36	14.5	8.96	10.1	9.74	6.69 U	13.4
IC1-B-3	2	457	600	185	178	385	121	407	366	38.4	387
IC1-B-4 ^(e)	2	16.2	15.2	4.94	4.77	8.38	6.12	4.19	4.64 U	6.69 U	7.26 U
IC1-B-5	2	10.6	9.47	4.77	3.82	7.38	6.33	3.74	4.64 U	6.69 U	7.26 U
COMP IC1-C	1	54.7	75.5	38.8	50.4	60.1	22.2	48.9	77.0	6.82	42.9
IC1-C-1 Top 6 in.	1	3390	3950	1314	1430	1490	499	1550	1120	150	1060
IC1-C-1	2	61.4	76.7	34.3	39.8	34.0	13.9	33.1	23.3	6.26	24.8
IC1-C-2	2	9.59	9.28	4.00	4.15	7.12	5.32	3.18	4.64 U	6.69 U	7.26 U
IC1-C-3	2	7.99	8.17	2.59	1.99	3.97	3.60	2.36	4.64 U	6.69 U	7.26 U
IC1-C-4	2	203	285	107	115	185	62.5	167	162	21.6	169
COMP OC4-B	1	49.5	72.5	29.6	32.7	61.7	23.3	47.4	44.8	6.78	44.3
OC4-B-1	2	7.61	7.54	3.15	2.11	4.58	4.27	3.16	4.64 U	6.69 U	7.26 U
OC4-B-2 Replicate 1	2	10.7	12.0	5.24	4.89	6.91	4.49	6.36	4.59	6.69 U	5.00
OC4-B-2 Replicate 2	2	7.75	8.04	3.18	2.40	4.99	4.23	3.55	4.64 U	6.69 U	7.26 U
OC4-B-2 Replicate 3	2	8.41	8.85	3.36	2.96	5.23	4.21	3.82	3.21	6.69 U	7.26 U
OC4-B-3 Special Chemistry	1	232	316	116	118	204	64.6	181	173	21.4	173
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	199	293	104	107	202	65.8	177	170	21.7	186
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	9.99	11.3	3.22	2.19	4.71	4.54	3.15	4.64 U	6.69 U	7.26 U
OC4-B-4	2	206	308	115	123	207	65.0	185	183	23.4	195

TABLE C.10. (contd)

Sediment Treatment	Analytical Batch	HPAHs (μg/kg dry weight)									Indeno-(1,2,3-cd) pyrene	Dibenzo-(a,h) anthracene	Benzo-(g,h,i) perylene
		Fluor-anthene	Pyrene	Benzo(a)-anthra-cene	Chrysene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Benzo(a) pyrene					
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	135	188	96.0	98.4	132	46.6	114	95.2	15.8	103		
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	163	255	86.3	93.4	174	55.2	150	152	18.8	161		
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	7.05	6.72	2.27	2.18 U	1.00 U	2.19 U	2.37 U	4.64 U	6.69 U	7.26 U		
R-AM Replicate 1	1	776	991	537	563	453	148	456	233	60.2	214		
R-AM Replicate 2	1	390	485	212	216	223	72.8	214	139	25.5	124		
R-AM Replicate 3	1	985	1160	350	311	509	156	495	388	45.8	342		
R-BF	2	238	285	105	131	241	79.0	204	229	27.5	245		
R-OS	2	11.4	11.6	3.82	4.35	7.03	4.68	3.92	4.18	6.69 U	6.27		

(a) DL Detection limit.

(b) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(c) U Undetected above given concentration.

(d) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(e) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.11. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs) Analysis, Oakland Harbor Intensive Study

		LPAHs (μg/kg dry weight)					
Sediment Treatment	Analytical Batch	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Method Blanks							
Blank 1	1	3.11 ^(a)	2.29 U ^(b)	1.09 U	1.68 U	3.80 ^(a)	2.77 U
Blank 2	2	17.9	6.92	3.62	1.68 U	12.4	2.77 U
Blank Spikes							
Blank 1	1	3.11 ^(a)	2.29 U	1.09 U	1.68 U	3.80 ^(a)	2.77 U
Blank 1 MS	1	108	101	102	99.4	109	99.4
Concentration Recovered		105	101	102	99.4	105	99.4
Amount Spiked		100	100	100	100	100	100
Percent Recovery		105%	101%	102%	99%	105%	99%
Blank 1	1	3.11 ^(a)	2.29 U	1.09 U	1.68 U	3.80 ^(a)	2.77 U
Blank 1 MSD	1	106	99.4	101	97.1	106	95.2
Concentration Recovered		103	99.4	101	97.1	102	95.2
Amount Spiked		100	100	100	100	100	100
Percent Recovery		103%	99%	101%	97%	102%	95%
MS/MSD RPD		2%	2%	1%	2%	3%	4%
MS/MSD I-STAT		0.01	0.01	0.00	0.01	0.01	0.02
Blank 2	2	17.9	6.92	3.62	1.68 U	12.4	2.77 U
Blank 2 MS	2	147	111	106	100	128	100
Concentration Recovered		129	104	102	100	116	100
Amount Spiked		100	100	100	100	100	100
Percent Recovery		129%	104%	102%	100%	116%	100%
Blank 2	2	17.9	6.92	3.62	1.68 U	12.4	2.77 U
Blank 2 MSD	2	138	106	103	98.3	124	97.3
Concentration Recovered		120	99.1	99.4	98.3	112	97.3
Amount Spiked		100	100	100	100	100	100
Percent Recovery		120%	99%	99%	98%	112%	97%
MS/MSD RPD		7%	5%	3%	2%	4%	3%
MS/MSD I-STAT		0.04	0.02	0.01	0.01	0.02	0.02
Matrix Spikes							
OC4-B-2 ^(c)	2	13.8	4.87	2.54	1.68 U	10.9	3.83
OC4-B-2 MS	2	76.4	57.8	56.5	54.1	77.5	57.3
Concentration Recovered		62.6	52.9	54.0	54.1	66.6	53.5
Amount Spiked		85.6	85.6	85.6	85.6	85.6	85.6
Percent Recovery		73%	62%	63%	63%	78%	62%
R-AM ^(c)	1	61.9	52.4	85.0	98.8	790	284
R-AM MS	1	116	118	103	135	451	248
Concentration Recovered		54.1	65.6	18.0	36.2	0.00 ^(d)	0.00 ^(d)
Amount Spiked		85.6	85.6	85.6	85.6	85.6	85.6
Percent Recovery		63%	77%	21% ^(e)	42%	NA ^(f)	NA

TABLE C.11. (contd)

LPAHs (μg/kg dry weight)							
<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Naphthalene</u>	<u>Acenaphthylene</u>	<u>Acenaphthene</u>	<u>Fluorene</u>	<u>Phenanthrene</u>	<u>Anthracene</u>
<u>Standard Reference Material</u>							
Certified Value SRM 1941		NC ^(g) NC	NC NC	NC NC	NC NC	577 ±59	202 ±42
SRM 1941	1	NA	NA	NA	NA	621	222
SRM 1941	2	NA	NA	NA	NA	695	241
<u>Analytical Replicates</u>							
OC4-B-2 Replicate 1	2	8.46	3.70	1.86	2.27	9.06	4.32
OC4-B-2 Replicate 2	2	16.3	5.61	2.79	1.68 U	11.3	3.53
OC4-B-2 Replicate 3	2	16.6	5.30	2.97	1.68 U	12.4	3.64
RSD		33% ^(h)	21%	23%	NA	16%	11%
R-AM Replicate 1	1	77.9	73.7	121	176	1230	512
R-AM Replicate 2	1	38.7	49.4	36.3	77.3	415	198
R-AM Replicate 3	1	69.2	34.2	97.6	43.0	724	141
RSD		33% ^(h)	38% ^(h)	51% ^(h)	70% ^(h)	52% ^(h)	70% ^(h)

- (a) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.
- (b) U Undetected above given concentration.
- (c) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.
- (d) Negative values reported as zero.
- (e) Recovery outside quality control range (40% to 120%).
- (f) NA Not applicable.
- (g) NC Not certified.
- (h) Value exceeds relative precision goal of $\leq 30\%$.

TABLE C.12. Quality Control Data for High Polynuclear Aromatic Hydrocarbons (HPAHs), Analysis, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	HPAHs (μg/kg dry weight)									
		Fluor-anthene	Pyrene	Benzo(a)-anthracene	Chrysene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Benzo(a)pyrene	Indeno-(1,2,3-c,d)pyrene	Dibenzo-(a,h)anthracene	Benzo-(g,h,i)perylene
Method Blanks											
Blank 1	1	3.94 ^(a)	2.37 U ^(b)	4.25 ^(a)	2.18 U	1.00 U	2.19 U	2.37 U	4.64 U	6.69 U	7.26 U
Blank 2	2	9.23	8.84	3.55	2.18 U	5.09	2.19 U	3.24	4.64 U	6.69 U	7.26 U
Blank Spikes											
Blank 1	1	3.94 ^(a)	2.37 U	4.25 ^(a)	2.18 U	1.00 U	2.19 U	2.37 U	4.64 U	6.69 U	7.26 U
Blank 1 MS	1	99.4	100	99.8	99.7	107	106	98.7	93.4	97.2	78.5
Concentration Recovered		95.5	100	95.6	99.7	107	106	98.7	93.4	97.2	78.5
Amount Spiked		100	100	100	100	100	100	100	100	100	100
Percent Recovery		95%	100%	96%	100%	107%	106%	99%	93%	97%	79%
Blank 1	1	3.94 ^(a)	2.37 U	4.25 ^(a)	2.18 U	1.00 U	2.19 U	2.37 U	4.64 U	6.69 U	7.26 U
Blank 1 MSD	1	95.9	97.3	97.5	98.7	99.2	93.8	92.9	90.5	94.2	73.7
Concentration Recovered		92.0	97.3	93.3	98.7	99.2	93.8	92.9	90.5	94.2	73.7
Amount Spiked		100	100	100	100	100	100	100	100	100	100
Percent Recovery		92%	97%	93%	99%	99%	94%	93%	91%	94%	74%
MS/MSD RPD		3%	3%	3%	1%	8%	12%	6%	0%	3%	7%
MS/MSD I-STAT		0.02	0.02	0.02	0.01	0.04	0.06	0.03	0.00	0.02	0.03
Blank 2	2	9.23	8.84	3.55	2.18 U	5.09	2.19 U	3.24	4.64 U	6.69 U	7.26 U
Blank 2 MS	2	99.5	102	96.1	97.1	107	102	99.5	92.1	94.4	89.8
Concentration Recovered		90.3	93.2	92.6	97.1	102	102	96.3	92.1	94.4	89.8
Amount Spiked		100	100	100	100	100	100	100	100	100	100
Percent Recovery		90%	93%	93%	97%	102%	102%	96%	92%	94%	90%
Blank 2	2	9.23	8.84	3.55	2.18 U	5.09	2.19 U	3.24	4.64 U	6.69 U	7.26 U
Blank 2 MSD	2	103	103	94.2	95.8	107	102	99.7	92.9	93.7	90.1
Concentration Recovered		93.8	94.2	90.7	95.8	102	102	96.5	92.9	93.7	90.1
Amount Spiked		100	100	100	100	100	100	100	100	100	100
Percent Recovery		94%	94%	91%	96%	102%	102%	96%	93%	94%	90%
MS/MSD RPD		4%	1%	2%	1%	0%	0%	0%	1%	0%	0%
MS/MSD I-STAT		0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00

TABLE C.12. (contd)

HPAHs ($\mu\text{g}/\text{kg}$ dry weight)											
Sediment Treatment	Analytical Batch	Fluor-anthene	Pyrene	Benzo(a)-anthracene	Chrysene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Benzo(a)pyrene	Indeno-(1,2,3-c,d)pyrene	Dibenzo-(a,h)anthracene	Benzo-(g,h,i)perylene
Matrix Spikes											
OC4-B-2 ^(c)	2	8.95	9.63	3.93	3.42	5.71	4.31	4.58	4.64 U	6.69 U	7.26 U
OC4-B-2 MS	2	49.7	50.8	51.3	51.3	62.5	57.7	55.0	49.3	47.7	49.4
Concentration Recovered		40.7	41.2	47.4	47.9	56.8	53.4	50.4	49.3	47.7	49.4
Amount Spiked		85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6
Percent Recovery		48%	48%	55%	56%	66%	62%	59%	58%	56%	58%
R-AM ^(c)	1	717	879	366	363	395	126	388	253	43.8	227
R-AM MS	1	377	453	274	265	276	152	262	188	101	177
Concentration Recovered		0.00 ^(d)	0.00 ^(d)	0.00 ^(d)	0.00 ^(d)	0.00 ^(d)	26.0	0.00 ^(d)	0.00 ^(d)	57.2	0.00 ^(d)
Amount Spiked		85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6
Percent Recovery		NA ^(e)	NA	NA	NA	0%	30% ^(f)	NA	NA	67%	NA
Standard Reference Material											
Certified Value SRM 1941		1220 ± 240	1080 ± 200	550 ± 79	NC ^(g) NC	780 ± 190	444 ± 49	670 ± 130	569 ± 40	NC NC	516 ± 83
SRM 1941	1	1260	1060	597	NA	1410 ^(h)	464	586	618	NA	525
SRM 1941	2	1270	1060	588	NA	1230 ^(h)	421	536	617	NA	550
Analytical Replicates											
OC4-B-2 Replicate 1	2	10.7	12.0	5.24	4.89	6.91	4.49	6.36	4.59	6.69 U	5.00
OC4-B-2 Replicate 2	2	7.75	8.04	3.18	2.40	4.99	4.23	3.55	4.64 U	6.69 U	7.26 U
OC4-B-2 Replicate 3	2	8.41	8.85	3.36	2.96	5.23	4.21	3.82	3.21	6.69 U	7.26 U
RSD		17%	22%	29%	38% ⁽ⁱ⁾	18%	4%	34% ⁽ⁱ⁾	NA	NA	NA

TABLE C.12. (contd)

Sediment Treatment	Analytical Batch	HPAHs ($\mu\text{g}/\text{kg}$ dry weight)									
		Fluor- anthene	Pyrene	Benzo(a)- anthra- cene	Chrysene	Benzo(b)- fluor- anthene	Benzo(k)- fluor- anthene	Benzo(a) pyrene	Indeno- (1,2,3- -c,d) pyrene	Dibenzo- (a,h) anthra- cene	Benzo- (g,h,i) perylene
R-AM Replicate 1	1	776	991	537	563	453	148	456	233	60.2	214
R-AM Replicate 2	1	390	485	212	216	223	72.8	214	139	25.5	124
R-AM Replicate 3	1	985	1160	350	311	509	155	495	388	45.8	342
RSD		42%(i)	40%(i)	45%(i)	49%(i)	38%(i)	37%(i)	39%(i)	50%(i)	40%(i)	48%(i)

(a) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(b) U Undetected above given concentration.

(c) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(d) Negative values reported as zero.

(e) NA Not applicable.

(f) Recovery outside quality control range (40% to 120%).

(g) NC Not certified.

(h) Value outside SRM range for certified value.

(i) Value exceeds relative precision goal of $\leq 30\%$.

TABLE C.13. Surrogate Percent Recoveries for Polynuclear Aromatic Hydrocarbons (PAHs) Including Quality Control Data for Sediment, Oakland Harbor Intensive

Sediment Treatment	Analytical Batch	Surrogate Percent Recoveries				
		Naphthalene d8	Acenaphthalene d10	Chrysene d12	Perylene d12	Dibenzo(a,h,i) Anthracene d14
COMP IC1-A	1	74	75	79	80	79
IC1-A-1 Special Chemistry ^(a)	1	68	68	75	72	76
IC1-A-1	1	71	72	83	72	86
IC1-A-2	1	65	67	77	68	80
IC1-A-3	1	71	73	81	75	84
IC1-A-4	1	71	71	78	70	82
IC1-A-5	1	73	74	82	72	86
IC1-A-6	1	68	68	77	66	83
IC1-A-8270	2	56	61	78	67	74
COMP IC1-B	1	68	72	82	78	83
COMP IC1-B Special	1	76	81	92	86	97
IC1-B-1	1	74	80	86	74	92
IC1-B-2	2	64	66	80	75	80
IC1-B-3	2	66	69	83	77	80
IC1-B-4 ^(b)	2	72	73	88	81	87
IC1-B-5	2	58	60	73	66	74
COMP IC1-C	1	74	79	89	80	94
IC1-C-1 Top 6 in.	1	55	64	80	71	87
IC1-C-1	2	60	63	73	67	74
IC1-C-2	2	70	71	85	78	85
IC1-C-3	2	68	69	83	72	87
IC1-C-4	2	69	72	85	76	85
COMP OC4-B	1	57	61	70	62	74
OC4-B-1	2	60	63	81	69	81
OC4-B-2 Replicate 1	2	65	64	75	61	76
OC4-B-2 Replicate 2	2	65	66	82	65	83
OC4-B-2 Replicate 3	2	70	69	87	67	85
OC4-B-3 Special Chemistry	1	65	70	85	77	91
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	69	75	91	79	88
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	51	57	76	62	77
OC4-B-4	2	51	59	81	67	74
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	55	56	72	62	71
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	58	61	81	70	80
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	63	59	78	61	79
R-AM Replicate 1	1	68	70	79	69	85
R-AM Replicate 2	1	74	75	89	77	95
R-AM Replicate 3	1	70	72	85	72	91
R-BF	2	49	53	67	59	67
R-OS	2	60	64	76	70	77

Quality Control Data

Method Blanks

Blank 1	1	62	63	70	70	66
Blank 2	2	66	68	76	72	74

TABLE C.13. (contd)

Sediment Treatment	Analytical Batch	Surrogate Percent Recoveries				
		Naphthalene d8	Acenaphthalene d10	Chrysene d12	Perylene d12	Dibenzo(a,h,i) Anthracene d14
<u>Matrix Spikes</u>						
OC4-B-2 MS	2	54	54	75	57	73
R-AM MS	1	73	76	91	77	98
<u>Analytical Replicates</u>						
OC4-B-2 Replicate 1	2	65	64	75	61	76
OC4-B-2 Replicate 2	2	65	66	82	65	83
OC4-B-2 Replicate 3	2	70	69	87	67	85
R-AM Replicate 1	1	68	70	79	69	85
R-AM Replicate 2	1	74	75	89	77	95
R-AM Replicate 3	1	70	72	85	72	91

(a) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(b) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.14. Sediment Chlorinated Pesticide Results (alphabetical, Aldrin - 4,4'- DDT), Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlordane	4,4'-DDE	4,4'-DDD	4,4'-DDT
Target DL ^(a)		2	2	2	2	2	30	2	2	2
Achieved DL		0.07	0.10	0.10	0.10	0.07	30	0.09	0.23	0.59
COMP IC1-A	1	0.07 U ^(b)	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-A-1 Special Chemistry ^(c)	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.78	0.59 U
IC1-A-1	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-A-2	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-A-3	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-A-4	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-A-5	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.40	1.22	0.59 U
IC1-A-6	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
COMP IC1-B	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.78	0.59 U
COMP IC1-B Special	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.14	1.73	0.59 U
IC1-B-1	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.09	2.14	0.59 U
IC1-B-2	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-B-3	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-B-4 ^(d)	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-B-5	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
COMP IC1-C	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.69	1.10	0.59 U
IC-C-1 Top 6 in.	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.89	0.98	0.59 U
IC1-C-1	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-C-2	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-C-3	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
IC1-C-4	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	2.29	4.45	0.59 U
COMP OC4-B	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.16	1.59	0.59 U
OC4-B-1	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-2 Replicate 1	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-2 Replicate 2	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-2 Replicate 3	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.69	0.59 U
OC4-B-3 Special Chemistry	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.99	4.27	0.59 U
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	2.67	5.10	0.59 U
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-4	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	14.52	7.58	0.59 U
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.51	2.23	0.59 U
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	0.98	0.10 U	0.10 U	0.10 U	0.07 U	30 U	3.05	3.85	6.79
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U

TABLE C.14. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								
		Aldrin	Alpha- BHC	Beta- BHC	Delta- BHC	Gamma- BHC	Chlordane	4,4'- DDE	4,4'- DDD	4,4'- DDT
R-AM Replicate 1	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.53	0.23 U	0.59 U
R-AM Replicate 2	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
R-AM Replicate 3	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
R-BF	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	2.81	3.70	0.59 U
R-OS	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	1.18	0.23 U	0.59 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(d) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.15. Sediment Chlorinated Pesticide Results (alphabetical, Dieldrin - Toxaphene), Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								
		Dieldrin	Endo-Sulfan I	Endo-Sulfan II	Endo-Sulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor-epoxide	Toxaphene
Target DL ^(a)		2	2	2	2	2	2	2	30	
Achieved DL		0.45	0.10	0.10	0.17	0.10	0.10	0.53	0.32	30
COMP IC1-A	1	0.45 U ^(b)	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-1 Special Chemistry ^(c)	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-1	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-2	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-3	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-4	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-5	1	0.57	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-A-6	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
COMP IC1-B	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
COMP IC1-B Special	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-B-1	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-B-2	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-B-3	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-B-4 ^(d)	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-B-5	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
COMP IC1-C	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-C-1 Top 6 in.	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-C-1	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-C-2	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-C-3	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
IC1-C-4	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
COMP OC4-B	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-1	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-2 Replicate 1	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-2 Replicate 2	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-2 Replicate 3	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-3 Special Chemistry	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-4	2	3.31	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	2.42	0.32 U	30 U
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	0.94	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U

TABLE C.15. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								
		<u>Dieldrin</u>	<u>Endo- Sulfan I</u>	<u>Endo- Sulfan II</u>	<u>Endo- Sulfan Sulfate</u>	<u>Endrin</u>	<u>Endrin Alde- hyde</u>	<u>Hepta- chlor</u>	<u>Hepta- chlor- epoxide</u>	<u>Toxa- phene</u>
R-AM Replicate 1	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
R-AM Replicate 2	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
R-AM Replicate 3	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.45	30 U
R-BF	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
R-OS	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(d) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.16. Quality Control Data for Sediment Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4'- DDT), Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlordane	4,4'-DDE	4,4'-DDD	4,4'-DDT
Method Blanks										
Blank	1	0.07 U ^(a)	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
Blank	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
Matrix Spikes										
OC4-B-2 ^(b)	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-2 MS	2	2.47	NA ^(c)	NA	NA	2.34	NA	NA	NA	10.2
Concentration Recovered		2.47	NA	NA	NA	2.34	NA	NA	NA	10.2
Amount Spiked		2.65	NS ^(d)	NS	NS	2.65	NS	NS	NS	10.6
Percent Recovery		93%	NA	NA	NA	88%	NA	NA	NA	96%
R-AM ^(b)	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
R-AM MS	1	4.21	NA	NA	NA	3.73	NA	NA	NA	16.8
Concentration Recovered		4.21	NA	NA	NA	3.73	NA	NA	NA	16.8
Amount Spiked		4.30	NS	NS	NS	4.30	NS	NS	NS	17.2
Percent Recovery		98%	NA	NA	NA	87%	NA	NA	NA	98%
Analytical Replicates										
OC4-B-2 Replicate 1	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-2 Replicate 2	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
OC4-B-2 Replicate 3	2	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.69	0.59 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.53	0.23 U	0.59 U
R-AM Replicate 2	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
R-AM Replicate 3	1	0.07 U	0.10 U	0.10 U	0.10 U	0.07 U	30 U	0.09 U	0.23 U	0.59 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(c) NA Not applicable.

(d) NS Not spiked.

TABLE C.17. Quality Control Data for Sediment Chlorinated Pesticide Analysis
(alphabetical, Dieldrin - Toxaphene), Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Pesticides (μg/kg dry weight)								
		Dieldrin	Endo-Sulfan I	Endo-Sulfan II	Endo-Sulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor-epoxide	Toxaphene
Method Blanks										
Blank	1	0.45 U ^(a)	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
Blank	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
Matrix Spikes										
OC4-B-2 ^(b)	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-2 MS	2	10.2	NA ^(c)	NA	NA	10.5	NA	2.43	NA	NA
Concentration Recovered		10.2	NA	NA	NA	10.5	NA	2.43	NA	NA
Amount Spiked		10.6	NS ^(d)	NS	NS	10.6	NS	2.65	NS	NS
Percent Recovery		96%	NA	NA	NA	99%	NA	92%	NA	NA
R-AM ^(b)	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
R-AM MS	1	17.1	NA	NA	NA	15.9	NA	4.27	NA	NA
Concentration Recovered		17.1	NA	NA	NA	15.9	NA	4.27	NA	NA
Amount Spiked		17.2	NS	NS	NS	17.2	NS	4.30	NS	NS
Percent Recovery		99%	NA	NA	NA	92%	NA	99%	NA	NA
Analytical Replicates										
OC4-B-2 Replicate 1	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-2 Replicate 2	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
OC4-B-2 Replicate 3	2	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
R-AM Replicate 2	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.32 U	30 U
R-AM Replicate 3	1	0.45 U	0.10 U	0.10 U	0.17 U	0.10 U	0.10 U	0.53 U	0.45	30 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(c) NA Not applicable.

(d) NS Not spiked.

TABLE C.18. Sediment Polychlorinated Biphenyls (PCBs) Results, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	PCBs ($\mu\text{g/kg}$ dry weight)			
		Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL (a)		20	20	20	20
Achieved DL		2.8	2.8	2.8	2.8
COMP IC1-A	1	2.8 U ^(b)	2.8 U	2.8 U	2.8 U
IC1-A-1 Special Chemistry ^(c)	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-A-1	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-A-2	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-A-3	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-A-4	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-A-5	1	2.8 U	2.8 U	41	2.8 U
IC1-A-6	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special	1	2.8 U	2.8 U	18	2.8 U
IC1-B-1	1	2.8 U	2.8 U	16	2.8 U
IC1-B-2	2	2.8 U	2.8 U	2.8 U	2.8 U
IC1-B-3	2	2.8 U	2.8 U	2.8 U	2.8 U
IC1-B-4 ^(d)	2	2.8 U	2.8 U	2.8 U	2.8 U
IC1-B-5	2	2.8 U	2.8 U	18	2.8 U
COMP IC1-C	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-C-1 Top 6 in.	1	2.8 U	2.8 U	2.8 U	2.8 U
IC1-C-1	2	2.8 U	2.8 U	2.8 U	2.8 U
IC1-C-2	2	2.8 U	2.8 U	28	2.8 U
IC1-C-3	2	2.8 U	2.8 U	17	2.8 U
IC1-C-4	2	2.8 U	2.8 U	2.8 U	16
COMP OC4-B	1	2.8 U	2.8 U	17	2.8 U
OC4-B-1	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-2 Replicate 1	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-2 Replicate 2	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-2 Replicate 3	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-3 Special Chemistry	1	2.8 U	2.8 U	28	2.8 U
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	2.8 U	2.8 U	2.8 U	35.1
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-4	2	2.8 U	203	2.8 U	230
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	2.8 U	2.8 U	2.8 U	12.4
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	2.8 U	2.8 U	2.8 U	34.5
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 1	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 2	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 3	1	2.8 U	2.8 U	2.8 U	2.8 U
R-BF	2	2.8 U	2.8 U	24.9	2.8 U
R-OS	2	2.8 U	2.8 U	2.8 U	2.8 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(d) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.19. Quality Control Data for Polychlorinated Biphenyls (PCBs)
Analysis, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	PCBs (µg/kg dry weight)			
		Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Method Blanks					
Blank	1	2.8 U ^(a)	2.8 U	2.8 U	2.8 U
Blank	2	2.8 U	2.8 U	2.8 U	2.8 U
Matrix Spikes					
OC4-B-2 ^(b)	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-2 MS	2	NA ^(c)	NA	58.3	NA
Concentration Recovered		NA	NA	58.3	NA
Amount Spiked		NS ^(d)	NS	53.0	NS
Percent Recovery		NA	NA	110%	NA
R-AM ^(b)	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM MS	1	NA	NA	93.1	NA
Concentration Recovered		NA	NA	93.1	NA
Amount Spiked		NS	NS	86.0	NS
Percent Recovery		NA	NA	108%	NA
Analytical Replicates					
OC4-B-2 Replicate 1	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-2 Replicate 2	2	2.8 U	2.8 U	2.8 U	2.8 U
OC4-B-2 Replicate 3	2	2.8 U	2.8 U	2.8 U	2.8 U
RSD		NA	NA	NA	NA
R-AM Replicate 1	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 2	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 3	1	2.8 U	2.8 U	2.8 U	2.8 U
RSD		NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(c) NA Not applicable.

(d) NS Not spiked.

TABLE C.20. Surrogate Recoveries for Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs) Including Quality Control Data for Sediment, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Surrogate Percent Recoveries	
		PCB 103	PCB 198
COMP IC1-A	1	75	97
IC1-A-1 Special Chemistry ^(a)	1	74	74
IC1-A-1	1	77	77
IC1-A-2	1	71	72
IC1-A-3	1	76	77
IC1-A-4	1	73	73
IC1-A-5	1	73	73
IC1-A-6	1	72	70
COMP IC1-B	1	76	77
COMP IC1-B Special	1	81	82
IC1-B-1	1	76	74
IC1-B-2	2	78	76
IC1-B-3	2	79	75
IC1-B-4 ^(b)	2	80	108
IC1-B-5	2	71	72
COMP IC1-C	1	79	79
IC1-C-1 Top 6 in.	1	72	71
IC1-C-1	2	73	68
IC1-C-2	2	80	75
IC1-C-3	2	79	78
IC1-C-4	2	72	72
COMP OC4-B	1	65	65
OC4-B-1	2	73	74
OC4-B-2 Replicate 1	2	71	67
OC4-B-2 Replicate 2	2	75	74
OC4-B-2 Replicate 3	2	80	77
OC4-B-3 Special Chemistry	1	68	74
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	78	74
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	73	69
OC4-B-4	2	65	62
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	64	60
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	67	66
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	70	68
R-AM Replicate 1	1	71	69
R-AM Replicate 2	1	77	80
R-AM Replicate 3	1	72	74
R-BF	2	61	58
R-OS	2	75	69

TABLE C.20. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Surrogate Percent Recoveries</u>	
		<u>PCB 103</u>	<u>PCB 198</u>

Quality Control DataMethod Blanks

Blank	1	68	70
Blank	2	73	74

Matrix Spikes

OC4-B-2 MS	2	69	67
R-AM MS	1	77	81

Standard Reference Material

No certified values provided for PCBs

Analytical Replicates

OC4-B-2 Replicate 1	2	71	67
OC4-B-2 Replicate 2	2	75	74
OC4-B-2 Replicate 3	2	80	77
R-AM Replicate 1	1	71	69
R-AM Replicate 2	1	77	80
R-AM Replicate 3	1	72	74

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- (a) Special Chemistry sample determined in the field due to a particular sediment characteristic.
- (b) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.21. Sediment Metals Results, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL ^(a)		0.02	2.5	0.1	33	5.5	0.01	7.5	6.2	0.10	7.8
Achieved DL		0.01	2.5	0.1	33	5.5	0.015	7.5	6.2	0.12	7.8
COMP IC1-A	1	0.039	3.91	0.1 U ^(b)	231	10.4	0.026	35.0	7.4	0.12 U	29.1
IC1-A-1 Special Chemistry ^(c)	1	0.039	3.56	0.1 U	212	32.3	0.033	46.9	6.3	0.12 U	33.8
IC1-A-1	1	0.033	3.77	0.1 U	339	10.2	0.018	62.2	6.4	0.13	36.2
IC1-A-2	1	0.049	4.25	0.1 U	482	14.2	0.025	39.1	6.0	0.12 U	36.2
IC1-A-3	1	0.030	3.11	0.1 U	310	8.8	0.018	31.8	7.7	0.14	26.2
IC1-A-4	1	0.026	2.13	0.1 U	249	11.6	0.018	32.9	8.8	0.12 U	24.5
IC1-A-5	1	0.118	5.07	0.119	525	14.9	0.096	44.3	10.1	0.12 U	43.7
IC1-A-6	1	0.034	3.78	0.1 U	420	10.4	0.024	31.1	6.6	0.12 U	27.9
COMP IC1-B	1	0.117	11.1	0.161	190	50.9	0.081	114	11.1	0.34	107
COMP IC1-B Special	1	0.197	10.6	0.272	191	37.7	0.398	86.8	13.8	0.34	92.2
IC1-B-1	1	0.246	10.7	0.319	187	48.0	0.200	105	19.1	0.20	107
IC1-B-2	1	0.090	10.0	0.210	161	44.6	0.073	104	8.4	0.34	92.0
IC1-B-3	1	0.082	10.0	0.182	216	38.1	0.091	83.2	11.0	0.20	81.6
IC1-B-4 ^(d)	1	0.104	10.4	0.238	157	47.4	0.074	110	10.2	0.35	99.4
IC1-B-5	1	0.099	10.2	0.240	167	49.0	0.067	108	8.7	0.21	95.9
COMP IC1-C	1	0.127	10.2	0.153	299	31.7	0.090	81.6	10.9	0.21	83.1
IC1-C-1 Top 6 in.	1	0.142	11.0	0.171	224	39.9	0.099	95.4	11.0	0.20	93.9
IC1-C-1	1	0.128	11.8	0.202	186	47.6	0.072	105	10.3	0.34	102
IC1-C-2	1	0.099	12.6	0.213	190	46.9	0.076	117	11.4	0.21	103
IC1-C-3	1	0.037	3.89	0.1 U	331	9.9	0.018	29.3	5.6	0.12 U	25.3
IC1-C-4	1	0.366	13.2	0.266	233	51.5	0.294	100	30.7	0.21	131
COMP OC4-B	1	0.129	4.43	0.110	433	21.0	0.091	76.1	12.5	0.13	63.5
OC4-B-1	1	0.052	2.65	0.1 U	410	11.5	0.029	70.6	3.8	0.12 U	41.8
OC4-B-2 Replicate 1	1	0.030	3.21	0.1 U	320	10.2	0.020	54.1	6.2	0.12 U	34.1
OC4-B-2 Replicate 2	1	0.030	2.42	0.1 U	283	10.4	0.024	53.1	5.7	0.12 U	33.0
OC4-B-2 Replicate 3	1	0.022	4.13	0.1 U	289	12.2	0.016 U	53.6	3.8	0.12 U	32.7
OC4-B-3 Special Chemistry	1	0.306	11.6	0.137	287	45.3	0.296	98.8	26.1	0.27	119
OC4-B-3 (-38.6 to -40.1 ft MLLW)	1	0.325	10.4	0.169	213	46.6	0.303	92.9	28.4	0.21	120
OC4-B-3 (-40.1 to -43.7 ft MLLW)	1	0.023	1.43	0.1 U	427	9.0	0.031	58.7	7.0	0.12 U	35.6
OC4-B-4	1	0.603	10.9	0.554	257	54.7	0.480	96.3	44.7	0.27	140
OC4-B-5 (-39.6 to -44.0 ft MLLW)	1	0.150	8.35	0.121	473	25.3	0.128	76.3	13.6	0.12 U	77.7
OC4-B-5 (-39.6 to -42.2 ft MLLW)	1	0.364	12.5	0.190	224	48.4	0.330	92.3	29.2	0.27	128
OC4-B-5 (-42.2 to -44.0 ft MLLW)	1	0.023	3.21	0.1 U	627	11.5	0.016 U	57.2	6.3	0.12 U	42.3

TABLE C.21. (contd)

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-AM Replicate 1	1	0.044	9.4	0.1 U	209	10.6	0.035	44.2	16.0	0.12 U	38.0
R-AM Replicate 2	1	0.041	10.1	0.1 U	183	12.6	0.037	40.5	14.1	0.12 U	36.9
R-AM Replicate 3	1	0.041	7.88	0.1 U	177	11.4	0.037	42.2	15.4	0.12 U	35.5
R-BF	1	0.409	12.6	0.194	189	52.5	0.342	110	31.5	0.28	149
R-OS	1	0.259	5.33	0.411	197	21.8	0.081	69.4	8.2	0.83	76.3

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(d) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.22. Quality Control Data for Sediment Metals Analysis, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Method Blank											
Blank Replicate 1	1	0.015	NA ^(a)	0.1 U ^(b)	NA	NA	0.016 U	NA	NA	0.12 U	NA
Blank Replicate 2	1	0.015	NA	0.1 U	NA	NA	0.016 U	NA	NA	0.12 U	NA
Matrix Spike											
OC4-B-2 ^(c)	1	0.027	3.25	0.1 U	297.3	10.9	0.016 U	53.6	5.2	0.12 U	33.3
OC4-B-2 MS	1	1.65	NA	2.140	NA	NA	1.86	NA	NA	1.64	NA
Concentration Recovered		1.62	NA	2.140	NA	NA	1.86	NA	NA	1.64	NA
Amount Spiked		2.00	NS ^(d)	2.000	NS	NS	2.00	NS	NS	2.00	NS
Percent Recovery		81%	NA	107%	NA	NA	93%	NA	NA	82%	NA
R-AM ^(c)	1	0.042	9.13	0.1 U	189.7	11.5	0.036	42.3	15.2	0.12 U	36.8
R-AM MS	1	1.83	NA	2.130	NA	NA	1.92	NA	NA	1.78	NA
Concentration Recovered		1.78	NA	2.130	NA	NA	1.88	NA	NA	1.78	NA
Amount Spiked		2.00	NS	2.000	NS	NS	2.00	NS	NS	2.00	NS
Percent Recovery		89%	NA	107%	NA	NA	94%	NA	NA	89%	NA
Standard Reference Material											
Certified Value 1646		NC ^(e)	11.6	0.36	76	18	0.063	32	28.2	NC	138
		NC	±1.3	±0.07	±3	±3	±0.012	±3	±1.8	NC	±6
SRM 1646		NA	12.4	0.28	71	21.1	0.080	32.5	28.9	NA	128
SRM 1646		NA	12.5	0.27	70	19.4	0.085 ^(f)	32.8	27.5	NA	132
Certified Value BEST-1		NC	NC	NC	NC	NC	0.092	NC	NC	NC	NC
		NC	NC	NC	NC	NC	±0.009	NC	NC	NC	NC
SRM BEST-1		NA	NA	NA	NA	NA	0.094	NA	NA	NA	NA
SRM BEST-1		NA	NA	NA	NA	NA	0.094	NA	NA	NA	NA
Analytical Replicates											
OC4-B-2 Replicate 1	1	0.030	3.21	0.1 U	320	10.2	0.020	54.1	6.2	0.12 U	34.1
OC4-B-2 Replicate 2	1	0.030	2.42	0.1 U	283	10.4	0.024	53.1	5.7	0.12 U	33.0
OC4-B-2 Replicate 3	1	0.022	4.13	0.1 U	289	12.2	0.016 U	53.6	3.8	0.12 U	32.7
RSD		17%	26% ^(g)	NA	7%	10%	NA	1%	24% ^(g)	NA	2%

TABLE C.22. (contd)

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-AM Replicate 1	1	0.044	9.4	0.1 U	209	10.6	0.035	44.2	16.0	0.12 U	38.0
R-AM Replicate 2	1	0.041	10.1	0.1 U	183	12.6	0.037	40.5	14.1	0.12 U	36.9
R-AM Replicate 3	1	0.041	7.88	0.1 U	177	11.4	0.037	42.2	15.4	0.12 U	35.5
RSD		4%	12%	NA	9%	9%	3%	4%	6%	NA	3%

- (a) NA Not applicable.
 (b) U Undetected above given concentration.
 (c) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.
 (d) NS Not spiked.
 (e) NC Not certified.
 (f) Value outside SRM range for certified value.
 (g) Value exceeds relative precision goal of $\leq 20\%$

TABLE C.23. Sediment Butyltin Results, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Triphenyltin Percent Internal Standard	Butyltin Species ($\mu\text{g/kg}$ dry weight)		
			Tri- butyltin	Di- butyltin	Mono- butyltin
Target DL ^(a)			10	10	10
Achieved DL			0.7	1.2	1.3
COMP IC1-A	1	108	0.7 U ^(b)	1.2 U	1.3 U
IC1-A-1 Special Chemistry ^(c)	1	95	4.8	1.2 U	1.3 U
IC1-A-1	1	112	0.7 U	1.2 U	1.3 U
IC1-A-2	1	86	0.7 U	1.2 U	1.3 U
IC1-A-3	1	91	0.7 U	1.2 U	1.3 U
IC1-A-4	1	93	1.4	1.2 U	1.3 U
IC1-A-5	1	100	0.7 U	1.2 U	1.3 U
IC1-A-6	1	88	0.7 U	1.2 U	1.3 U
COMP IC1-B	1	103	0.7 U	1.2 U	1.3 U
COMP IC1-B Special	1	108	3.9	1.2 U	1.3 U
IC1-B-1	1	97	0.7 U	1.2 U	1.3 U
IC1-B-2	2	98	1.8	1.2 U	1.3 U
IC1-B-3	2	81	0.7 U	1.2 U	1.3 U
IC1-B-4 ^(d)	2	100	0.7 U	1.2 U	1.3 U
IC1-B-5	2	81	0.7 U	1.2 U	1.3 U
COMP IC1-C	1	107	1.2	1.2 U	1.3 U
IC1-C-1 Top 6 in.	1	93	1.1	1.2 U	1.3 U
IC1-C-1	2	114	0.7 U	1.2 U	1.3 U
IC1-C-2	2	102	0.7 U	1.2 U	1.3 U
IC1-C-3	2	97	0.7 U	1.2 U	1.3 U
IC1-C-4	2	107	3.9	2.0	1.3 U
COMP OC4-B	1	105	1.5	1.2 U	1.3 U
OC4-B-1	2	109	0.7 U	1.2 U	1.3 U
OC4-B-2 Replicate 1	2	97	0.7 U	1.2 U	1.3 U
OC4-B-2 Replicate 2	2	109	0.7 U	1.2 U	1.3 U
OC4-B-2 Replicate 3	2	100	0.7 U	1.2 U	1.3 U
OC4-B-3 Special Chemistry	1	100	4.0	2.1	1.3 U
OC4-B-3 (-38.6 to -40.1 ft MLLW)	2	113	4.0	2.2	1.3 U
OC4-B-3 (-40.1 to -43.7 ft MLLW)	2	97	0.7 U	1.2 U	1.3 U
OC4-B-4	2	102	0.8	1.2 U	1.3 U
OC4-B-5 (-39.6 to -44.0 ft MLLW)	2	112	4.9	1.4	1.3 U
OC4-B-5 (-39.6 to -42.2 ft MLLW)	2	93	5.5	2.5	1.3 U
OC4-B-5 (-42.2 to -44.0 ft MLLW)	2	104	0.7 U	1.2 U	1.3 U
R-AM Replicate 1	1	105	0.7 U	1.2 U	1.3 U
R-AM Replicate 2	1	112	0.7 U	1.2 U	1.3 U
R-AM Replicate 3	1	99	0.9	1.2 U	1.3 U
R-BF	2	105	4.3	2.3	1.3 U
R-OS	2	102	0.7 U	1.2 U	1.3 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(d) All of the sediment from this station is represented in COMP IC1-B Special only.

TABLE C.24. Quality Control Data for Sediment Butyltin Analysis, Oakland Harbor Intensive Study

Sediment Treatment	Analytical Batch	Triphenyltin Percent Internal Standard	Butyltin Species (µg/kg dry weight)		
			Tri-butyltin	Di-butyltin	Mono-butyltin
Method Blanks					
Blank	1	114	0.7 U ^(a)	1.2 U	1.3 U
Blank	2	97	0.7 U	1.2 U	1.3 U
Matrix Spikes					
OC4-B-2 ^(b)	2	102	0.7 U	1.2 U	1.3 U
OC4-B-2 MS	2	100	28.4	28.1	10.7
Concentration Recovered		NA ^(c)	28.4	28.1	10.7
Amount Spiked		NS ^(d)	29.1	29.1	33.5
Percent Recovery		NA	98%	97%	32%
R-AM ^(b)	1	105	0.7 U	1.2 U	1.3 U
R-AM MS	1	94	28.5	26.8	11.9
Concentration Recovered		NA	28.5	26.8	11.9
Amount Spiked		NS	30.1	30.1	30.1
Percent Recovery		NA	95%	89%	40%
Standard Reference Material					
Certified Value PACS		NC ^(e)	1270	1160	280
		NC	±220	±180	±170
PACS-1	1	NA	1105	1080	564 ^(f)
PACS-1	2	NA	993	948	443 ^(f)
Analytical Replicates					
OC4-B-2 Replicate 1	2	97	0.7 U	1.2 U	1.3 U
OC4-B-2 Replicate 2	2	109	0.7 U	1.2 U	1.3 U
OC4-B-2 Replicate 3	2	100	0.7 U	1.2 U	1.3 U
RSD		NA	NA	NA	NA
R-AM Replicate 1	1	105	0.7 U	1.2 U	1.3 U
R-AM Replicate 2	1	112	0.7 U	1.2 U	1.3 U
R-AM Replicate 3	1	99	0.9	1.2 U	1.3 U
RSD		NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(c) NA Not applicable.

(d) NS Not spiked.

(e) NC Not certified.

(f) Value outside SRM range for certified value.

APPENDIX D

BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE STATIC TEST WITH
96-HOUR REFERENCE TOXICANT TEST FOR *RHEPOXYNIUS abronius*

TABLE D.1. Test Results for 10-Day *R. abronius* Solid-Phase Static Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>R. abronius</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
		Live (a)	Dead or Missing			
COMP IC1-A	1	20	0	1.00	0.91	0.07
COMP IC1-A	2	18	2	0.90		
COMP IC1-A	3	17	3	0.85		
COMP IC1-A	4	17	3	0.85		
COMP IC1-A	5	19	1	0.95		
COMP IC1-B	1	6	14	0.30	0.26	0.16
COMP IC1-B	2	5	15	0.25		
COMP IC1-B	3	0	20	0.00		
COMP IC1-B	4	6	14	0.30		
COMP IC1-B	5	9	11	0.45		
COMP IC1-B Special	1	16	4	0.80	0.76	0.12
COMP IC1-B Special	2	17	3	0.85		
COMP IC1-B Special	3	11	9	0.55		
COMP IC1-B Special	4	17	3	0.85		
COMP IC1-B Special	5	15	5	0.75		
COMP IC1-C	1	17	3	0.85	0.63	0.19
COMP IC1-C	2	16	4	0.80		
COMP IC1-C	3	9	11	0.45		
COMP IC1-C	4	9	11	0.45		
COMP IC1-C	5	12	8	0.60		
COMP OC4-B	1	20	0	1.00	0.98	0.03
COMP OC4-B	2	19	1	0.95		
COMP OC4-B	3	19	1	0.95		
COMP OC4-B	4	20	0	1.00		
COMP OC4-B	5	20	0	1.00		
R-AM	1	19	1	0.95	0.96	0.04
R-AM	2	18	2	0.90		
R-AM	3	20	0	1.00		
R-AM	4	19	1	0.95		
R-AM	5	20	0	1.00		
R-BF	1	20	0	1.00	0.89	0.12
R-BF	2	20	0	1.00		
R-BF	3	18	2	0.90		
R-BF	4	17	3	0.85		
R-BF	5	14	6	0.70		
R-OS	1	19	1	0.95	0.97	0.03
R-OS	2	20	0	1.00		
R-OS	3	20	0	1.00		
R-OS	4	19	1	0.95		
R-OS	5	19	1	0.95		
C-WB	1	19	1	0.95	0.95	0.06
C-WB	2	20	0	1.00		
C-WB	3	17	3	0.85		
C-WB	4	20	0	1.00		
C-WB	5	19	1	0.95		

(a) Survival based on initial exposure of 20 organisms per replicate.

TABLE D.2. Rank Order Based on Mean Proportion Surviving 10-Day
R. abronius Solid-Phase Static Test, Oakland Harbor
 Intensive Study

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP IC1-B	0.26
COMP IC1-C	0.63
COMP IC1-B Special	0.76
R-BF	0.89
COMP IC1-A	0.91
C-WB	0.95
R-AM	0.96
R-OS	0.97
COMP OC4-B	0.98

TABLE D.3. Daily Observations of *R. abronius* on Sediment Surface
During 10-Day Solid-Phase Static Test, Oakland Harbor
Intensive Study

Sediment Treatment	Replicate	<i>R. abronius</i> on Sediment for Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	0	T ^(b)	0	0	0	0	0	0	0	0
COMP IC1-A	4	0	0	0	0	0	0	1	0	0	0
COMP IC1-A	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	1	0	1	0	0	0	1	2	1	3	2
COMP IC1-B	2	1	0	0	0	0	0	2	4	0	1
COMP IC1-B	3	0	0	0	0	0	0	1	0	0	1
COMP IC1-B	4	0	0	0	0	0	1	1	1	1	1
COMP IC1-B	5	0	0	0	0	0	0	1	1	1	0
COMP IC1-B Special	1	0	T	0	0	0	0	0	0	0	0
COMP IC1-B Special	2	0	0	0	0	0	1	0	1	0	1
COMP IC1-B Special	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	4	0	0	0	0	0	0	1	0	0	1
COMP IC1-B Special	5	0	0	0	0	0	0	1	0	0	0
COMP IC1-C	1	0	0	0	0	0	0	1	0	0	0
COMP IC1-C	2	0	0	0	0	1	0	0	0	1	0
COMP IC1-C	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	4	0	0	0	0	0	0	1	0	0	0
COMP IC1-C	5	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	1	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	2	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	3	0	0	0	0	0	0	0	0	1	1
COMP OC4-B	4	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	5	0	0	0	0	0	0	0	0	0	0
R-AM	1	0	0	1	0	0	0	0	0	0	1
R-AM	2	0	0	1	0	0	0	0	0	0	1
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	2	0	2
R-AM	5	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	1	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	1	1
R-BF	5	0	0	0	0	0	0	3	1	0	0

TABLE D.3. (contd)

Sediment Treatment	Replicate	<i>R. abronius</i> on Sediment for Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	T	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	T	0	0	0	1	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0
C-WB	1	0	0	0	0	0	0	0	0	0	0
C-WB	2	0	0	0	0	0	0	0	0	0	0
C-WB	3	0	0	0	0	0	1	1	1	1	1
C-WB	4	0	0	0	0	0	0	0	0	0	0
C-WB	5	0	0	0	1	0	0	1	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) T Too turbid.

TABLE D.4. Daily Observations of *R. abronius* Floating on Surface
During 10-Day Solid-Phase Static Test, Oakland
Harbor Intensive Study

Sediment Treatment	Replicate	<i>R. abronius</i> Floating for Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	2	0	1	0	0	1	0	0	0	0
COMP IC1-A	2	1	0	0	0	0	0	0	1	0	0
COMP IC1-A	3	0	0	0	0	1	1	0	0	0	0
COMP IC1-A	4	1	0	0	0	0	1	0	0	0	0
COMP IC1-A	5	3	0	0	0	0	0	0	0	0	0
COMP IC1-B	1	0	0	1	0	2	3	0	1	0	0
COMP IC1-B	2	0	1	0	1	0	3	1	0	2	1
COMP IC1-B	3	1	0	0	0	0	1	0	0	0	0
COMP IC1-B	4	3	0	0	1	0	3	0	0	1	1
COMP IC1-B	5	0	1	0	1	0	5	0	0	1	2
COMP IC1-B Special	1	0	0	3	0	2	2	0	0	0	0
COMP IC1-B Special	2	0	0	1	0	0	0	0	0	2	0
COMP IC1-B Special	3	1	0	0	0	0	5	0	2	1	0
COMP IC1-B Special	4	1	0	0	0	0	4	0	1	0	0
COMP IC1-B Special	5	2	0	0	0	1	2	0	0	0	0
COMP IC1-C	1	0	0	0	0	0	2	0	0	1	1
COMP IC1-C	2	0	0	0	0	0	6	1	0	0	1
COMP IC1-C	3	0	0	0	0	0	5	1	0	0	1
COMP IC1-C	4	0	0	0	0	0	1	1	0	2	1
COMP IC1-C	5	0	0	0	0	0	4	0	0	0	1
COMP OC4-B	1	1	0	0	0	0	0	0	0	0	0
COMP OC4-B	2	1	1	0	0	2	1	0	1	1	0
COMP OC4-B	3	1	0	2	0	1	8	0	1	0	1
COMP OC4-B	4	1	0	2	0	0	3	1	0	1	0
COMP OC4-B	5	2	0	0	0	0	5	0	2	0	0
R-AM	1	2	0	0	0	0	0	0	0	0	0
R-AM	2	1	0	0	0	0	1	0	0	0	0
R-AM	3	0	0	0	0	0	2	0	0	0	0
R-AM	4	1	0	0	0	0	0	0	0	0	0
R-AM	5	0	1	0	0	0	2	0	0	0	0
R-BF	1	0	0	0	0	0	3	0	0	1	1
R-BF	2	0	0	1	0	1	5	0	0	3	1
R-BF	3	2	0	0	0	0	2	0	0	0	0
R-BF	4	0	0	1	0	0	1	1	0	1	1
R-BF	5	0	0	0	0	0	0	0	0	1	0

TABLE D.4. (contd)

Sediment Treatment	Replicate	<i>R. abronius</i> Floating for Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	0	0	0	0	0	1	0	0	0	0
R-OS	2	0	0	0	0	1	1	0	0	0	0
R-OS	3	0	0	2	0	2	1	0	0	0	1
R-OS	4	0	0	1	0	0	3	0	0	0	0
R-OS	5	0	2	0	0	0	1	0	0	1	0
C-WB	1	1	0	0	0	0	0	0	0	0	0
C-WB	2	2	0	0	0	0	0	0	0	0	0
C-WB	3	0	0	0	0	0	0	0	0	0	0
C-WB	4	0	0	0	0	0	0	0	0	0	0
C-WB	5	1	0	0	0	0	0	0	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

TABLE D.5. Water Quality Summary for 10-Day *R. abronius* Solid-Phase Static Test, Oakland Harbor Intensive Study

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0
COMP IC1-A	15.4	16.3	7.90	8.15	7.3	8.3	30.0	32.0
COMP IC1-B	15.3	16.2	8.10	8.42 ^(b)	6.0	8.2	29.0	32.0
COMP IC1-B Special	15.1	16.4	7.98	8.29	6.0	8.3	30.0	32.0
COMP IC1-C	15.3	16.1	7.96	8.25	7.1	8.3	30.0	32.0
COMP OC4-B	15.2	16.0	7.99	8.23	7.5	8.3	30.0	32.0
R-AM	15.2	16.2	7.96	8.18	6.3 ^(b)	8.3	30.0	32.0
R-BF	15.3	16.1	7.88	8.29	5.0 ^(b)	8.9	29.0	32.0
R-OS	15.2	16.1	7.97	8.17	6.7	8.2	30.0	32.5
C-WB	15.1	16.1	7.94	8.14	7.5	8.3	30.0	32.0

(a) NA Not applicable.

(b) Data point out of range.

TABLE D.6. Test Results for 96-Hour *R. abronius* Reference Toxicant Test, Oakland Harbor Intensive Study

Cadmium Concentration (mg/L)	Replicate	<i>R. abronius</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
		Live (a)	Dead or Missing			
0.0	1	20	0	1.00	0.97	0.06
0.0	2	20	0	1.00		
0.0	3	18	2	0.90		
0.25	1	18	2	0.90	0.87	0.06
0.25	2	16	4	0.80		
0.25	3	18	2	0.90		
0.5	1	17	3	0.85	0.77	0.08
0.5	2	15	5	0.75		
0.5	3	14	6	0.70		
1.0	1	5	15	0.25	0.30	0.05
1.0	2	6	14	0.30		
1.0	3	7	13	0.35		
2.0	1	0	20	0.00	0.03	0.06
2.0	2	0	20	0.00		
2.0	3	2	18	0.10		

(a) Survival based on initial exposure of 20 organisms per replicate.

TABLE D.7. Daily Observations of *R. abronius* Floating on Surface
During 96-Hour Reference Toxicant Test, Oakland Harbor
Intensive Study

Cadmium Concentration (mg/L)	Replicate	<i>R. abronius</i> Floating on Surface			
		2 h	24 h	48 h	72 h
0.0	1	1	1	0	0
0.0	2	0	0	1	0
0.0	3	3	3	3	3
0.25	1	0	0	0	0
0.25	2	0	3	5	0
0.25	3	1	2	3	0
0.5	1	0	4	0	0
0.5	2	1	1	1	0
0.5	3	0	2	0	0
1.0	1	1	2	0	0
1.0	2	3	1	1	0
1.0	3	1	4	0	0
2.0	1	0	3	0	0
2.0	2	2	9	0	0
2.0	3	0	6	6	0

TABLE D.8. Water Quality Summary for 96-Hour *R. abronius* Reference Toxicant Test, Oakland Harbor Intensive Study

Cadmium Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0
0.0	15.4	15.8	8.10	8.14	7.7	8.2	30.5	32.0
0.25	15.5	16.0	8.10	8.14	7.9	8.2	30.5	32.0
0.50	15.4	16.4	8.07	8.13	7.6	8.3	30.5	32.0
1.0	15.3	16.4	8.05	8.10	7.7	8.4	30.5	32.0
2.0	15.4	16.0	8.01	8.07	7.8	8.4	30.5	32.0

(a) NA Not applicable.

APPENDIX E

BIOASSAY RESULTS FOR 10-DAY SOLID-PHASE TEST WITH
MACOMA nasuta AND *NEPHTYS caecoides*

TABLE E.1. Test Results for 10-Day *M. nasuta* Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>M. nasuta</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
		Live ^(a)	Dead or Missing			
COMP IC1-A	1	20	0	1.00	0.99	0.02
COMP IC1-A	2	19	1	0.95		
COMP IC1-A	3	20	0	1.00		
COMP IC1-A	4	20	0	1.00		
COMP IC1-A	5	21 ^(b)	0	1.00		
COMP IC1-B	1	19	1	0.95	0.99	0.02
COMP IC1-B	2	20	0	1.00		
COMP IC1-B	3	20	0	1.00		
COMP IC1-B	4	20	0	1.00		
COMP IC1-B	5	20	0	1.00		
COMP IC1-B Special	1	20	0	1.00	0.97	0.03
COMP IC1-B Special	2	20	0	1.00		
COMP IC1-B Special	3	19	1	0.95		
COMP IC1-B Special	4	19	1	0.95		
COMP IC1-B Special	5	19	1	0.95		
COMP IC1-C	1	20	0	1.00	1.00	0.00
COMP IC1-C	2	20	0	1.00		
COMP IC1-C	3	20	0	1.00		
COMP IC1-C	4	20	0	1.00		
COMP IC1-C	5	20	0	1.00		
COMP OC4-B	1	20	0	1.00	0.99	0.02
COMP OC4-B	2	20	0	1.00		
COMP OC4-B	3	20	0	1.00		
COMP OC4-B	4	20	0	1.00		
COMP OC4-B	5	19	1	0.95		
R-AM	1	20	0	1.00	0.96	0.04
R-AM	2	19	1	0.95		
R-AM	3	18	2	0.90		
R-AM	4	20	0	1.00		
R-AM	5	19	1	0.95		
R-BF	1	20	0	1.00	0.99	0.02
R-BF	2	20	0	1.00		
R-BF	3	20	0	1.00		
R-BF	4	20	0	1.00		
R-BF	5	19	1	0.95		
R-OS	1	19	1	0.95	0.98	0.03
R-OS	2	20	0	1.00		
R-OS	3	20	0	1.00		
R-OS	4	NI ^(c)	NI	NI		
R-OS	5	NI	NI	NI		
C-NE	1	20	0	1.00	0.99	0.02
C-NE	2	20	0	1.00		
C-NE	3	19	1	0.95		
C-NE	4	20	0	1.00		
C-NE	5	20	0	1.00		

TABLE E.1. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>M. nasuta</u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
		<u>Live (a)</u>	<u>Dead or Missing</u>			
C-SB	1	20	0	1.00		
C-SB	2	20	0	1.00		
C-SB	3	20	0	1.00		
C-SB	4	20	0	1.00		
C-SB	5	20	0	1.00	1.00	0.00

(a) Survival based on initial exposure of 20 organisms per replicate.

(b) 21 organisms initiated.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE E.2. Rank Order Based on Mean Proportion Surviving for 10-Day
M. nasuta Solid-Phase Test, Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
R-AM	0.96
COMP IC1-B Special	0.97
R-OS	0.98
COMP IC1-A	0.99
R-BF	0.99
COMP IC1-B	0.99
C-NE	0.99
COMP OC4-B	0.99
COMP IC1-C	1.00
C-SB	1.00

TABLE E.3. Daily Observations of *M. nasuta* on Sediment Surface During 10-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>M. nasuta</i> on Sediment Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	1	1	1	1	0	0	0	0	0	0
COMP IC1-A	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	2	0	0	1	0	0	0	0	0	1
COMP IC1-A	4	4	2	2	2	3	2	3	1	0	0
COMP IC1-A	5	T ^(b)	0	T	0	0	0	0	1	0	0
COMP IC1-B	1	12	7	7	4	2	1	1	1	0	1
COMP IC1-B	2	13	12	9	7	6	5	6	4	3	3
COMP IC1-B	3	15	13	10	9	6	7	6	5	5	4
COMP IC1-B	4	12	7	4	3	1	1	0	0	0	0
COMP IC1-B	5	11	9	8	4	4	1	1	2	1	1
COMP IC1-B Special	1	11	6	5	4	4	4	4	4	3	3
COMP IC1-B Special	2	10	7	3	2	2	1	2	2	2	2
COMP IC1-B Special	3	15	9	6	5	5	5	4	3	2	2
COMP IC1-B Special	4	13	11	8	7	7	6	6	6	5	5
COMP IC1-B Special	5	14	10	9	8	7	7	7	6	6	5
COMP IC1-C	1	5	3	3	3	2	2	2	2	2	2
COMP IC1-C	2	3	2	1	1	0	1	0	0	0	0
COMP IC1-C	3	8	5	3	3	2	2	1	1	1	1
COMP IC1-C	4	3	2	2	1	1	0	1	1	1	1
COMP IC1-C	5	6	2	1	2	3	2	2	1	1	1
COMP OC4-B	1	9	7	1	1	1	0	1	T	0	0
COMP OC4-B	2	6	1	1	0	0	0	0	0	0	0
COMP OC4-B	3	2	0	0	0	0	0	0	0	0	0
COMP OC4-B	4	5	2	2	0	0	1	1	1	1	1
COMP OC4-B	5	7	4	4	3	3	2	1	1	0	1
R-AM	1	8	8	3	4	6	3	6	3	3	4
R-AM	2	1	0	0	1	0	1	1	0	1	1
R-AM	3	5	2	1	1	3	2	2	1	1	1
R-AM	4	3	0	1	0	2	2	2	1	1	2
R-AM	5	12	7	2	0	7	0	7	1	3	6
R-BF	1	4	2	2	0	0	1	1	0	0	1
R-BF	2	9	4	3	2	0	0	0	2	0	1
R-BF	3	6	1	0	0	0	0	0	0	0	0
R-BF	4	6	0	0	0	0	0	0	0	0	0
R-BF	5	7	4	4	4	4	2	2	1	0	0

TABLE E.3. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> on Sediment Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	7	5	4	4	2	0	0	0	0	0
R-OS	2	1	0	0	0	0	0	0	0	0	0
R-OS	3	3	2	0	0	0	0	1	1	0	0
R-OS	4	NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI	NI
R-OS	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	1	0	1	1	1	1	0	0	2	2
C-NE	2	5	4	4	3	5	4	4	2	3	3
C-NE	3	9	6	6	7	8	7	6	7	5	6
C-NE	4	5	5	6	5	4	3	3	2	2	3
C-NE	5	1	1	2	1	0	0	0	1	1	0
C-SB	1	2	0	0	0	0	0	0	0	0	0
C-SB	2	2	1	0	1	0	1	1	0	0	0
C-SB	3	2	0	0	0	0	0	0	1	0	0
C-SB	4	1	0	0	0	0	0	0	0	0	0
C-SB	5	1	0	0	0	0	0	0	0	2	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) T Too turbid.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE E.4. Daily Observation of *M. nasuta* Siphons Exposed During 10-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>M. nasuta</i> Siphons Exposed Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	4	4	4	2	2	5	3	4	1	3
COMP IC1-A	2	T ^(b)	3	1	1	0	4	0	0	1	0
COMP IC1-A	3	3	8	3	7	3	2	3	1	1	1
COMP IC1-A	4	11	6	8	4	6	5	2	4	2	6
COMP IC1-A	5	T	4	T	2	0	1	0	0	0	1
COMP IC1-B	1	19	18	10	6	12	3	6	2	5	3
COMP IC1-B	2	27	18	19	14	10	10	11	5	9	7
COMP IC1-B	3	25	25	16	10	16	13	18	9	11	11
COMP IC1-B	4	24	14	14	12	11	9	5	5	7	6
COMP IC1-B	5	15	14	15	9	9	8	8	6	5	3
COMP IC1-B Special	1	17	16	17	10	10	9	5	3	4	6
COMP IC1-B Special	2	23	21	20	7	9	4	4	4	3	4
COMP IC1-B Special	3	26	25	16	6	10	8	15	11	4	4
COMP IC1-B Special	4	24	17	12	9	9	7	5	11	9	5
COMP IC1-B Special	5	27	28	25	19	18	15	18	17	13	11
COMP IC1-C	1	11	6	2	5	5	6	5	3	5	5
COMP IC1-C	2	15	21	12	5	2	5	4	0	0	1
COMP IC1-C	3	14	9	14	7	11	6	9	3	6	0
COMP IC1-C	4	15	5	9	9	5	6	4	3	4	5
COMP IC1-C	5	14	8	7	4	5	4	3	0	2	2
COMP OC4-B	1	13	12	7	4	4	1	1	T	0	2
COMP OC4-B	2	17	8	9	2	2	6	0	3	0	0
COMP OC4-B	3	9	6	10	3	2	2	2	1	1	1
COMP OC4-B	4	12	6	5	6	4	7	7	1	7	3
COMP OC4-B	5	17	12	12	12	9	8	10	7	0	5
R-AM	1	5	9	8	9	6	9	8	10	10	9
R-AM	2	0	2	2	2	1	3	6	3	2	1
R-AM	3	5	4	5	5	5	4	3	2	3	2
R-AM	4	5	4	5	3	7	8	11	8	6	9
R-AM	5	9	7	7	10	11	10	13	5	8	9
R-BF	1	11	9	11	3	7	7	5	3	3	3
R-BF	2	10	8	4	1	1	3	3	0	1	2
R-BF	3	5	4	9	0	0	2	0	0	0	0
R-BF	4	7	7	3	2	2	3	1	0	2	0
R-BF	5	13	12	9	10	7	9	5	0	1	2

TABLE E.4. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> Siphons Exposed Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	11	10	5	7	8	4	3	0	2	1
R-OS	2	5	6	1	0	1	1	3	0	0	0
R-OS	3	9	6	4	3	0	1	1	0	0	0
R-OS	4	NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI	NI
R-OS	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	10	3	1	2	2	0	0	0	0	2
C-NE	2	8	3	9	4	7	4	4	3	5	7
C-NE	3	7	9	9	10	13	8	7	7	8	6
C-NE	4	6	6	9	6	10	7	4	4	11	8
C-NE	5	2	3	2	0	2	4	1	0	0	2
C-SB	1	8	1	9	2	2	6	1	2	1	1
C-SB	2	9	6	7	4	5	4	2	0	0	0
C-SB	3	8	4	4	2	1	0	0	0	0	0
C-SB	4	8	2	5	0	1	3	1	0	1	0
C-SB	5	4	3	5	3	3	4	1	1	5	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) T Too turbid.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE E.5. Daily Observation of *M. nasuta* Dead and Removed During 10-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>M. nasuta</i> Dead and Removed Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	4	0	0	0	0	1	0	0	0	0	0
COMP IC1-B Special	5	0	0	0	0	0	0	1	0	0	0
COMP IC1-C	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	5	0	0	0	0	0	0	0	2	0	0
COMP OC4-B	1	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	2	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	3	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	4	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	5	0	0	0	0	0	0	0	0	0	0
R-AM	1	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	1
R-AM	3	0	0	0	0	0	0	1	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	1	0	0

TABLE E.5. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> Dead and Removed Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	0	0	0	0	1	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	NI ^(b)	NI	NI	NI	NI	NI	NI	NI	NI	NI
R-OS	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	0	0	1	0	0	0	0	0
C-NE	4	0	0	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE E.6. Water Quality Summary for 10-Day *M. nasuta*/*N. caecoides* Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Flow rate (mL/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0	115	135
COMP IC1-A	15.3	17.7 ^(b)	7.83	8.26	7.0	8.9	30.0	31.0	116	134
COMP IC1-B	15.2	16.9	7.83	8.23	7.1	8.7	30.0	31.0	116	132
COMP IC1-B Special	15.3	16.9	7.84	8.23	7.3	8.7	30.0	30.5	116	132
COMP IC1-C	15.2	17.4 ^(b)	7.85	8.25	6.7	8.8	30.0	30.5	116	133
COMP OC4-B	15.2	17.0	7.82	8.17	7.2	8.6	30.0	31.0	116	132
R-AM	15.3	17.4 ^(b)	7.84	8.24	7.1	8.8	30.0	31.0	116	132
R-BF	15.1	17.3 ^(b)	7.81	8.21	7.0	8.6	30.0	31.0	116	132
R-OS	15.3	16.7	7.94	8.26	7.5	8.6	30.0	31.0	120	133
C-NE	15.3	17.0	7.83	8.25	7.1	8.7	30.0	32.0	116	132
C-SB	15.3	17.4 ^(b)	7.82	8.25	6.8	8.8	30.0	31.0	116	132

(a) NA Not applicable.

(b) Data point out of range.

TABLE E.7. Test Results for 10-Day *N. caecoides* Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>N. caecoides</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
		Live ^(a)	Dead or Missing			
COMP IC1-A	1	20	0	1.00	0.94	0.07
COMP IC1-A	2	19	1	0.95		
COMP IC1-A	3	18	2	0.90		
COMP IC1-A	4	17	3	0.85		
COMP IC1-A	5	20	0	1.00		
COMP IC1-B	1	17	3	0.85	0.85	0.04
COMP IC1-B	2	16	4	0.80		
COMP IC1-B	3	17	3	0.85		
COMP IC1-B	4	18	2	0.90		
COMP IC1-B	5	17	3	0.85		
COMP IC1-B Special	1	19	1	0.95	0.81	0.10
COMP IC1-B Special	2	14	6	0.70		
COMP IC1-B Special	3	15	5	0.75		
COMP IC1-B Special	4	16	4	0.80		
COMP IC1-B Special	5	17	3	0.85		
COMP IC1-C	1	15	5	0.75	0.88	0.10
COMP IC1-C	2	16	4	0.80		
COMP IC1-C	3	18	2	0.90		
COMP IC1-C	4	19	1	0.95		
COMP IC1-C	5	20	0	1.00		
COMP OC4-B	1	19	1	0.95	0.91	0.07
COMP OC4-B	2	20	0	1.00		
COMP OC4-B	3	17	3	0.85		
COMP OC4-B	4	17	3	0.85		
COMP OC4-B	5	18	2	0.90		
R-AM	1	17	3	0.85	0.92	0.06
R-AM	2	18	2	0.90		
R-AM	3	20	0	1.00		
R-AM	4	19	1	0.95		
R-AM	5	18	2	0.90		
R-BF	1	17	3	0.85	0.85	0.00
R-BF	2	17	3	0.85		
R-BF	3	17	3	0.85		
R-BF	4	17	3	0.85		
R-BF	5	17	3	0.85		
R-OS	1	20	0	1.00	0.97	0.03
R-OS	2	19	1	0.95		
R-OS	3	19	1	0.95		
R-OS	4	NI ^(b)	NI	NI		
R-OS	5	NI	NI	NI		
C-NE	1	20	0	1.00	0.97	0.07
C-NE	2	20	0	1.00		
C-NE	3	17	3	0.85		
C-NE	4	20	0	1.00		
C-NE	5	20	0	1.00		

TABLE E.7. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>N. caecoides</i></u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
		<u>Live (a)</u>	<u>Dead or Missing</u>			
C-SB	1	19	1	0.95		
C-SB	2	19	1	0.95		
C-SB	3	20	0	1.00		
C-SB	4	20	0	1.00		
C-SB	5	19	1	0.95	0.97	0.03

(a) Survival based on initial exposure of 20 organisms per replicate.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE E.8. Rank Order Based on Mean Proportion Surviving 10-Day
N. caecoides Solid-Phase Test, Oakland Harbor
 Intensive Study

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP IC1-B Special	0.81
R-BF	0.85
COMP IC1-B	0.85
COMP IC1-C	0.88
COMP OC4-B	0.91
R-AM	0.92
COMP IC1-A	0.94
R-OS	0.97
C-NE	0.97
C-SB	0.97

TABLE E.9. Daily Observations of *N. caecoides* on Sediment Surface During 10-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>N. caecoides</i> on Sediment Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	1	0	0	0	0	0	0	0	0	0
COMP IC1-A	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	1	0	1	0	0	0	0	0	0	0
COMP IC1-A	4	0	0	0	1	0	0	0	0	0	0
COMP IC1-A	5	T ^(b)	0	T	0	0	0	0	0	0	0
COMP IC1-B	1	1	0	0	0	0	0	0	1	1	1
COMP IC1-B	2	0	1	1	0	0	0	0	0	0	0
COMP IC1-B	3	1	0	0	0	0	0	0	0	0	0
COMP IC1-B	4	1	0	0	1	0	0	0	0	0	0
COMP IC1-B	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	2	0	0	0	0	0	0	0	1	0	0
COMP IC1-B Special	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	1	0	0	0	0	0	0	2	0	0	0
COMP IC1-C	2	0	0	0	0	0	1	0	0	0	0
COMP IC1-C	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	5	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	1	1	1	0	1	0	0	0	T	0	0
COMP OC4-B	2	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	3	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	4	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	5	0	0	0	0	0	0	0	0	0	0
R-AM	1	0	0	0	1	0	0	0	1	1	0
R-AM	2	1	0	1	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	0	0

TABLE E.9. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i> on Sediment Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0
R-OS	3	0 ^(c)	0	0	0	0	0	0	0	0	0
R-OS	4	NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI	NI
R-OS	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	1	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) T Too turbid.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE E.10. Daily Observations of *N. caecoides* Dead and Removed During 10-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>N. caecoides</i> Dead and Removed Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
COMP IC1-A	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	0	0	0	1	0	0	0	0	0	0
COMP IC1-A	4	0	0	0	1	0	0	0	0	0	0
COMP IC1-A	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	1	0	0	0	0	0	0	0	0	0	3
COMP IC1-B	2	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	4	0	0	0	1	0	0	0	0	0	0
COMP IC1-B	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	1	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	2	0	0	0	0	0	0	0	0	1	0
COMP IC1-B Special	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	5	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	1	0	0	0	1	0	0	1	1	0	0
COMP IC1-C	2	0	0	0	1	0	1	0	0	0	0
COMP IC1-C	3	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	4	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	5	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	1	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	2	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	3	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	4	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	5	0	0	0	0	0	0	1	0	0	0
R-AM	1	0	0	0	1	0	0	0	0	1	0
R-AM	2	0	0	1	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	1	0	0	0
R-AM	5	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	0	0

TABLE E.10. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i> Dead and Removed Test Days 0 through 9									
		0 ^(a)	1	2	3	4	5	6	7	8	9
R-OS	1	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	1	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0
R-OS	4	NI ^(b)	NI	NI	NI	NI	NI	NI	NI	NI	NI
R-OS	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	1	2	0	0	0	0	0	0
C-NE	4	0	0	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	1	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) NI No information; insufficient sediment to test all five replicates.

APPENDIX F

BIOASSAY RESULTS FOR 28-DAY SOLID-PHASE TEST WITH
MACOMA nasuta AND *NEPHTYS caecoides*

TABLE F.1. Test Results for 28-Day *M. nasuta* Solid-Phase Test,
Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>M. nasuta</i></u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
		<u>Live (a)</u>	<u>Dead or Missing</u>			
COMP IC1-A	1	21	4	0.84	0.90	0.07
COMP IC1-A	2	21	4	0.84		
COMP IC1-A	3	24	1	0.96		
COMP IC1-A	4	22	3	0.88		
COMP IC1-A	5	25	0	1.00		
COMP IC1-B	1	25	0	1.00	0.93	0.08
COMP IC1-B	2	21	4	0.84		
COMP IC1-B	3	21	4	0.84		
COMP IC1-B	4	25	0	1.00		
COMP IC1-B	5	24	1	0.96		
COMP IC1-B Special	1	24	1	0.96	0.95	0.02
COMP IC1-B Special	2	24	1	0.96		
COMP IC1-B Special	3	24	1	0.96		
COMP IC1-B Special	4	23	2	0.92		
COMP IC1-B Special	5	24	1	0.96		
COMP IC1-C	1	24	1	0.96	0.94	0.04
COMP IC1-C	2	24	1	0.96		
COMP IC1-C	3	22	3	0.88		
COMP IC1-C	4	24	1	0.96		
COMP IC1-C	5	23	2	0.92		
COMP OC4-B	1	22	3	0.88	0.94	0.05
COMP OC4-B	2	24	1	0.96		
COMP OC4-B	3	22	3	0.88		
COMP OC4-B	4	24	1	0.96		
COMP OC4-B	5	25	0	1.00		
R-AM	1	24	1	0.96	0.94	0.04
R-AM	2	24	1	0.96		
R-AM	3	24	1	0.96		
R-AM	4	22	3	0.88		
R-AM	5	23	2	0.92		
R-BF	1	25	0	1.00	0.94	0.06
R-BF	2	24	1	0.96		
R-BF	3	23	2	0.92		
R-BF	4	21	4	0.84		
R-BF	5	24	1	0.96		
R-OS	1	16	9	0.64	0.83	0.14
R-OS	2	24	1	0.96		
R-OS	3	20	5	0.80		
R-OS	4	23	2	0.92		
R-OS	5	NI ^(b)	NI	NI		
C-NE	1	25	0	1.00	0.94	0.07
C-NE	2	23	2	0.92		
C-NE	3	24	1	0.96		
C-NE	4	21	4	0.84		
C-NE	5	25	0	1.00		

TABLE F.1. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>M. nasuta</u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
		<u>Live (a)</u>	<u>Dead or Missing</u>			
C-SB	1	22	3	0.88		
C-SB	2	22	3	0.88		
C-SB	3	22	3	0.88		
C-SB	4	25	0	1.00		
C-SB	5	25	0	1.00	0.93	0.07

(a) Survival based on initial exposure of 25 organisms per replicate.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE F.2. Rank Order Based on Mean Proportion Surviving 28-Day
M. nasuta Solid-Phase Test, Oakland Harbor
 Intensive Study

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
R-OS	0.83
COMP IC1-A	0.90
COMP IC1-B	0.93
C-SB	0.93
R-AM	0.94
COMP IC1-C	0.94
R-BF	0.94
COMP OC4-B	0.94
C-NE	0.94
COMP IC1-B Special	0.95

TABLE F.3. Daily Observation for *M. nasuta* on Sediment Surface During 28-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment		Replicate	<i>M. nasuta</i> on Sediment Test Days 0 through 27																											
			0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
COMP	IC1-A	1	8	1	3	2	0	5	2	2 ^(b)	3	0	0	0	4	4	0	0	2	3	1	0	1	2	2	1	0	0	1	0
COMP	IC1-A	2	1	0	0	0	1	1	0	1	1	1	2	2	3	1	1	1	2	0	0	0	1	1	1	1	0	0	0	0
COMP	IC1-A	3	T	0	1	0	0	0	0	0	1	0	0	0	3	1	0	0	0	0	1	0	0	0	0	0	1	0	1	0
COMP	IC1-A	4	1	2	2	2	2	3	3	1	2	1	1	0	0	2	0	1	1	1	1	1	1	1	1	0	0	0	0	0
COMP	IC1-A	5	T	0	0	1	0	0	0	0	1	0	1	0	1	2	1	1	T	0	2	2	1	1	1	1	1	0	0	1
COMP	IC1-B	1	14	7	4	3	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	IC1-B	2	19	17	15	13	13	13	9	7	6	8	8	8	8	10	8	6	7	7	5	6	5	5	5	5	5	4	3	2
COMP	IC1-B	3	12	6	2	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	IC1-B	4	4	3	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	IC1-B	5	13	4	2	2	2	2	1	0	0	1	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	IC1-B Special	1	9	7	7	6	3	3	0	2	1	0	1	0	2	3	0	1	0	1	1	1	1	1	0	0	0	0	0	0
COMP	IC1-B Special	2	9	7	5	4	4	3	3	2	2	2	2	3	3	3	3	0	1	0	2	2	2	2	1	1	0	0	0	0
COMP	IC1-B Special	3	13	7	T	6	6	7	2	1	0	2	2	3	2	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0
COMP	IC1-B Special	4	6	0	1	1	1	3	1	0	0	0	0	0	1	2	0	0	0	1	1	1	1	1	1	1	1	0	0	0
COMP	IC1-B Special	5	14	4	1	2	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	IC1-C	1	4	3	3	3	2	1	0	1	1	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
COMP	IC1-C	2	2	0	0	0	0	0	0	6	0	5	0	7	0	0	0	0	7	0	0	0	1	0	0	0	0	0	0	0
COMP	IC1-C	3	9	6	6	3	1	2	2	1	0	1	0	1	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
COMP	IC1-C	4	3	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
COMP	IC1-C	5	7	2	1	1	0	0	1	0	0	0	0	0	1	2	0	0	0	0	2	2	0	0	0	0	0	0	0	1
COMP	OC4-B	1	9	10	9	7	4	5	4	2	1	0	0	0	1	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0
COMP	OC4-B	2	7	3	2	1	1	1	1	1	1	0	0	0	1	3	0	0	1	0	2	2	0	0	0	0	0	0	1	0
COMP	OC4-B	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	OC4-B	4	2	2	1	0	0	0	0	6	0	T	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP	OC4-B	5	2	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM		1	1	3	4	3	3	3	3	5	5	5	4	7	8	12	8	6	5	4	11	11	9	5	4	6	8	7	8	10
R-AM		2	2	1	2	4	2	5	4	0	6	0	9	0	9	9	5	5	0	8	10	10	11	10	9	6	5	6	7	6
R-AM		3	5	1	0	2	0	2	2	1	0	0	1	1	4	4	2	2	2	1	5	5	2	2	4	5	3	3	1	3
R-AM		4	0	0	0	1	0	1	1	2	2	1	2	2	2	6	4	2	4	3	5	5	5	6	5	5	4	5	6	6
R-AM		5	2	0	1	6	5	5	7	6	4	8	9	8	11	9	4	8	5	6	8	8	7	5	5	6	8	6	8	5
R-BF		1	5	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF		2	7	3	1	0	0	1	0	0	0	0	0	0	0	1	T	0	0	0	T	T	0	T	0	T	0	0	0	0
R-BF		3	1	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF		4	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
R-BF		5	2	0	0	0	0	0	T	1	T	T	0	T	0	T	T	0	0	T	T	T	T	0	T	T	0	0	T	0

TABLE F.3. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> on Sediment Test Days 0 through 27																											
		0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
R-OS	1	9	3	1	1	4	2	0	1	1	0	0	2	0	1	0	0	0	0	1	0	2	2	1	0	1	0	1	1
R-OS	2	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	7	0	0	0 ^(c)	0	1	0	1	0	1	0	0	0	1	1	0	1	2	1	0	0	0	0	0	0	0	2	2
R-OS	4	1	1	0	ND ^(c)	0	0	ND	0	0	ND	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0
R-OS	5	NI ^(d)	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	2	1	1	2	1	1	1	2	1	1	4	4	1	2	1	1	2	2	2	2	1	1	1	1	0	0
C-NE	2	0	1	2	5	1	3	4	7	7	5	4	5	9	9	6	2	2	1	4	4	4	4	3	1	4	3	5	5
C-NE	3	7	7	4	5	6	1	4	7	6	4	4	2	5	5	4	1	2	2	5	5	4	5	2	3	2	2	2	3
C-NE	4	5	5	3	4	5	5	5	7	6	6	5	11	7	7	6	6	5	5	6	5	5	4	6	6	6	6	8	8
C-NE	5	1	0	1	1	3	4	3	1	1	1	3	0	2	2	1	1	2	2	5	5	2	2	3	3	4	6	5	4
C-SB	1	0	0	0	0	0	0	0	3	0	3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
C-SB	3	3	0	0	0	0	1	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

- (a) On Test Day 0 observations were performed 2 h after test initiation.
 (b) T Too turbid.
 (c) ND No data.
 (d) NI No information; insufficient sediment to test all five replicates.

TABLE F.4. Daily Observation for *M. nasuta* Siphons Exposed During 28-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment		<i>M. nasuta</i> Siphons Exposed Test Days 0 through 27																											
Treatment	Replicate	0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
COMP IC1-A	1	13 ^(b)	16	11	7	11	12	7	7	11	6	6	4	11	7	7	6	5	1	0	4	4	1	1	3	2	1	2	3
COMP IC1-A	2	T	4	1	6	4	T	4	T	2	3	4	1	2	3	2	2	3	0	0	2	0	4	4	5	1	3	2	4
COMP IC1-A	3	T	0	2	5	1	2	2	0	2	1	0	1	2	0	1	0	0	0	0	2	2	0	1	1	0	1	1	0
COMP IC1-A	4	T	7	9	5	5	6	4	5	4	1	3	3	3	4	2	1	3	1	3	2	3	0	1	0	0	0	0	0
COMP IC1-A	5	T	5	7	8	1	0	3	0	5	2	4	0	0	3	3	4	T	1	6	4	4	4	0	2	2	1	0	10
COMP IC1-B	1	24	13	10	7	4	8	6	0	1	8	0	7	0	0	1	0	2	0	3	3	0	0	0	0	1	0	0	0
COMP IC1-B	2	36	31	21	20	15	13	16	9	11	15	10	13	18	19	12	10	9	10	6	4	7	7	7	6	5	4	4	4
COMP IC1-B	3	23	17	17	13	9	9	5	1	0	1	2	1	1	2	0	0	0	1	4	6	3	2	2	1	0	0	0	0
COMP IC1-B	4	19	11	7	4	6	4	2	8	2	0	3	1	2	3	2	0	0	0	2	4	0	2	0	0	0	1	0	0
COMP IC1-B	5	19	21	15	14	12	12	12	3	8	6	4	4	5	3	6	6	1	2	2	0	3	2	0	0	1	0	3	0
COMP IC1-B Special	1	19	16	15	17	11	6	3	6	6	7	3	2	6	2	4	3	2	4	4	7	3	1	3	2	0	2	4	0
COMP IC1-B Special	2	26	18	16	12	4	6	3	8	5	5	5	2	9	1	4	1	3	4	0	2	2	0	0	2	2	3	2	4
COMP IC1-B Special	3	11	12	T	13	11	7	3	5	3	3	0	2	6	2	1	0	0	0	3	5	3	4	1	0	1	1	1	2
COMP IC1-B Special	4	14	12	9	7	11	5	10	3	2	0	2	2	4	4	5	3	4	3	2	4	5	1	2	0	0	1	0	0
COMP IC1-B Special	5	15	12	2	2	2	1	1	2	1	4	1	2	2	1	2	0	0	0	0	0	3	5	1	1	1	2	1	1
COMP IC1-C	1	5	7	4	6	4	2	2	2	2	0	4	0	2	2	3	2	2	0	0	0	2	1	0	0	1	0	1	0
COMP IC1-C	2	3	5	4	3	3	2	0	7	0	14	0	8	0	1	1	0	13	2	3	0	0	0	0	0	0	0	0	0
COMP IC1-C	3	19	13	15	6	6	5	6	5	2	3	4	1	4	3	5	4	8	0	2	2	4	3	1	0	1	3	3	2
COMP IC1-C	4	7	7	6	2	0	1	1	0	1	0	1	0	0	0	1	0	0	1	0	2	3	2	0	0	0	0	0	3
COMP IC1-C	5	19	10	4	0	1	3	1	1	0	1	0	0	0	0	1	0	1	1	0	1	3	0	1	2	2	2	2	2
COMP OC4-B	1	17	21	17	12	11	11	8	4	4	1	6	5	10	10	4	3	2	0	2	4	0	0	0	1	1	0	1	4
COMP OC4-B	2	17	8	12	6	3	7	3	2	1	3	0	0	0	0	3	2	1	2	0	0	5	4	2	2	1	2	0	2
COMP OC4-B	3	13	6	10	5	6	2	7	0	3	2	1	1	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0
COMP OC4-B	4	7	9	9	2	1	0	5	8	3	T	4	2	2	0	2	0	1	0	4	4	3	3	1	0	0	0	0	0
COMP OC4-B	5	6	4	4	0	1	0	T	1	3	1	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	1	0
R-AM	1	9	8	7	6	5	4	5	8	8	10	9	9	12	7	7	9	6	8	10	5	12	12	4	5	9	4	11	12
R-AM	2	7	4	8	3	9	10	12	3	10	3	10	2	14	12	9	11	0	11	14	8	10	14	8	6	4	8	6	9
R-AM	3	15	6	3	2	6	4	6	2	1	0	2	3	7	7	4	3	3	3	3	4	4	5	3	4	4	3	3	3
R-AM	4	0	1	0	2	0	1	2	2	4	2	4	2	4	5	3	3	5	3	6	8	11	4	5	1	1	5	8	6
R-AM	5	8	4	4	7	5	7	7	5	9	8	8	6	14	11	7	9	8	11	11	7	10	7	12	13	12	8	9	7
R-BF	1	8	4	2	3	5	1	0	1	1	2	2	0	0	0	0	0	1	0	4	3	0	0	1	1	1	0	0	0
R-BF	2	16	11	7	10	3	4	0	1	0	2	0	1	1	2	T	0	3	2	T	T	2	T	0	T	0	0	3	0
R-BF	3	7	5	2	2	1	1	2	T	0	0	0	0	0	0	0	0	1	0	0	0	3	2	0	1	2	1	1	0
R-BF	4	7	8	3	3	2	1	0	0	0	0	0	1	0	1	2	1	3	2	8	6	5	0	0	0	0	0	1	0
R-BF	5	5	4	3	0	0	0	T	11	T	T	0	T	T	T	T	1	0	T	T	T	T	3	T	T	0	0	T	0

TABLE F.4. (contd)

		<i>M. nasuta</i> Siphons Exposed Test Days 0 through 27																											
Sediment Treatment	Replicate	0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
R-OS	1	23	13	16	12	8	8	7	3	3	3	4	3	3	5	5	4	2	2	4	3	4	3	2	1	4	1	3	4
	2	T	9	7	4	6	0 ^(c)	6	4	1	0	2	0	3	5	2	1	0	5	2	0	0	3	2	3	0	0	2	0
	3	T	8	8	2	3	ND ^(c)	7	7	1	3	0	2	1	2	4	3	2	2	3	2	4	4	4	7	7	4	4	4
	4	12 ^(d)	9	8	ND	2	0	ND	4	3	ND	1	0	3	2	3	1	3	1	2	2	0	1	0	2	0	2	0	1
	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	5	0	0	3	2	5	3	0	5	4	3	1	7	0	3	1	0	1	0	2	4	4	0	0	0	0	0	0
	2	17	4	6	3	2	12	4	6	6	6	7	2	12	3	4	3	2	3	6	6	6	9	4	2	6	3	7	2
	3	5	6	5	5	5	2	4	5	4	2	2	5	5	4	5	3	4	4	3	4	6	4	3	0	4	3	4	2
	4	19	8	10	9	11	8	5	8	11	6	8	13	17	10	8	7	9	11	4	6	7	6	5	11	10	10	9	9
	5	7	0	5	1	6	6	5	7	3	6	0	3	2	4	3	3	4	5	7	6	6	2	3	2	2	6	1	2
C-SB	1	2	0	2	1	1	1	1	5	0	5	0	2	0	0	1	1	0	0	2	4	2	3	0	0	1	2	0	1
	2	8	1	0	1	0	3	0	0	0	2	0	0	1	0	0	0	1	4	4	5	4	1	1	1	0	0	1	3
	3	6	3	6	4	3	2	1	1	0	2	1	0	1	0	0	1	1	0	0	0	0	3	1	0	0	1	0	1
	4	10	3	3	1	1	1	1	0	0	0	0	0	1	2	0	0	1	2	2	5	0	0	0	2	1	0	0	0
	5	3	5	6	2	1	1	1	1	0	2	0	1	0	2	0	0	0	0	0	0	4	2	0	2	1	1	0	1

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) T Too turbid.

(c) ND No data.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE F.5. Daily Observations for *M. nasuta* Dead and Removed During 28-Day Solid-Phase Test, Oakland Harbor Intensive Study

[illegible]

TABLE F.5. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> Dead and Removed Test Days 0 through 27																											
		0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
R-OS	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1
R-OS	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
R-OS	4	0 ^(c)	0	0	0	0	ND	0	0	0	ND	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
R-OS	5	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C-NE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
C-NE	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
C-SB	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
C-SB	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) ND No data.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE F.6. Water Quality Summary for 28-Day *M. nasuta*/*N. caecoides*
Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Flow rate (mL/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0	115	135
COMP IC1-A	14.9	16.8	7.81	8.22	7.0	8.6	30.0	31.0	116	134
COMP IC1-B	15.0	16.8	7.82	8.22	6.9	8.5	30.0	31.0	116	134
COMP IC1-B Special	15.0	16.9	7.83	8.23	7.1	8.5	30.0	31.0	116	134
COMP IC1-C	15.0	16.9	7.81	8.23	7.0	8.7	30.0	31.5	116	134
COMP OC4-B	15.1	16.9	7.81	8.19	7.0	8.6	30.0	31.0	116	134
R-AM	15.0	16.8	7.82	8.22	7.1	8.6	30.0	31.0	116	134
R-BF	15.3	16.8	7.78	8.19	7.0	8.5	30.0	31.0	116	134
R-OS	15.3	17.6 ^(b)	7.81	8.23	7.0	8.6	30.0	31.5	116	132
C-NE	15.0	16.9	7.84	8.21	7.0	8.9	30.0	31.5	116	134
C-SB	15.1	16.9	7.79	8.21	6.8	8.7	30.0	31.0	116	134

(a) NA Not applicable.

(b) Data point out of range.

TABLE F.7. Test Results for 28-Day *N. caecoides* Solid-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	<i>N. caecoides</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
		Live ^(a)	Dead or Missing			
COMP IC1-A	1	49	6	0.89	0.93	0.07
COMP IC1-A	2	52	3	0.95		
COMP IC1-A	3	54	1	0.98		
COMP IC1-A	4	46	9	0.84		
COMP IC1-A	5	56 ^(b)	0	1.00		
COMP IC1-B	1	49	6	0.89	0.84	0.09
COMP IC1-B	2	42	13	0.76		
COMP IC1-B	3	48	7	0.87		
COMP IC1-B	4	40	15	0.73		
COMP IC1-B	5	51	4	0.93		
COMP IC1-B Special	1	44	11	0.80	0.87	0.05
COMP IC1-B Special	2	51	4	0.93		
COMP IC1-B Special	3	46	9	0.84		
COMP IC1-B Special	4	49	6	0.89		
COMP IC1-B Special	5	48	7	0.87		
COMP IC1-C	1	48	7	0.87	0.81	0.12
COMP IC1-C	2	46	9	0.84		
COMP IC1-C	3	47	8	0.85		
COMP IC1-C	4	49	6	0.89		
COMP IC1-C	5	33	22	0.60		
COMP OC4-B	1	51	4	0.93	0.89	0.04
COMP OC4-B	2	47	8	0.85		
COMP OC4-B	3	51	4	0.93		
COMP OC4-B	4	49	6	0.89		
COMP OC4-B	5	47	8	0.85		
R-AM	1	52	3	0.95	0.91	0.10
R-AM	2	48	7	0.87		
R-AM	3	41	14	0.75		
R-AM	4	53	2	0.96		
R-AM	5	55	0	1.00		
R-BF	1	49	6	0.89	0.87	0.05
R-BF	2	45	10	0.82		
R-BF	3	45	10	0.82		
R-BF	4	52	3	0.95		
R-BF	5	49	6	0.89		
R-OS	1	49	6	0.89	0.94	0.03
R-OS	2	53	2	0.96		
R-OS	3	53	2	0.96		
R-OS	4	52	3	0.95		
R-OS	5	NI ^(c)	NI	NI		
C-NE	1	53	2	0.96	0.93	0.08
C-NE	2	44	11	0.80		
C-NE	3	69 ^(b)	0	1.00		
C-NE	4	51	4	0.93		
C-NE	5	54	1	0.98		

TABLE F.7. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>N. caecoides</i></u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
		<u>Live</u> ^(a)	<u>Dead or Missing</u>			
C-SB	1	43	12	0.78		
C-SB	2	54	1	0.98		
C-SB	3	51	4	0.93		
C-SB	4	50	5	0.91		
C-SB	5	50	5	0.91	0.90	0.07

(a) Survival based on initial exposure of 55 organisms per replicate.

(b) Tank was inadvertently initiated with greater than 55 organisms.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE F.8. Rank Order Based on Mean Proportion Surviving 28-Day
N. caecoides Solid-Phase Test, Oakland Harbor
 Intensive Study

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP IC1-C	0.81
COMP IC1-B	0.84
COMP IC1-B Special	0.87
R-BF	0.87
COMP OC4-B	0.89
C-SB	0.90
R-AM	0.91
COMP IC1-A	0.93
C-NE	0.93
R-OS	0.94

TABLE F.9. Daily Observation for *N. caecoides* on Sediment Surface During 28-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment		<i>N. caecoides</i> on Sediment Test Days 0 through 27																											
Treatment	Replicate	0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
COMP IC1-A	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	2	T ^(b)	0	0	0	0	0	T	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
COMP IC1-A	4	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	5	T	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	T	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	4	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	3	0	0	T	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	3	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	1	2	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	4	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	5	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	2	1	0	1	0	0	0	0	0	0	0	0	0	T	T	0	0	0	T	T	0	T	0	T	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	T	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	T	0	T	T	0	T	T	T	T	0	0	T	T	T	T	0	T	T	0	0	T	0

TABLE F.9. (contd)

Sediment Treatment		<i>N. caecoides</i> on Sediment Test Days 0 through 27																											
Replicate	0 (a)																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
R-OS	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	T	0	0	0	0	0	ND(c)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	ND	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
R-OS	5	NI(d)	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C-SB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) T Too turbid.

(c) ND No data.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE F.10. Daily Observation for *N. caecoides* Dead and Removed During 28-Day Solid-Phase Test, Oakland Harbor Intensive Study

Sediment			<i>N. caecoides</i> Dead and Removed Test Days 0 through 27																										
Treatment	Replicate	0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
COMP IC1-A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-A	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	3	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-B Special	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	3	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IC1-C	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP OC4-B	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	3	0	0	0	0	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE F.10. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i> Dead and Removed Test Days 0 through 27																											
		0 ^(a)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
R-OS	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	ND ^(b)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	ND	0	0	ND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	5	NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
C-NE	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	2	0	0	0	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
C-SB	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-SB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) On Test Day 0 observations were performed 2 h after test initiation.

(b) ND No data.

(c) NI No information; insufficient sediment to test all five replicates.

APPENDIX G

BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE-PHASE TEST,
96-HOUR REFERENCE TOXICANT TEST AND 96-HOUR AMMONIA TEST
FOR *CITHARICHTHYS stigmaeus*

TABLE G.1. Test Results for 96-Hour *C. stigmaeus* Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live (a)	Dead or Missing			
COMP IC1-A	0	1	9	1	0.90		
COMP IC1-A	0	2	9	1	0.90		
COMP IC1-A	0	3	8	2	0.80		
COMP IC1-A	0	4	8	2	0.80		
COMP IC1-A	0	5	8	2	0.80	0.84	0.05
COMP IC1-A	10	1	9	1	0.90		
COMP IC1-A	10	2	10	0	1.00		
COMP IC1-A	10	3	7	3	0.70		
COMP IC1-A	10	4	7	3	0.70		
COMP IC1-A	10	5	8	2	0.80	0.82	0.13
COMP IC1-A	50	1	9	1	0.90		
COMP IC1-A	50	2	9	1	0.90		
COMP IC1-A	50	3	10	0	1.00		
COMP IC1-A	50	4	7	3	0.70		
COMP IC1-A	50	5	8	2	0.80	0.86	0.11
COMP IC1-A	100	1	7	3	0.70		
COMP IC1-A	100	2	8	2	0.80		
COMP IC1-A	100	3	5	5	0.50		
COMP IC1-A	100	4	8	2	0.80		
COMP IC1-A	100	5	8	2	0.80	0.72	0.13
COMP IC1-B	0	1	10	0	1.00		
COMP IC1-B	0	2	10	0	1.00		
COMP IC1-B	0	3	10	0	1.00		
COMP IC1-B	0	4	8	2	0.80		
COMP IC1-B	0	5	9	1	0.90	0.94	0.09
COMP IC1-B	10	1	9	1	0.90		
COMP IC1-B	10	2	7	3	0.70		
COMP IC1-B	10	3	10	0	1.00		
COMP IC1-B	10	4	10	0	1.00		
COMP IC1-B	10	5	10	0	1.00	0.92	0.13
COMP IC1-B	50	1	9	1	0.90		
COMP IC1-B	50	2	5	5	0.50		
COMP IC1-B	50	3	7	3	0.70		
COMP IC1-B	50	4	4	6	0.40		
COMP IC1-B	50	5	6	4	0.60	0.62	0.19
COMP IC1-B	100	1	0	10	0.00		
COMP IC1-B	100	2	0	10	0.00		
COMP IC1-B	100	3	0	10	0.00		
COMP IC1-B	100	4	0	10	0.00		
COMP IC1-B	100	5	0	10	0.00	0.00	0.00
COMP IC1-B R ^(b)	100	1	0	5	0.00		
COMP IC1-B R ^(b)	100	2	0	5	0.00		
COMP IC1-B R ^(b)	100	3	0	5	0.00	0.00	0.00
COMP IC1-B-SPECIAL	0	1	8	2	0.80		
COMP IC1-B-SPECIAL	0	2	9	1	0.90		
COMP IC1-B-SPECIAL	0	3	10	0	1.00		
COMP IC1-B-SPECIAL	0	4	9	1	0.90		
COMP IC1-B-SPECIAL	0	5	10	0	1.00	0.92	0.08

TABLE G.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live (a)	Dead or Missing			
COMP IC1-B-SPECIAL	10	1	9	1	0.90		
COMP IC1-B-SPECIAL	10	2	10	0	1.00		
COMP IC1-B-SPECIAL	10	3	9	1	0.90		
COMP IC1-B-SPECIAL	10	4	8	2	0.80		
COMP IC1-B-SPECIAL	10	5	9	1	0.90	0.90	0.07
COMP IC1-B-SPECIAL	50	1	9	1	0.90		
COMP IC1-B-SPECIAL	50	2	9	1	0.90		
COMP IC1-B-SPECIAL	50	3	10	0	1.00		
COMP IC1-B-SPECIAL	50	4	8	2	0.80		
COMP IC1-B-SPECIAL	50	5	9	1	0.90	0.90	0.07
COMP IC1-B-SPECIAL	100	1	1	9	0.10		
COMP IC1-B-SPECIAL	100	2	5	5	0.50		
COMP IC1-B-SPECIAL	100	3	2	8	0.20		
COMP IC1-B-SPECIAL	100	4	1	9	0.10		
COMP IC1-B-SPECIAL	100	5	0	10	0.00	0.18	0.19
COMP IC1-B SPECIAL R ^(b)	100	1	1	4	0.20		
COMP IC1-B SPECIAL R ^(b)	100	2	0	5	0.00		
COMP IC1-B SPECIAL R ^(b)	100	3	0	5	0.00	0.07	0.12
COMP IC1-C	0	1	10	0	1.00		
COMP IC1-C	0	2	10	0	1.00		
COMP IC1-C	0	3	10	0	1.00		
COMP IC1-C	0	4	9	1	0.90		
COMP IC1-C	0	5	6	4	0.60	0.90	0.17
COMP IC1-C	10	1	9	1	0.90		
COMP IC1-C	10	2	9	1	0.90		
COMP IC1-C	10	3	7	3	0.70		
COMP IC1-C	10	4	7	3	0.70		
COMP IC1-C	10	5	10	0	1.00	0.84	0.13
COMP IC1-C	50	1	9	1	0.90		
COMP IC1-C	50	2	7	3	0.70		
COMP IC1-C	50	3	9	1	0.90		
COMP IC1-C	50	4	8	2	0.80		
COMP IC1-C	50	5	6	4	0.60	0.78	0.13
COMP IC1-C	100	1	3	7	0.30		
COMP IC1-C	100	2	5	5	0.50		
COMP IC1-C	100	3	8	2	0.80		
COMP IC1-C	100	4	6	4	0.60		
COMP IC1-C	100	5	6	4	0.60	0.56	0.18
COMP IC1-C R	100	1	5	0	1.00		
COMP IC1-C R	100	2	5	0	1.00		
COMP IC1-C R	100	3	3	2	0.60	0.87	0.23
COMP OC4-B	0	1	7	3	0.70		
COMP OC4-B	0	2	9	1	0.90		
COMP OC4-B	0	3	9	1	0.90		
COMP OC4-B	0	4	7	3	0.70		
COMP OC4-B	0	5	10	0	1.00	0.84	0.13

TABLE G.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live (a)	Dead or Missing			
COMP OC4-B	10	1	9	1	0.90		
COMP OC4-B	10	2	8	2	0.80		
COMP OC4-B	10	3	9	1	0.90		
COMP OC4-B	10	4	7	3	0.70		
COMP OC4-B	10	5	7	3	0.70	0.80	0.10
COMP OC4-B	50	1	10	0	1.00		
COMP OC4-B	50	2	9	1	0.90		
COMP OC4-B	50	3	9	1	0.90		
COMP OC4-B	50	4	9	1	0.90		
COMP OC4-B	50	5	9	1	0.90	0.92	0.04
COMP OC4-B	100	1	9	1	0.90		
COMP OC4-B	100	2	9	1	0.90		
COMP OC4-B	100	3	6	4	0.60		
COMP OC4-B	100	4	8	2	0.80		
COMP OC4-B	100	5	9	1	0.90	0.82	0.13
R-AM	0	1	10	0	1.00		
R-AM	0	2	10	0	1.00		
R-AM	0	3	10	0	1.00		
R-AM	0	4	10	0	1.00		
R-AM	0	5	8	2	0.80	0.96	0.09
R-AM	10	1	9	1	0.90		
R-AM	10	2	8	2	0.80		
R-AM	10	3	10	0	1.00		
R-AM	10	4	8	2	0.80		
R-AM	10	5	9	1	0.90	0.88	0.08
R-AM	50	1	9	1	0.90		
R-AM	50	2	7	3	0.70		
R-AM	50	3	10	0	1.00		
R-AM	50	4	8	2	0.80		
R-AM	50	5	9	1	0.90	0.86	0.11
R-AM	100	1	7	2	0.78		
R-AM	100	2	10	0	1.00		
R-AM	100	3	7	3	0.70		
R-AM	100	4	7	3	0.70		
R-AM	100	5	9	1	0.90	0.82	0.13
R-BF	0	1	10	0	1.00		
R-BF	0	2	9	1	0.90		
R-BF	0	3	9	1	0.90		
R-BF	0	4	10	0	1.00		
R-BF	0	5	10	0	1.00	0.96	0.05
R-BF	10	1	10	0	1.00		
R-BF	10	2	8	2	0.80		
R-BF	10	3	9	1	0.90		
R-BF	10	4	9	1	0.90		
R-BF	10	5	9	1	0.90	0.90	0.07
R-BF	50	1	10	0	1.00		
R-BF	50	2	9	1	0.90		
R-BF	50	3	9	1	0.90		
R-BF	50	4	9	1	0.90		
R-BF	50	5	9	1	0.90	0.92	0.04

TABLE G.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live ^(a)	Dead or Missing			
R-BF	100	1	9	1	0.90		
R-BF	100	2	8	2	0.80		
R-BF	100	3	10	0	1.00		
R-BF	100	4	8	2	0.80		
R-BF	100	5	9	1	0.90	0.88	0.08
R-BF R ^(b)	100	1	5	0	1.00		
R-BF R ^(b)	100	2	5	0	1.00		
R-BF R ^(b)	100	3	5	0	1.00	1.00	0.00
Control R ^(b)	0	1	5	0	1.00		
Control R ^(b)	0	2	5	0	1.00		
Control R ^(b)	0	3	5	0	1.00		
Control R ^(b)	0	4	5	0	1.00	1.00	0.00

(a) Survival based on initial exposure of 10 organisms for original test and 5 organisms for retest per replicate.

(b) R Sediment treatment retested to assess potential ammonia toxicity.

TABLE G.2. Summary of Mean Proportion Surviving 96-Hour
C. stigmaeus Suspended-Particulate-Phase Test,
Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Concentration (Percent SPP)</u>	<u>Mean Proportion Surviving</u>
COMP IC1-A	0	0.84
COMP IC1-A	10	0.82
COMP IC1-A	50	0.86
COMP IC1-A	100	0.72
COMP IC1-B	0	0.94
COMP IC1-B	10	0.92
COMP IC1-B	50	0.62
COMP IC1-B	100	0.00
COMP IC1-B R ^(a)	100	0.00
COMP IC1-B-SPECIAL	0	0.92
COMP IC1-B-SPECIAL	10	0.90
COMP IC1-B-SPECIAL	50	0.90
COMP IC1-B-SPECIAL	100	0.18
COMP IC1-B SPECIAL R ^(a)	100	0.07
COMP IC1-C	0	0.90
COMP IC1-C	10	0.84
COMP IC1-C	50	0.78
COMP IC1-C	100	0.56
COMP IC1-C R ^(a)	100	0.87
COMP OC4-B	0	0.84
COMP OC4-B	10	0.80
COMP OC4-B	50	0.92
COMP OC4-B	100	0.82
R-AM	0	0.96
R-AM	10	0.88
R-AM	50	0.86
R-AM	100	0.82

TABLE G.2. (contd)

<u>Sediment Treatment</u>	<u>Concentration (Percent SPP)</u>	<u>Mean Proportion Surviving</u>
R-BF	0	0.96
R-BF	10	0.90
R-BF	50	0.92
R-BF	100	0.88
R-BF R ^(a)	100	1.00
Control R ^(a)	0	1.00

(a) R Sediment treatment retested to assess potential ammonia toxicity.

TABLE G.3. Daily Observations of *C. stigmaeus* During 96-Hour Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i> Live				<i>C. stigmaeus</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
COMP IC1-A	0	1	10	10	9	9	0	0	1	0
COMP IC1-A	0	2	10	10	10	9	0	0	0	1
COMP IC1-A	0	3	10	10	9	9	0	0	1	0
COMP IC1-A	0	4	10	10	9	8	0	0	1	1
COMP IC1-A	0	5	10	10	8	8	0	0	2	0
COMP IC1-A	10	1	8	10	9	9	2 ^(a)	0	0	0
COMP IC1-A	10	2	10	10	10	10	0	0	0	0
COMP IC1-A	10	3	10	10	9	7	0	0	1	2
COMP IC1-A	10	4	10	10	8	8	0	0	2	0
COMP IC1-A	10	5	10	10	8	8	0	0	2	0
COMP IC1-A	50	1	10	9	9	9	0	1	0	0
COMP IC1-A	50	2	10	10	10	10	0	0	0	0
COMP IC1-A	50	3	10	10	10	10	0	0	0	0
COMP IC1-A	50	4	10	9	7	7	0	1	2	0
COMP IC1-A	50	5	10	10	8	8	0	0	2	0
COMP IC1-A	100	1	10	10	9	8	0	0	0	0
COMP IC1-A	100	2	10	9	8	8	0	1	1	0
COMP IC1-A	100	3	10	8	5	5	0	2	2	1
COMP IC1-A	100	4	10	9	9	9	0	1	0	0
COMP IC1-A	100	5	10	9	8	8	0	1	1	0
COMP IC1-B	0	1	10	10	10	10	0	0	0	0
COMP IC1-B	0	2	10	10	10	10	0	0	0	0
COMP IC1-B	0	3	10	10	10	10	0	0	0	0
COMP IC1-B	0	4	10	10	9	8	0	0	1	1
COMP IC1-B	0	5	10	10	10	9	0	0	0	0
COMP IC1-B	10	1	10	10	10	9	0	0	0	0
COMP IC1-B	10	2	10	8	7	8	0	2	0	0
COMP IC1-B	10	3	10	10	10	10	0	0	0	0
COMP IC1-B	10	4	10	10	10	10	0	0	0	0
COMP IC1-B	10	5	10	9	8	9	0	1	0	0
COMP IC1-B	50	1	10	9	9	9	0	1	0	0
COMP IC1-B	50	2	10	6	5	5	0	4	1	0
COMP IC1-B	50	3	10	10	10	8	0 ^(a)	0	0	2
COMP IC1-B	50	4	7	4	4	4	3 ^(a)	3	0	0
COMP IC1-B	50	5	10	6	6	6	0	4	0	0
COMP IC1-B	100	1	0 ^(b)	TRM ^(c)	TRM	TRM	10	TRM	TRM	TRM
COMP IC1-B	100	2	0 ^(b)	TRM	TRM	TRM	10	TRM	TRM	TRM
COMP IC1-B	100	3	0 ^(b)	TRM	TRM	TRM	10	TRM	TRM	TRM
COMP IC1-B	100	4	0 ^(b)	TRM	TRM	TRM	10	TRM	TRM	TRM
COMP IC1-B	100	5	0 ^(b)	TRM	TRM	TRM	10	TRM	TRM	TRM
COMP IC1-B R ^(d)	100	1	5	0	TRM	TRM	0	5	TRM	TRM
COMP IC1-B R ^(d)	100	2	5	0	TRM	TRM	0	5	TRM	TRM
COMP IC1-B R ^(d)	100	3	5	0	TRM	TRM	0	5	TRM	TRM
COMP IC1-B-SPECIAL	0	1	10	8	8	8	0	2	0	0
COMP IC1-B-SPECIAL	0	2	10	10	9	9	0	0	1	0
COMP IC1-B-SPECIAL	0	3	10	10	10	10	0	0	0	0
COMP IC1-B-SPECIAL	0	4	10	9	9	9	0	1	0	0
COMP IC1-B-SPECIAL	0	5	10	10	10	10	0	0	0	0

TABLE G.3. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i> Live				<i>C. stigmaeus</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
COMP IC1-B-SPECIAL	10	1	10	10	10	9	0	0	0	1
COMP IC1-B-SPECIAL	10	2	10	10	10	10	0	0	0	0
COMP IC1-B-SPECIAL	10	3	10	10	10	9	0	0	0	0
COMP IC1-B-SPECIAL	10	4	10	9	8	8	0	1	1	0
COMP IC1-B-SPECIAL	10	5	10	10	10	9	0	0	0	1
COMP IC1-B-SPECIAL	50	1	10	10	9	9	0	0	1	0
COMP IC1-B-SPECIAL	50	2	10	9	9	9	0	1	0	0
COMP IC1-B-SPECIAL	50	3	10	10	10	10	0	0	0	0
COMP IC1-B-SPECIAL	50	4	10	10	10	9	0	0	0	1
COMP IC1-B-SPECIAL	50	5	10	10	8	9	0	0	1	0
COMP IC1-B-SPECIAL	100	1	10	1	1	1	0	9	0	0
COMP IC1-B-SPECIAL	100	2	10	5	5	5	0	5	0	0
COMP IC1-B-SPECIAL	100	3	10	2	2	2	0	8	0	0
COMP IC1-B-SPECIAL	100	4	9	1	1	1	1 ^(a)	9	0	0
COMP IC1-B-SPECIAL	100	5	10	0	TRM	TRM	0	10	TRM	TRM
COMP IC1-B SPECIAL R ^(d)	100	1	5	1	1	1	0	4	0	0
COMP IC1-B SPECIAL R ^(d)	100	2	5	0	TRM	TRM	0	5	TRM	TRM
COMP IC1-B SPECIAL R ^(d)	100	3	5	0	TRM	TRM	0	5	TRM	TRM
COMP IC1-C	0	1	10	10	10	10	0 ^(a)	0	0	0
COMP IC1-C	0	2	9	10	10	9	1 ^(a)	0	0	0
COMP IC1-C	0	3	10	10	10	10	0	0	0	0
COMP IC1-C	0	4	10	10	10	8	0	0	0	1
COMP IC1-C	0	5	10	10	9	7	0	0	1	1
COMP IC1-C	10	1	10	9	9	9	0	1	0	0
COMP IC1-C	10	2	10	10	10	10	0	0	0	0
COMP IC1-C	10	3	10	8	8	7	0	2	0	1
COMP IC1-C	10	4	10	9	8	6	0	1	1	1
COMP IC1-C	10	5	10	10	10	10	0	0	0	0
COMP IC1-C	50	1	10	10	10	10	0	0	0	0
COMP IC1-C	50	2	10	7	6	7	0	3	0	0
COMP IC1-C	50	3	10	10	10	10	0	0	0	0
COMP IC1-C	50	4	10	9	8	8	0	1	1	0
COMP IC1-C	50	5	10	10	8	8	0	0	2	0
COMP IC1-C	100	1	10	3	3	3	0 ^(a)	7	0	0
COMP IC1-C	100	2	9	6	6	6	1 ^(a)	4	0	0
COMP IC1-C	100	3	10	9	9	8	0	1	0	1
COMP IC1-C	100	4	10	8	5	6	0	2	1	0
COMP IC1-C	100	5	8	6	6	6	2 ^(a)	3	0	0
COMP IC1-C R ^(d)	100	1	5	5	5	5	0	0	0	0
COMP IC1-C R ^(d)	100	2	5	5	5	5	0	0	0	0
COMP IC1-C R ^(d)	100	3	5	3	3	3	0	2	0	0
COMP OC4-B	0	1	10	10	10	7	0	0	0	1
COMP OC4-B	0	2	10	10	9	9	0	0	0	0
COMP OC4-B	0	3	10	10	10	9	0	0	0	1
COMP OC4-B	0	4	10	10	8	8	0	0	2	0
COMP OC4-B	0	5	10	10	10	10	0	0	0	0

TABLE G.3. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i> Live				<i>C. stigmaeus</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
COMP OC4-B	10	1	10	9	9	9	0	1	0	0
COMP OC4-B	10	2	10	10	10 ^(e)	8	0	0	0	2
COMP OC4-B	10	3	10	10	ND	9	0	0	ND	0
COMP OC4-B	10	4	10	9	8	7	0	1	1	1
COMP OC4-B	10	5	10	10	8	8	0	0	1	0
COMP OC4-B	50	1	10	10	10	9	0 ^(a)	0	0	0
COMP OC4-B	50	2	9	10	9	9	1 ^(a)	0	1	0
COMP OC4-B	50	3	10	10	9	9	0	0	1	0
COMP OC4-B	50	4	10	9	9	9	0	1	0	0
COMP OC4-B	50	5	10	10	ND	9	0	0	ND	0
COMP OC4-B	100	1	10	8	9	8	0	1	0	0
COMP OC4-B	100	2	10	9	8	8	0 ^(a)	1	0	0
COMP OC4-B	100	3	8	10	9	8	2 ^(a)	0	1	1
COMP OC4-B	100	4	10	8	7	8	0	1	1	0
COMP OC4-B	100	5	10	10	10	9	0	0	0	0
R-AM	0	1	10	10	10	10	0	0	0	0
R-AM	0	2	10	10	10	10	0 ^(a)	0	0	0
R-AM	0	3	9	10	10	10	1 ^(a)	0	0	0
R-AM	0	4	9	10	10	9	1 ^(a)	0	0	0
R-AM	0	5	10	10	9	8	0	0	1	1
R-AM	10	1	10	10	10	10	0	0	0	0
R-AM	10	2	10	9	8	8	0	1	1	0
R-AM	10	3	10	10	10	10	0	0	0	0
R-AM	10	4	10	10	9	9	0	0	1	0
R-AM	10	5	10	10	10	9	0	0	0	1
R-AM	50	1	10	9	9	9	0	1	0	0
R-AM	50	2	10	8	7	7	0	1	2	0
R-AM	50	3	10	10	10	10	0 ^(a)	0	0	0
R-AM	50	4	9	9	8	8	1 ^(a)	1	1	0
R-AM	50	5	9	10	10	9	1 ^(a)	0	0	1
R-AM	100	1	9 ^(f)	9	7	7	0	1	2	0
R-AM	100	2	10	10	10	9	0	0	0	0
R-AM	100	3	10	8	8	8	0	1	1	0
R-AM	100	4	10	10	8	7	0	0	2	1
R-AM	100	5	10	9	9	9	0	1	0	0
R-BF	0	1	10	10	10	10	0	0	0	0
R-BF	0	2	10	10	10	10	0	0	0	0
R-BF	0	3	10	9	9	9	0	1	0	0
R-BF	0	4	10	10	10	10	0	0	0	0
R-BF	0	5	10	10	10	10	0	0	0	0
R-BF	10	1	10	10	10	10	0	0	0	0
R-BF	10	2	10	8	8	8	0	1	0	0
R-BF	10	3	10	10	9	9	0	0	1	0
R-BF	10	4	10	10	9	9	0	0	1	0
R-BF	10	5	10	10	10	9	0	0	0	1
R-BF	50	1	10	10	10	10	0	0	0	0
R-BF	50	2	10	9	9	9	0	1	0	0
R-BF	50	3	10	10	9	9	0	0	1	0
R-BF	50	4	10	10	10	10	0	0	0	0
R-BF	50	5	10	10	9	9	0	0	1	0

TABLE G.3. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>C. stigmaeus</i> Live				<i>C. stigmaeus</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
R-BF	100	1	10	10	10	10	0	0	0	0
R-BF	100	2	7	7	10	9	T(g)	T	0	1
R-BF	100	3	10	7	10	10	0	0	0	0
R-BF	100	4	10	10	10	9	0	0	0	1
R-BF	100	5	10	9	10	9	0	0	0	1
R-BF R ^(d)	100	1	T	5	5	5	T	0	0	0
R-BF R ^(d)	100	2	T	5	5	5	T	0	0	0
R-BF R ^(d)	100	3	T	5	5	5	T	0	0	0
Control R ^(d)	0	1	5	5	5	5	0	0	0	0
Control R ^(d)	0	2	5	5	5	5	0	0	0	0
Control R ^(d)	0	3	5	5	5	5	0	0	0	0
Control R ^(d)	0	4	5	5	5	5	0	0	0	0

(a) Replaced dead organisms with live *C. stigmaeus*.

(b) Died within 4 h of initiation.

(c) TRM Terminated.

(d) R Sediment treatment retested to assess potential ammonia toxicity.

(e) ND No data.

(f) Only nine *C. stigmaeus* initiated.

(g) T Too turbid.

TABLE G.4. Water Quality Summary for 96-Hour *C. stigmaeus* Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Concentration (Percent SPP)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Ammonia (mg/L)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0	NE ^(b)	NE
COMP IC1-A	0	14.0	16.7	7.77	8.17	7.3	9.5	30.5	31.0	NM ^(c)	NM
COMP IC1-A	10	14.3	16.5	7.73	8.15	7.3	9.4	30.5	31.5	NM	NM
COMP IC1-A	50	13.8	16.5	7.71	8.06	7.3	8.7	30.0	31.0	NM	NM
COMP IC1-A	100	13.3	16.5	7.76	7.95	7.2	7.9	30.0	31.0	NM	NM
COMP IC1-B	0	14.2	16.4	7.76	8.20	7.3	9.9	30.0	31.0	NM	NM
COMP IC1-B	10	14.0	16.5	7.77	8.21	6.7	9.6	30.0	31.0	NM	NM
COMP IC1-B	50	13.9	16.5	8.00	8.27	6.8	8.4	30.0	30.5	NM	NM
COMP IC1-B	100	12.6 ^(d)	16.2	8.23	8.30	6.5	7.9	30.0	30.0	NM	NM
COMP IC1-B R ^{(e)(f)}	100	13.4	16.0	8.24	8.28	7.7	7.8	29.5	30.0	20.74	21.96
COMP IC1-B-SPECIAL	0	15.4	16.3	7.78	8.05	7.3	9.6	30.0	31.0	NM	NM
COMP IC1-B-SPECIAL	10	14.9	16.3	7.84	8.08	7.3	9.4	30.0	31.5	NM	NM
COMP IC1-B-SPECIAL	50	14.8	16.0	7.98	8.17	7.3	8.6	30.0	31.0	NM	NM
COMP IC1-B-SPECIAL	100	14.1	15.9	8.06	8.27	6.3	7.8	30.0	30.5	NM	NM
COMP IC1-B SPECIAL R ^{(e)(f)}	100	13.4	16.0	8.23	8.30	7.5	7.9	30.0	30.0	17.08	19.52
COMP IC1-C	0	14.2	16.5	7.70	8.16	6.5	9.4	30.5	31.0	NM	NM
COMP IC1-C	10	13.8	16.6	7.85	8.16	7.5	8.7	30.5	31.0	NM	NM
COMP IC1-C	50	14.1	16.2	7.94	8.20	7.2	7.9	30.0	31.0	NM	NM
COMP IC1-C	100	14.3	16.2	7.99	8.25	4.5 ^(d)	7.9	30.0	31.0	NM	NM
COMP IC1-C R ^(e)	100	14.0	15.9	8.00	8.17	7.4	7.8	30.0	30.0	14.64	17.08
COMP OC4-B	0	15.5	16.4	7.80	8.12	7.2	9.7	30.0	31.0	NM	NM
COMP OC4-B	10	15.2	16.3	7.81	8.07	7.1	9.8	30.0	31.0	NM	NM
COMP OC4-B	50	15.1	16.2	7.67	8.13	6.0	8.4	30.0	31.0	NM	NM
COMP OC4-B	100	14.2	16.4	7.54	8.20	6.0	7.8	30.0	31.0	NM	NM
R-AM	0	14.9	16.2	7.70	8.05	6.0	9.7	30.5	31.5	NM	NM
R-AM	10	14.9	16.2	7.80	8.03	6.9	9.5	30.5	31.5	NM	NM
R-AM	50	14.9	16.1	7.80	8.06	7.2	8.9	30.0	31.5	NM	NM
R-AM	100	14.7	16.2	7.68	8.08	7.0	8.2	30.0	32.0	NM	NM
R-BF	0	14.3	17.5 ^(d)	7.70	7.99	6.8	8.9	30.5	31.5	NM	NM
R-BF	10	13.6	17.5 ^(d)	7.73	8.05	7.0	8.7	30.0	32.0	NM	NM
R-BF	50	13.1	17.5 ^(d)	7.01 ^(d)	8.17	6.8	7.6	30.0	31.0	NM	NM
R-BF	100	13.3	17.5 ^(d)	7.58	8.24	6.5	7.5	30.0	30.5	NM	NM
R-BF R ^(e)	100	13.4	16.3	7.71	8.15	6.6	7.8	28.0	29.5	14.64	17.08
Control R ^(e)	0	15.0	16.0	7.87	8.00	7.7	7.9	30.0	30.5	5.49	8.54

(a) NA Not applicable.

(b) NE Not established.

(c) NM Not measured.

(d) Data point out of range.

(e) R Sediment treatment retested to assess potential ammonia toxicity.

(f) Terminated on Day 1.

TABLE G.5. Test Results for 96-Hour *C. stigmaeus* Reference Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration (mg/L)	Replicate	<i>C. stigmaeus</i>		Mean Proportion Surviving	Proportion Surviving	Standard Deviation
		Live (a)	Dead or Missing			
0.0	1	9	1	0.90		
0.0	2	9	1	0.90		
0.0	3	10	0	1.00	0.93	0.06
0.5	1	8	2	0.80		
0.5	2	7	3	0.70		
0.5	3	10	0	1.00	0.83	0.15
1.0	1	6	4	0.60		
1.0	2	7	3	0.70		
1.0	3	4	6	0.40	0.57	0.15
1.5	1	8	2	0.80		
1.5	2	5	5	0.50		
1.5	3	5	5	0.50	0.60	0.17
2.0	1	2	8	0.20		
2.0	2	1	9	0.10		
2.0	3	6	4	0.60	0.30	0.26

(a) Survival based on initial exposure of 10 organisms per replicate.

TABLE G.6. Daily Observations for *C. stigmaeus* During Reference
Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration (mg/L)	Replicate	<u><i>C. stigmaeus</i> Live</u>				<u><i>C. stigmaeus</i> Dead</u>			
		<u>2 h</u>	<u>24 h</u>	<u>48 h</u>	<u>72 h</u>	<u>2 h</u>	<u>24 h</u>	<u>48 h</u>	<u>72 h</u>
0.0	1	10	10	9	9	0	0	1	0
0.0	2	10	10	9	9	0	0	1	0
0.0	3	10	10	10	10	0	0	0	0
0.5	1	10	10	10	10	0	0	0	0
0.5	2	10	9	9	8	0	1	0	1
0.5	3	10	10	10	9	0	0	0	1
1.0	1	10	10	10	9	0	0	0	1
1.0	2	10	10	10	10	0	0	0	0
1.0	3	10	10	10	9	0	0	0	1
1.5	1	10	10	10	9	0	0	0	1
1.5	2	10	7	7	7	0	3	0	0
1.5	3	10	10	9	8	0	0	1	1
2.0	1	10	9	8	8	0	1	1	0
2.0	2	10	10	10	9	0	0	0	1
2.0	3	10	9	9	9	0	1	0	0

TABLE G.7. Water Quality Summary for 96-Hour *C. stigmaeus* Reference Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0
0.0	14.6	16.7	7.82	8.16	7.2	9.5	30.0	32.0
0.5	14.4	16.1	7.79	8.15	7.6	9.4	30.0	31.5
1.0	14.2	16.7	7.76	8.12	6.7	9.4	30.5	31.5
1.5	14.3	16.6	7.87	8.09	7.6	9.3	30.5	31.5
2.0	14.3	16.6	7.86	8.05	7.6	9.3	30.0	31.5

(a) NA Not applicable.

TABLE G.8. Test Results for 96-Hour *C. stigmaeus* Ammonia Test,
Oakland Harbor Intensive Study

Nominal Ammonia Concentration (mg/L)	Actual Ammonia Concentration (mg/L)	Replicate	<i>C. stigmaeus</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live (a)	Dead or Missing			
7.5	24.4	1	5	0	1.00		
7.5	14.6	2	5	0	1.00		
7.5	13.4	3	5	0	1.00	1.00	0.00
15.0	21.2	1	5	0	1.00		
15.0	21.2	2	5	0	1.00		
15.0	21.2	3	5	0	1.00	1.00	0.00
30.0	39.0	1	1	4	0.20		
30.0	43.9	2	0	5	0.00		
30.0	39.0	3	0	5	0.00	0.07	0.12
60.0	109.8	1	0	5	0.00		
60.0	109.8	2	0	5	0.00		
60.0	73.2	3	0	5	0.00	0.00	0.00

(a) Survival based on initial exposure of 5 organisms per replicate.

TABLE G.9. Daily Observations for *C. stigmaeus* During 96-Hour Ammonia Test, Oakland Harbor Intensive Study

Ammonia Concentration (mg/L)	Replicate	<i>C. stigmaeus</i> Live				<i>C. stigmaeus</i> Dead			
		2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
7.5	1	5	5	5	5	0	0	0	0
7.5	2	5	5	5	5	0	0	0	0
7.5	3	5	5	5	5	0	0	0	0
15.0	1	5	5	5	5	0	0	0	0
15.0	2	5	5	5	5	0	0	0	0
15.0	3	5	5	5	5	0	0	0	0
30.0	1	5	1	1	1	0	4	0	0
30.0	2	5	0	TRM ^(a)	TRM	0	5	TRM	TRM
30.0	3	5	1	1	0	0	4	0	1
60.0	1	5	0	TRM	TRM	0	5	TRM	TRM
60.0	2	5	0	TRM	TRM	0	5	TRM	TRM
60.0	3	5	0	TRM	TRM	0	5	TRM	TRM

(a) TRM Terminated.

TABLE G.10. Water Quality Summary for 96-Hour *C. stigmaeus* Ammonia Test, Oakland Harbor Intensive Study

Ammonia Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Ammonia (mg/L)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	6.0	NA ^(a)	28.0	32.0	NE ^(b)	NE
7.5	15.3	16.0	7.84	8.00	7.6	7.9	30.0	30.5	13.42	24.40
15.0	15.4	16.0	7.85	7.99	7.6	7.9	30.0	30.5	19.52	23.18
30.0	15.5	16.1	7.97	8.02	7.8	7.9	30.0	30.5	39.04	43.92
60.0	15.6	16.0	7.92	7.97	7.7	7.9	30.0	30.5	73.20	109.80

(a) NA Not applicable.

(b) NE Not established.

APPENDIX H

BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE-PHASE TEST
AND 96-HOUR REFERENCE TOXICANT TEST FOR *HOLMESIMYSIS costata*

TABLE H.1. Test Results for 96-Hour *H. costata* Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Percent Concentration	Replicate	<i>H. costata</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live ^(a)	Dead or Missing			
COMP IC1-A	0	1	10	0	1.00		
COMP IC1-A	0	2	9	1	0.90		
COMP IC1-A	0	3	10	0	1.00		
COMP IC1-A	0	4	10	0	1.00		
COMP IC1-A	0	5	9	1	0.90	0.96	0.05
COMP IC1-A	10	1	10	0	1.00		
COMP IC1-A	10	2	10	0	1.00		
COMP IC1-A	10	3	9	1	0.90		
COMP IC1-A	10	4	10	0	1.00		
COMP IC1-A	10	5	10	0	1.00	0.98	0.04
COMP IC1-A	50	1	10	0	1.00		
COMP IC1-A	50	2	10	0	1.00		
COMP IC1-A	50	3	9	1	0.90		
COMP IC1-A	50	4	9	1	0.90		
COMP IC1-A	50	5	10	0	1.00	0.96	0.05
COMP IC1-A	100	1	9	1	0.90		
COMP IC1-A	100	2	10	0	1.00		
COMP IC1-A	100	3	9	1	0.90		
COMP IC1-A	100	4	10	0	1.00		
COMP IC1-A	100	5	10	0	1.00	0.96	0.05
COMP IC1-B	0	1	10	0	1.00		
COMP IC1-B	0	2	10	0	1.00		
COMP IC1-B	0	3	10	0	1.00		
COMP IC1-B	0	4	10	0	1.00		
COMP IC1-B	0	5	10	0	1.00	1.00	0.00
COMP IC1-B	10	1	10	0	1.00		
COMP IC1-B	10	2	9	1	0.90		
COMP IC1-B	10	3	9	1	0.90		
COMP IC1-B	10	4	10	0	1.00		
COMP IC1-B	10	5	10	0	1.00	0.96	0.05
COMP IC1-B	50	1	10	0	1.00		
COMP IC1-B	50	2	10	0	1.00		
COMP IC1-B	50	3	10	0	1.00		
COMP IC1-B	50	4	10	0	1.00		
COMP IC1-B	50	5	10	0	1.00	1.00	0.00
COMP IC1-B	100	1	9	1	0.90		
COMP IC1-B	100	2	10	0	1.00		
COMP IC1-B	100	3	10	0	1.00		
COMP IC1-B	100	4	10	0	1.00		
COMP IC1-B	100	5	10	0	1.00	0.98	0.04
COMP IC1-B Special	0	1	10	0	1.00		
COMP IC1-B Special	0	2	10	0	1.00		
COMP IC1-B Special	0	3	10	0	1.00		
COMP IC1-B Special	0	4	10	0	1.00		
COMP IC1-B Special	0	5	10	0	1.00	1.00	0.00

TABLE H.1. (contd)

Sediment Treatment	Percent Concentration	Replicate	<i>H. costata</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
			Live (a)	Dead or Missing			
COMP IC1-B Special	10	1	10	0	1.00		
COMP IC1-B Special	10	2	10	0	1.00		
COMP IC1-B Special	10	3	10	0	1.00		
COMP IC1-B Special	10	4	10	0	1.00		
COMP IC1-B Special	10	5	10	0	1.00	1.00	0.00
COMP IC1-B Special	50	1	10	0	1.00		
COMP IC1-B Special	50	2	10	0	1.00		
COMP IC1-B Special	50	3	10	0	1.00		
COMP IC1-B Special	50	4	10	0	1.00		
COMP IC1-B Special	50	5	9	1	0.90	0.98	0.04
COMP IC1-B Special	100	1	9	1	0.90		
COMP IC1-B Special	100	2	10	0	1.00		
COMP IC1-B Special	100	3	10	0	1.00		
COMP IC1-B Special	100	4	10	0	1.00		
COMP IC1-B Special	100	5	10	0	1.00	0.98	0.04
COMP IC1-C	0	1	10	0	1.00		
COMP IC1-C	0	2	10	0	1.00		
COMP IC1-C	0	3	9	1	0.90		
COMP IC1-C	0	4	10	0	1.00		
COMP IC1-C	0	5	10	0	1.00	0.98	0.04
COMP IC1-C	10	1	10	0	1.00		
COMP IC1-C	10	2	10	0	1.00		
COMP IC1-C	10	3	10	0	1.00		
COMP IC1-C	10	4	10	0	1.00		
COMP IC1-C	10	5	10	0	1.00	1.00	0.00
COMP IC1-C	50	1	9	1	0.90		
COMP IC1-C	50	2	10	0	1.00		
COMP IC1-C	50	3	10	0	1.00		
COMP IC1-C	50	4	10	0	1.00		
COMP IC1-C	50	5	10	0	1.00	0.98	0.04
COMP IC1-C	100	1	9	1	0.90		
COMP IC1-C	100	2	10	0	1.00		
COMP IC1-C	100	3	10	0	1.00		
COMP IC1-C	100	4	9	1	0.90		
COMP IC1-C	100	5	10	0	1.00	0.96	0.05
COMP OC4-B	0	1	10	0	1.00		
COMP OC4-B	0	2	10	0	1.00		
COMP OC4-B	0	3	10	0	1.00		
COMP OC4-B	0	4	10	0	1.00		
COMP OC4-B	0	5	10	0	1.00	1.00	0.00
COMP OC4-B	10	1	10	0	1.00		
COMP OC4-B	10	2	9	1	0.90		
COMP OC4-B	10	3	10	0	1.00		
COMP OC4-B	10	4	10	0	1.00		
COMP OC4-B	10	5	10	0	1.00	0.98	0.04

TABLE H.1. (contd)

<u>Sediment Treatment</u>	<u>Percent Concentration</u>	<u>Replicate</u>	<u>H. costata</u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
			<u>Live (a)</u>	<u>Dead or Missing</u>			
COMP OC4-B	50	1	10	0	1.00		
COMP OC4-B	50	2	10	0	1.00		
COMP OC4-B	50	3	10	0	1.00		
COMP OC4-B	50	4	10	0	1.00		
COMP OC4-B	50	5	10	0	1.00	1.00	0.00
COMP OC4-B	100	1	10	0	1.00		
COMP OC4-B	100	2	10	0	1.00		
COMP OC4-B	100	3	10	0	1.00		
COMP OC4-B	100	4	10	0	1.00		
COMP OC4-B	100	5	9	1	0.90	0.98	0.04
R-AM	0	1	10	0	1.00		
R-AM	0	2	9	1	0.90		
R-AM	0	3	10	0	1.00		
R-AM	0	4	10	0	1.00		
R-AM	0	5	10	0	1.00	0.98	0.04
R-AM	10	1	10	0	1.00		
R-AM	10	2	9	1	0.90		
R-AM	10	3	10	0	1.00		
R-AM	10	4	9	1	0.90		
R-AM	10	5	10	0	1.00	0.96	0.05
R-AM	50	1	10	0	1.00		
R-AM	50	2	10	0	1.00		
R-AM	50	3	9	1	0.90		
R-AM	50	4	9	1	0.90		
R-AM	50	5	10	0	1.00	0.96	0.05
R-AM	100	1	10	0	1.00		
R-AM	100	2	10	0	1.00		
R-AM	100	3	9	1	0.90		
R-AM	100	4	10	0	1.00		
R-AM	100	5	10	0	1.00	0.98	0.04
R-BF	0	1	9	1	0.90		
R-BF	0	2	10	0	1.00		
R-BF	0	3	10	0	1.00		
R-BF	0	4	10	0	1.00		
R-BF	0	5	9	1	0.90	0.96	0.05
R-BF	10	1	10	0	1.00		
R-BF	10	2	10	0	1.00		
R-BF	10	3	10	0	1.00		
R-BF	10	4	10	0	1.00		
R-BF	10	5	9	1	0.90	0.98	0.04
R-BF	50	1	10	0	1.00		
R-BF	50	2	10	0	1.00		
R-BF	50	3	9	1	0.90		
R-BF	50	4	9	1	0.90		
R-BF	50	5	10	0	1.00	0.96	0.05

TABLE H.1. (contd)

<u>Sediment Treatment</u>	<u>Percent Concentration</u>	<u>Replicate</u>	<u>H. costata</u>		<u>Proportion Surviving</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation</u>
			<u>Live (a)</u>	<u>Dead or Missing</u>			
R-BF	100	1	10	0	1.00		
R-BF	100	2	9	1	0.90		
R-BF	100	3	9	1	0.90		
R-BF	100	4	9	1	0.90		
R-BF	100	5	9	1	0.90	0.92	0.04
R-OS	0	1	10	0	1.00		
R-OS	0	2	9	1	0.90		
R-OS	0	3	10	0	1.00		
R-OS	0	4	10	0	1.00		
R-OS	0	5	9	1	0.90	0.96	0.05
R-OS	10	1	9	1	0.90		
R-OS	10	2	10	0	1.00		
R-OS	10	3	10	0	1.00		
R-OS	10	4	10	0	1.00		
R-OS	10	5	10	0	1.00	0.98	0.04
R-OS	50	1	10	0	1.00		
R-OS	50	2	10	0	1.00		
R-OS	50	3	9	1	0.90		
R-OS	50	4	10	0	1.00		
R-OS	50	5	10	0	1.00	0.98	0.04
R-OS	100	1	10	0	1.00		
R-OS	100	2	10	0	1.00		
R-OS	100	3	10	0	1.00		
R-OS	100	4	9	1	0.90		
R-OS	100	5	9	1	0.90	0.96	0.05

(a) Survival based on initial exposure of 10 organisms per replicate.

TABLE H.2. Summary of Mean Proportion Surviving for 96-Hour
H. costata Suspended-Particulate-Phase Test,
Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Concentration (Percent SPP)</u>	<u>Mean Proportion Surviving</u>
COMP IC1-A	0	0.96
COMP IC1-A	10	0.98
COMP IC1-A	50	0.96
COMP IC1-A	100	0.96
COMP IC1-B	0	1.00
COMP IC1-B	10	0.96
COMP IC1-B	50	1.00
COMP IC1-B	100	0.98
COMP IC1-B Special	0	1.00
COMP IC1-B Special	10	1.00
COMP IC1-B Special	50	0.98
COMP IC1-B Special	100	0.98
COMP IC1-C	0	0.98
COMP IC1-C	10	1.00
COMP IC1-C	50	0.98
COMP IC1-C	100	0.96
COMP OC4-B	0	1.00
COMP OC4-B	10	0.98
COMP OC4-B	50	1.00
COMP OC4-B	100	0.98
R-AM	0	0.98
R-AM	10	0.96
R-AM	50	0.96
R-AM	100	0.98
R-BF	0	0.96
R-BF	10	0.98
R-BF	50	0.96
R-BF	100	0.92
R-OS	0	0.96
R-OS	10	0.98
R-OS	50	0.98
R-OS	100	0.96

TABLE H.3. Daily Observations for 96-Hour *H. costata* Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>H. costata</i> Live				<i>H. costata</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
COMP IC1-A	0	1	10	10	10	10	0	0	0	0
COMP IC1-A	0	2	10	10	10	9	0	0	0	1
COMP IC1-A	0	3	10	10	10	10	0	0	0	0
COMP IC1-A	0	4	10	10	10	10	0	0	0	0
COMP IC1-A	0	5	10	10	10	9	0	0	0	1
COMP IC1-A	10	1	10	10	10	10	0	0	0	0
COMP IC1-A	10	2	10	10	10	10	0	0	0	0
COMP IC1-A	10	3	10	9	9	9	0	1	0	0
COMP IC1-A	10	4	10	10	10	10	0	0	0	0
COMP IC1-A	10	5	10	10	10	10	0	0	0	0
COMP IC1-A	50	1	10	10	10	10	0	0	0	0
COMP IC1-A	50	2	10	10	10	10	0	0	0	0
COMP IC1-A	50	3	10	10	10	9	0	0	0	1
COMP IC1-A	50	4	10	9	9	9	0	1	0	0
COMP IC1-A	50	5	10	10	10	10	0	0	0	0
COMP IC1-A	100	1	10	10	10	10	0	0	0	0
COMP IC1-A	100	2	10	10	10	10	0	0	0	0
COMP IC1-A	100	3	10	9	9	9	0	1	0	0
COMP IC1-A	100	4	10	10	10	10	0	0	0	0
COMP IC1-A	100	5	10	10	10	10	0	0	0	0
COMP IC1-B	0	1	10	10	10	10	0	0	0	0
COMP IC1-B	0	2	10	10	10	10	0	0	0	0
COMP IC1-B	0	3	10	10	10	10	0	0	0	0
COMP IC1-B	0	4	10	10	10	10	0	0	0	0
COMP IC1-B	0	5	10	10	10	10	0	0	0	0
COMP IC1-B	10	1	10	10	10	10	0	0	0	0
COMP IC1-B	10	2	10	10	10	10	0	0	0	0
COMP IC1-B	10	3	10	10	10	10	0	0	0	0
COMP IC1-B	10	4	10	10	10	10	0	0	0	0
COMP IC1-B	10	5	10	10	10	10	0	0	0	0
COMP IC1-B	50	1	10	10	10	10	0	0	0	0
COMP IC1-B	50	2	10	10	10	10	0	0	0	0
COMP IC1-B	50	3	10	10	10	10	0	0	0	0
COMP IC1-B	50	4	10	10	10	10	0	0	0	0
COMP IC1-B	50	5	10	10	10	10	0	0	0	0
COMP IC1-B	100	1	10	10	10	10	0	0	0	0
COMP IC1-B	100	2	10	10	10	10	0	0	0	0
COMP IC1-B	100	3	10	10	10	10	0	0	0	0
COMP IC1-B	100	4	10	10	10	10	0	0	0	0
COMP IC1-B	100	5	10	10	10	10	0	0	0	0
COMP IC1-B Special	0	1	10	10	10	10	0	0	0	0
COMP IC1-B Special	0	2	10	10	10	10	0	0	0	0
COMP IC1-B Special	0	3	10	10	10	10	0	0	0	0
COMP IC1-B Special	0	4	10	10	10	10	0	0	0	0
COMP IC1-B Special	0	5	10	10	10	10	0	0	0	0
COMP IC1-B Special	10	1	10	10	10	10	0	0	0	0
COMP IC1-B Special	10	2	10	10	10	10	0	0	0	0
COMP IC1-B Special	10	3	10	10	10	10	0	0	0	0
COMP IC1-B Special	10	4	10	10	10	10	0	0	0	0
COMP IC1-B Special	10	5	10	10	10	10	0	0	0	0

TABLE H.3. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>H. costata</i> Live				<i>H. costata</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
COMP IC1-B Special	50	1	10	10	10	10	0	0	0	0
COMP IC1-B Special	50	2	10	10	10	10	0	0	0	0
COMP IC1-B Special	50	3	10	10	10	10	0	0	0	0
COMP IC1-B Special	50	4	10	10	10	10	0	0	0	0
COMP IC1-B Special	50	5	10	10	10	10	0	0	0	0
COMP IC1-B Special	100	1	10	10	10	9	0	0	0	1
COMP IC1-B Special	100	2	10	10	10	10	0	0	0	0
COMP IC1-B Special	100	3	10	10	10	10	0	0	0	0
COMP IC1-B Special	100	4	10	10	10	10	0	0	0	0
COMP IC1-B Special	100	5	10	10	10	10	0	0	0	0
COMP IC1-C	0	1	10	10	10	10	0	0	0	0
COMP IC1-C	0	2	10	10	10	10	0	0	0	0
COMP IC1-C	0	3	10	10	10	10	0	0	0	0
COMP IC1-C	0	4	10	10	10	10	0	0	0	0
COMP IC1-C	0	5	10	10	10	10	0	0	0	0
COMP IC1-C	10	1	10	10	10	10	0	0	0	0
COMP IC1-C	10	2	10	10	10	10	0	0	0	0
COMP IC1-C	10	3	10	10	10	10	0	0	0	0
COMP IC1-C	10	4	10	10	10	10	0	0	0	0
COMP IC1-C	10	5	10	10	10	10	0	0	0	0
COMP IC1-C	50	1	10	10	10	10	0	0	0	0
COMP IC1-C	50	2	10	10	10	10	0	0	0	0
COMP IC1-C	50	3	10	10	10	10	0	0	0	0
COMP IC1-C	50	4	10	10	10	10	0	0	0	0
COMP IC1-C	50	5	10	10	10	10	0	0	0	0
COMP IC1-C	100	1	10	9	9	9	0	1	1	1
COMP IC1-C	100	2	10	10	10	10	0	0	0	0
COMP IC1-C	100	3	10	10	10	10	0	0	0	0
COMP IC1-C	100	4	10	10	10	10	0	0	0	0
COMP IC1-C	100	5	10	10	10	10	0	0	0	0
COMP OC4-B	0	1	10	10	10	10	0	0	0	0
COMP OC4-B	0	2	10	10	10	10	0	0	0	0
COMP OC4-B	0	3	10	10	10	10	0	0	0	0
COMP OC4-B	0	4	10	10	10	10	0	0	0	0
COMP OC4-B	0	5	10	10	10	10	0	0	0	0
COMP OC4-B	10	1	10	10	10	10	0	0	0	0
COMP OC4-B	10	2	10	10	10	10	0	0	0	0
COMP OC4-B	10	3	10	10	10	10	0	0	0	0
COMP OC4-B	10	4	10	10	10	10	0	0	0	0
COMP OC4-B	10	5	10	10	10	10	0	0	0	0
COMP OC4-B	50	1	10	10	10	10	0	0	0	0
COMP OC4-B	50	2	10	10	10	10	0	0	0	0
COMP OC4-B	50	3	10	10	10	10	0	0	0	0
COMP OC4-B	50	4	10	10	10	10	0	0	0	0
COMP OC4-B	50	5	10	10	10	10	0	0	0	0
COMP OC4-B	100	1	10	10	10	10	0	0	0	0
COMP OC4-B	100	2	10	10	10	10	0	0	0	0
COMP OC4-B	100	3	10	10	10	10	0	0	0	0
COMP OC4-B	100	4	10	10	10	10	0	0	0	0
COMP OC4-B	100	5	10	10	9	9	0	0	1	0

TABLE H.3. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>H. costata</i> Live				<i>H. costata</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
R-AM	0	1	10	10	10	10	0	0	0	0
R-AM	0	2	10	10	10	10	0	0	0	0
R-AM	0	3	10	10	10	10	0	0	0	0
R-AM	0	4	10	10	10	10	0	0	0	0
R-AM	0	5	10	10	10	10	0	0	0	0
R-AM	10	1	10	10	10	10	0	0	0	0
R-AM	10	2	10	10	10	10	0	0	0	0
R-AM	10	3	10	10	10	10	0	0	0	0
R-AM	10	4	10	10	10	10	0	0	0	0
R-AM	10	5	10	10	10	10	0	0	0	0
R-AM	50	1	10	10	10	10	0	0	0	0
R-AM	50	2	10	10	10	10	0	0	0	0
R-AM	50	3	10	10	10	10	0	0	0	0
R-AM	50	4	10	10	10	10	0	0	0	0
R-AM	50	5	10	10	10	10	0	0	0	0
R-AM	100	1	10	10	10	10	0	0	0	0
R-AM	100	2	10	10	10	10	0	0	0	0
R-AM	100	3	10	10	10	10	0	0	0	0
R-AM	100	4	10	10	10	10	0	0	0	0
R-AM	100	5	10	10	10	10	0	0	0	0
R-BF	0	1	10	10	10	9	0	0	0	1
R-BF	0	2	10	10	10	10	0	0	0	0
R-BF	0	3	10	10	10	10	0	0	0	0
R-BF	0	4	10	10	10	10	0	0	0	0
R-BF	0	5	10	10	10	10	0	0	0	0
R-BF	10	1	10	10	10	10	0	0	0	0
R-BF	10	2	10	10	10	10	0	0	0	0
R-BF	10	3	10	10	10	10	0	0	0	0
R-BF	10	4	10	10	10	10	0	0	0	0
R-BF	10	5	10	10	10	10	0	0	0	0
R-BF	50	1	10	10	10	10	0	0	0	0
R-BF	50	2	10	10	10	10	0	0	0	0
R-BF	50	3	10	10	10	9	0	0	0	1
R-BF	50	4	10	10	10	10	0	0	0	0
R-BF	50	5	10	10	10	9	0	0	0	1
R-BF	100	1	10	10	10	10	0	0	0	0
R-BF	100	2	10	10	10	9	0	0	0	1
R-BF	100	3	10	10	10	10	0	0	0	0
R-BF	100	4	10	10	10	9	0	0	0	1
R-BF	100	5	10	10	10	9	0	0	0	1
R-OS	0	1	10	10	10	10	0	0	0	0
R-OS	0	2	10	10	10	10	0	0	0	0
R-OS	0	3	10	10	10	10	0	0	0	0
R-OS	0	4	10	10	10	10	0	0	0	0
R-OS	0	5	10	10	10	9	0	0	0	1
R-OS	10	1	10	10	10	10	0	0	0	0
R-OS	10	2	10	10	10	10	0	0	0	0
R-OS	10	3	10	10	10	10	0	0	0	0
R-OS	10	4	10	10	10	10	0	0	0	0
R-OS	10	5	10	10	10	10	0	0	0	0

TABLE H.3. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	<i>H. costata</i> Live				<i>H. costata</i> Dead			
			2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
R-0S	50	1	10	10	10	10	0	0	0	0
R-0S	50	2	10	10	10	10	0	0	0	0
R-0S	50	3	10	9	9	9	0	1	0	0
R-0S	50	4	10	10	10	10	0	0	0	0
R-0S	50	5	10	10	10	10	0	0	0	0
R-0S	100	1	10	10	10	10	0	0	0	0
R-0S	100	2	10	10	10	10	0	0	0	0
R-0S	100	3	10	10	10	10	0	0	0	0
R-0S	100	4	10	9	9	9	0	1	0	0
R-0S	100	5	10	10	10	10	0	0	0	0

TABLE H.4. Water Quality Summary for 96-Hour *H. costata* Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

Sediment Treatment	Concentration (Percent SPP)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		13.0	17.0	7.30	8.30	4.0	NA ^(a)	28.0	32.0
COMP IC1-A	0	14.7	16.3	7.81	8.22	7.4	9.6	30.0	30.5
COMP IC1-A	10	14.7	16.2	7.83	8.20	7.4	9.3	30.5	31.0
COMP IC1-A	50	14.7	16.3	7.77	8.12	7.4	8.8	30.5	31.0
COMP IC1-A	100	14.7	16.2	7.67	8.10	6.0	8.2	30.5	31.0
COMP IC1-B	0	14.6	16.5	7.79	8.23	7.5	9.8	30.0	30.5
COMP IC1-B	10	14.6	16.5	7.84	8.24	7.5	9.5	30.0	31.0
COMP IC1-B	50	14.6	16.5	7.91	8.28	7.4	8.4	30.0	30.5
COMP IC1-B	100	14.5	16.4	8.09	8.35	6.4	8.1	29.5	30.5
COMP IC1-B Special	0	14.8	15.9	7.78	8.07	7.1	8.0	30.0	31.0
COMP IC1-B Special	10	14.8	15.8	7.80	8.14	7.0	7.9	30.0	31.0
COMP IC1-B Special	50	14.8	16.0	7.88	8.30	6.9	8.0	30.0	31.0
COMP IC1-B Special	100	14.7	16.0	8.00	8.39 ^(b)	7.0	8.1	29.5	31.0
COMP IC1-C	0	15.0	16.3	7.77	8.23	7.3	9.7	30.5	31.0
COMP IC1-C	10	14.9	16.3	7.85	8.23	6.1	9.6	30.5	31.0
COMP IC1-C	50	14.9	16.1	7.76	8.25	7.1	8.1	30.0	31.0
COMP IC1-C	100	15.0	15.9	7.87	8.27	5.8	7.8	29.5	31.0
COMP OC4-B	0	14.9	15.8	7.85	8.27	7.4	8.7	30.0	31.0
COMP OC4-B	10	14.8	15.8	7.77	8.22	6.8	8.4	30.0	31.0
COMP OC4-B	50	14.7	15.8	7.83	8.05	6.8	7.9	30.0	31.0
COMP OC4-B	100	14.7	15.8	7.80	8.10	6.3	7.8	30.0	31.0
R-AM	0	14.5	16.1	7.87	8.27	7.4	9.1	30.0	31.0
R-AM	10	14.5	16.1	7.85	8.23	7.4	8.7	30.0	31.0
R-AM	50	14.7	16.1	7.83	8.11	7.0	8.3	30.0	31.0
R-AM	100	14.6	16.2	7.85	8.06	7.1	8.1	30.0	30.5
R-BF	0	14.5	16.2	7.79	8.03	6.9	8.4	30.0	31.0
R-BF	10	14.5	16.2	7.70	8.04	6.2	8.3	30.0	31.0
R-BF	50	14.6	16.1	7.79	8.07	6.5	8.0	30.0	31.0
R-BF	100	14.6	16.1	7.60	8.12	6.5	8.1	30.0	31.0
R-OS	0	14.7	16.2	7.87	8.22	7.5	9.8	30.5	31.0
R-OS	10	14.8	16.3	7.88	8.21	7.5	9.4	30.5	30.5
R-OS	50	14.8	16.2	7.78	8.15	7.3	8.3	30.5	31.5
R-OS	100	14.7	16.3	7.85	8.17	6.5	8.0	30.0	32.0

(a) NA Not applicable.

(b) Data point out of range.

TABLE H.5. Test Results for 96-Hour *H. costata* Reference Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration ($\mu\text{g/L}$)	Replicate	<i>H. costata</i>		Proportion Surviving	Mean Proportion Surviving	Standard Deviation
		Live ^(a)	Dead			
0	1	9	1	0.90	0.97	0.06
0	2	10	0	1.00		
0	3	10	0	1.00		
50	1	6	4	0.60	0.63	0.06
50	2	7	3	0.70		
50	3	6	4	0.60		
100	1	2	8	0.20	0.30	0.10
100	2	4	6	0.40		
100	3	3	7	0.30		
200	1	0	10	0.00	0.00	0.00
200	2	0	10	0.00		
200	3	0	10	0.00		
500	1	0	10	0.00	0.00	0.00
500	2	0	10	0.00		
500	3	0	10	0.00		

(a) Survival based on initial exposure of 10 organisms per replicate.

TABLE H.6. Daily Observations of 96-Hour *H. costata* Reference Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration ($\mu\text{g/L}$)	Replicate	<i>H. costata</i> Live				<i>H. costata</i> Dead			
		2 h	24 h	48 h	72 h	2 h	24 h	48 h	72 h
0	1	10	10	10	10	0	0	0	0
0	2	10	10	10	10	0	0	0	0
0	3	10	10	10	10	0	0	0	0
50	1	10	10	7	7	0	0	3	0
50	2	10	10	7	7	0	0	3	0
50	3	10	10	6	6	0	0	4	0
100	1	10	7	3	3	0	3	4	0
100	2	10	6	4	4	0	4	2	0
100	3	10	7	3	3	0	3	4	0
200	1	10	3	0	0	0	7	3	0
200	2	10	3	0	0	0	7	3	0
200	3	10	2	0	0	0	8	2	0
500	1	10	0	0	0	0	10	0	0
500	2	10	0	0	0	0	10	0	0
500	3	10	0	0	0	0	10	0	0

TABLE H.7. Water Quality Summary for 96-Hour *H. costata* Reference Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration ($\mu\text{g/L}$)	Temperature ($^{\circ}\text{C}$)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	4.0	NA ^(a)	28.0	32.0
0	14.8	15.8	7.82	8.23	7.2	8.6	30.0	31.0
50	14.9	15.7	7.90	8.26	7.6	8.5	30.0	31.0
100	14.8	15.8	7.91	8.26	7.5	8.7	30.0	31.0
200	14.9	15.8	7.91	8.27	7.7	8.5	30.0	31.0
500	15.1	15.7	7.92	8.26	7.7	8.6	30.0	30.5

(a) NA Not applicable.

APPENDIX I

BIOASSAY RESULTS FOR 72-HOUR SUSPENDED-PARTICULATE-PHASE TEST
AND 72-HOUR REFERENCE TOXICANT TEST FOR *MYTILUS edulis*

TABLE I.1. Test Results for All Replicates in 72-Hour Larval *M. edulis* Suspended-Particulate-Phase Test, Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Concentration (Percent SPP)</u>	<u>Replicate</u>	<u>Mean Stocking Density</u>	<u>Number Normal</u>	<u>Proportion Normal</u>	<u>Number Surviving</u>	<u>Proportion Surviving</u>	<u>Mean Proportion Normal</u>	<u>Mean Proportion Surviving</u>	<u>Standard Deviation (a)</u>
Test 1										
COMP IC1-A	0	1	280	200	0.71	229	0.82			
COMP IC1-A	0	2	280	211	0.75	243	0.87			
COMP IC1-A	0	3	280	240	0.86	262	0.94			
COMP IC1-A	0	4	280	246	0.88	272	0.97			
COMP IC1-A	0	5	280	192	0.69	211	0.75	0.78	0.87	0.09
COMP IC1-A	10	1	280	232	0.83	257	0.92			
COMP IC1-A	10	2	280	232	0.83	257	0.92			
COMP IC1-A	10	3	280	180	0.64	220	0.79			
COMP IC1-A	10	4	280	215	0.77	251	0.90			
COMP IC1-A	10	5	280	235	0.84	254	0.91	0.78	0.89	0.06
COMP IC1-A	50	1	280	209	0.75	227	0.81			
COMP IC1-A	50	2	280	181	0.65	211	0.75			
COMP IC1-A	50	3	280	209	0.75	231	0.83			
COMP IC1-A	50	4	280	204	0.73	220	0.79			
COMP IC1-A	50	5	280	173	0.62	197	0.70	0.70	0.78	0.05
COMP IC1-A	100	1	280	223	0.80	244	0.87			
COMP IC1-A	100	2	280	221	0.79	256	0.91			
COMP IC1-A	100	3	280	216	0.77	241	0.86			
COMP IC1-A	100	4	280	191	0.68	225	0.80			
COMP IC1-A	100	5	280	241	0.86	268	0.96	0.78	0.88	0.06
COMP IC1-B	0	1	280	190	0.68	204	0.73			
COMP IC1-B	0	2	280	178	0.64	202	0.72			
COMP IC1-B	0	3	280	188	0.67	211	0.75			
COMP IC1-B	0	4	280	231	0.83	256	0.91			
COMP IC1-B	0	5	280	222	0.79	238	0.85	0.72	0.79	0.08
COMP IC1-B	10	1	280	215	0.77	241	0.86			
COMP IC1-B	10	2	280	209	0.75	225	0.80			
COMP IC1-B	10	3	280	211	0.75	242	0.86			
COMP IC1-B	10	4	280	213	0.76	235	0.84			
COMP IC1-B	10	5	280	210	0.75	228	0.81	0.76	0.83	0.03

TABLE I.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	Mean Stocking Density	Number Normal	Proportion Normal	Number Surviving	Proportion Surviving	Mean Proportion Normal	Mean Proportion Surviving	Standard Deviation (a)
COMP IC1-B	50	1	280	42	0.15	180	0.64			
COMP IC1-B	50	2	280	69	0.25	185	0.66			
COMP IC1-B	50	3	280	30	0.11	176	0.63			
COMP IC1-B	50	4	280	87	0.31	199	0.71			
COMP IC1-B	50	5	280	58	0.21	185	0.66	0.21	0.66	0.03
COMP IC1-B	100	1	280	0	0.00	114	0.41			
COMP IC1-B	100	2	280	0	0.00	227	0.81			
COMP IC1-B	100	3	280	0	0.00	152	0.54			
COMP IC1-B	100	4	280	0	0.00	213	0.76			
COMP IC1-B	100	5	280	0	0.00	203	0.73	0.00	0.65	0.17
COMP IC1-C	0	1	280	204	0.73	215	0.77			
COMP IC1-C	0	2	280	185	0.66	201	0.72			
COMP IC1-C	0	3	280	205	0.73	230	0.82			
COMP IC1-C	0	4	280	218	0.78	239	0.85			
COMP IC1-C	0	5	280	213	0.76	226	0.81	0.73	0.79	0.05
COMP IC1-C	10	1	280	191	0.68	220	0.79			
COMP IC1-C	10	2	280	201	0.72	221	0.79			
COMP IC1-C	10	3	280	214	0.76	226	0.81			
COMP IC1-C	10	4	280	210	0.75	228	0.81			
COMP IC1-C	10	5	280	202	0.72	226	0.81	0.73	0.80	0.01
COMP IC1-C	50	1	280	186	0.66	219	0.78			
COMP IC1-C	50	2	280	213	0.76	250	0.89			
COMP IC1-C	50	3	280	204	0.73	229	0.82			
COMP IC1-C	50	4	280	188	0.67	202	0.72			
COMP IC1-C	50	5	280	191	0.68	213	0.76	0.70	0.79	0.06
COMP IC1-C	100	1	280	132	0.47	213	0.76			
COMP IC1-C	100	2	280	108	0.39	200	0.71			
COMP IC1-C	100	3	280	127	0.45	218	0.78			
COMP IC1-C	100	4	280	130	0.46	256	0.91			
COMP IC1-C	100	5	280	132	0.47	230	0.82	0.45	0.80	0.08
R-OS	0	1	280	248	0.89	278	0.99			
R-OS	0	2	280	185	0.66	195	0.70			
R-OS	0	3	280	225	0.80	253	0.90			
R-OS	0	4	280	219	0.78	228	0.81			
R-OS	0	5	280	223	0.80	240	0.86	0.79	0.85	0.11

TABLE I.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	Mean Stocking Density	Number Normal	Proportion Normal	Number Surviving	Proportion Surviving	Mean Proportion Normal	Mean Proportion Surviving	Standard Deviation (a)
R-OS	10	1	280	213	0.76	237	0.85			
R-OS	10	2	280	202	0.72	216	0.77			
R-OS	10	3	280	211	0.75	232	0.83			
R-OS	10	4	280	198	0.71	206	0.74			
R-OS	10	5	280	177	0.63	219	0.78	0.71	0.79	0.04
R-OS	50	1	280	209	0.75	233	0.83			
R-OS	50	2	280	197	0.70	217	0.78			
R-OS	50	3	280	200	0.71	218	0.78			
R-OS	50	4	280	212	0.76	225	0.80			
R-OS	50	5	280	219	0.78	239	0.85	0.74	0.81	0.03
R-OS	100	1	280	214	0.76	241	0.86			
R-OS	100	2	280	198	0.71	217	0.78			
R-OS	100	3	280	180	0.64	193	0.69			
R-OS	100	4	280	199	0.71	226	0.81			
R-OS	100	5	280	221	0.79	247	0.88	0.72	0.80	0.08
Test 2										
COMP IC1-B Special	0	1	240	259	1.00 ^(b)	261	1.00 ^(b)			
COMP IC1-B Special	0	2	240	198	0.83	217	0.91			
COMP IC1-B Special	0	3	240	293	1.00 ^(b)	297	1.00 ^(b)			
COMP IC1-B Special	0	4	240	265	1.00 ^(b)	266	1.00 ^(b)			
COMP IC1-B Special	0	5	240	247	1.00 ^(b)	252	1.00 ^(b)	0.97	0.98	0.04
COMP IC1-B Special	10	1	240	228	0.95	229	0.96			
COMP IC1-B Special	10	2	240	232	0.97	233	0.97			
COMP IC1-B Special	10	3	240	253	1.00 ^(b)	258	1.00 ^(b)			
COMP IC1-B Special	10	4	240	241	1.00 ^(b)	242	1.00 ^(b)			
COMP IC1-B Special	10	5	240	252	1.00 ^(b)	253	1.00 ^(b)	0.98	0.99	0.02
COMP IC1-B Special	50	1	240	242	1.00 ^(b)	245	1.00 ^(b)			
COMP IC1-B Special	50	2	240	239	1.00	243	1.00 ^(b)			
COMP IC1-B Special	50	3	240	235	0.98	241	1.00 ^(b)			
COMP IC1-B Special	50	4	240	229	0.96	233	0.97			
COMP IC1-B Special	50	5	240	253	1.00 ^(b)	257	1.00 ^(b)	0.99	0.99	0.01

TABLE I.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	Mean Stocking Density	Number Normal	Proportion Normal	Number Surviving	Proportion Surviving	Mean Proportion Normal	Mean Proportion Surviving	Standard Deviation (a)
COMP IC1-B Special	100	1	240	3	0.01	29	0.12			
COMP IC1-B Special	100	2	240	1	0.00	39	0.16			
COMP IC1-B Special	100	3	240	0	0.00	94	0.39			
COMP IC1-B Special	100	4	240	1	0.00	64	0.27			
COMP IC1-B Special	100	5	240	0	0.00	74	0.31	0.00	0.25	0.11
COMP OC4-B	0	1	240	236	0.98	237	0.99			
COMP OC4-B	0	2	240	257	1.00 ^(b)	261	1.00 ^(b)			
COMP OC4-B	0	3	240	224	0.93	228	0.95			
COMP OC4-B	0	4	240	290	1.00 ^(b)	292	1.00 ^(b)			
COMP OC4-B	0	5	240	234	0.98	238	0.99	0.98	0.99	0.02
COMP OC4-B	10	1	240	194	0.81 ^(b)	195	0.81 ^(b)			
COMP OC4-B	10	2	240	255	1.00 ^(b)	257	1.00 ^(b)			
COMP OC4-B	10	3	240	235	0.98	237	0.99			
COMP OC4-B	10	4	240	229	0.96 ^(b)	230	0.96 ^(b)			
COMP OC4-B	10	5	240	245	1.00 ^(b)	248	1.00 ^(b)	0.95	0.95	0.08
COMP OC4-B	50	1	240	24	0.10	137	0.57			
COMP OC4-B	50	2	240	204	0.85	208	0.87			
COMP OC4-B	50	3	240	220	0.92	224	0.93			
COMP OC4-B	50	4	240	203	0.85	208	0.87			
COMP OC4-B	50	5	240	216	0.90	218	0.91	0.72	0.83	0.15
COMP OC4-B	100	1	240	37	0.15	139	0.58			
COMP OC4-B	100	2	240	206	0.86	220	0.92			
COMP OC4-B	100	3	240	18	0.08	174	0.73			
COMP OC4-B	100	4	240	165	0.69 ^(b)	202	0.84 ^(b)			
COMP OC4-B	100	5	240	292	1.00 ^(b)	297	1.00 ^(b)	0.56	0.81	0.16
R-AM	0	1	240	212	0.88	214	0.89			
R-AM	0	2	240	238	0.99	239	1.00			
R-AM	0	3	240	234	0.98	235	0.98			
R-AM	0	4	240	222	0.93	224	0.93			
R-AM	0	5	240	250	1.00 ^(b)	252	1.00 ^(b)	0.96	0.96	0.05
R-AM	10	1	240	231	0.96	231	0.96			
R-AM	10	2	240	234	0.98	237	0.99			
R-AM	10	3	240	240	1.00	244	1.00 ^(b)			
R-AM	10	4	240	227	0.95 ^(b)	234	0.98 ^(b)			
R-AM	10	5	240	252	1.00 ^(b)	254	1.00 ^(b)	0.98	0.99	0.02

OH INTENSIVE

1.5

TABLE I.1. (contd)

Sediment Treatment	Concentration (Percent SPP)	Replicate	Mean Stocking Density	Number Normal	Proportion Normal	Number Surviving	Proportion Surviving	Mean Proportion Normal	Mean Proportion Surviving	Standard Deviation (a)
R-AM	50	1	240	249	1.00 ^(b)	251	1.00 ^(b)			
R-AM	50	2	240	202	0.84	204	0.85			
R-AM	50	3	240	219	0.91	219	0.91			
R-AM	50	4	240	257	1.00 ^(b)	260	1.00 ^(b)			
R-AM	50	5	240	224	0.93	229	0.96	0.94	0.94	0.06
R-AM	100	1	240	211	0.88	211	0.88			
R-AM	100	2	240	234	0.98	237	0.99			
R-AM	100	3	240	216	0.90	219	0.91			
R-AM	100	4	240	248	1.00 ^(b)	249	1.00 ^(b)			
R-AM	100	5	240	205	0.86	212	0.88	0.92	0.93	0.05
R-BF	0	1	240	237	0.99	242	1.00 ^(b)			
R-BF	0	2	240	259	1.00 ^(b)	261	1.00 ^(b)			
R-BF	0	3	240	257	1.00 ^(b)	261	1.00 ^(b)			
R-BF	0	4	240	213	0.89	218	0.91			
R-BF	0	5	240	265	1.00 ^(b)	267	1.00 ^(b)	0.98	0.98	0.04
R-BF	10	1	240	233	0.97	236	0.98			
R-BF	10	2	240	255	1.00 ^(b)	256	1.00 ^(b)			
R-BF	10	3	240	251	1.00 ^(b)	252	1.00 ^(b)			
R-BF	10	4	240	219	0.91	221	0.92			
R-BF	10	5	240	204	0.85	206	0.86	0.95	0.95	0.06
R-BF	50	1	240	234	0.98	237	0.99			
R-BF	50	2	240	225	0.94	226	0.94			
R-BF	50	3	240	203	0.85	206	0.86			
R-BF	50	4	240	249	1.00 ^(b)	254	1.00 ^(b)			
R-BF	50	5	240	241	1.00 ^(b)	243	1.00 ^(b)	0.95	0.96	0.06
R-BF	100	1	240	214	0.89	215	0.90			
R-BF	100	2	240	219	0.91	222	0.93			
R-BF	100	3	240	261	1.00 ^(b)	265	1.00 ^(b)			
R-BF	100	4	240	228	0.95	230	0.96			
R-BF	100	5	240	250	1.00 ^(b)	254	1.00 ^(b)	0.95	0.96	0.05

(a) Standard deviation is based on proportion surviving.

(b) When number normal or number surviving exceeded the stocking density, a proportion normal and/or proportion survival of 1.00 was used for mean calculations and statistical analysis.

TABLE I.2. Water Quality Summary for 72-Hour Larval *M. edulis*
Suspended-Particulate-Phase Test, Oakland Harbor
Intensive Study

Sediment Treatment	Concentration (Percent SPP)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		14.0	18.0	7.30	8.30	4.0	NA ^(a)	29.0	33.0
Test 1									
COMP IC1-A	0	15.1	16.2	7.95	8.14	7.4	8.4	30.0	30.5
COMP IC1-A	10	15.1	16.2	7.94	8.16	7.1	8.5	30.0	31.0
COMP IC1-A	50	15.2	16.2	7.92	8.18	7.5	8.2	30.0	30.5
COMP IC1-A	100	15.2	16.2	7.88	8.18	7.4	7.9	30.0	31.0
COMP IC1-B	0	15.0	16.7	7.87	8.13	7.3	8.6	30.0	30.5
COMP IC1-B	10	15.0	16.4	7.77	8.20	7.4	8.4	30.0	30.5
COMP IC1-B	50	15.1	16.2	8.00	8.34 ^(b)	7.4	8.0	30.0	30.5
COMP IC1-B	100	15.0	16.2	8.24	8.49 ^(b)	6.4	8.0	29.5	30.5
COMP IC1-C	0	15.2	16.3	7.84	8.14	7.3	8.3	30.5	32.0
COMP IC1-C	10	15.3	16.2	7.92	8.19	7.4	8.4	30.5	32.0
COMP IC1-C	50	15.2	16.0	8.00	8.26	7.4	7.8	30.0	31.0
COMP IC1-C	100	15.2	16.1	8.16	8.35 ^(b)	6.3	7.9	30.0	31.0
R-OS	0	15.3	16.3	7.84	8.15	7.4	8.5	30.0	31.5
R-OS	10	15.3	16.4	7.95	8.17	7.2	8.4	30.0	31.0
R-OS	50	15.2	16.3	7.97	8.19	7.3	8.0	30.5	31.5
R-OS	100	15.2	16.3	8.02	8.22	6.6	7.9	30.0	31.5
Test 2									
COMP IC1-B Special	0	16.6	18.0	7.59	8.14	6.9	8.5	30.0	30.5
COMP IC1-B Special	10	16.6	17.9	7.68	8.17	7.1	8.6	30.5	31.0
COMP IC1-B Special	50	16.7	17.9	7.79	8.29 ^(b)	7.0	8.4	30.0	30.5
COMP IC1-B Special	100	16.7	17.8	7.89	8.40 ^(b)	6.9	7.4	30.0	30.5
COMP OC4-B	0	16.5	17.8	7.49	8.14	7.0	8.6	30.0	31.0
COMP OC4-B	10	16.4	17.8	7.53	8.17	7.0	8.6	30.0	31.0
COMP OC4-B	50	16.4	17.8	7.52	8.28 ^(b)	7.1	8.1	30.0	30.5
COMP OC4-B	100	16.4	17.8	7.42	8.38 ^(b)	6.5	7.5	30.0	31.0
R-AM	0	16.5	18.0	7.40	8.15	7.0	8.6	30.0	30.5
R-AM	10	16.5	18.0 ^(b)	7.49	8.16	7.1	8.6	30.0	31.0
R-AM	50	16.6	18.1 ^(b)	7.52	8.21	7.0	8.3	30.0	31.5
R-AM	100	16.7	18.1 ^(b)	7.61	8.25	7.1	8.3	30.0	31.5
R-BF	0	16.6	18.0	7.44	8.16	6.9	8.6	30.0	30.5
R-BF	10	16.5	18.0	7.37	8.17	7.0	8.6	30.5	31.0
R-BF	50	16.5	18.0	7.41	8.21	7.2	8.3	30.0	30.5
R-BF	100	16.5	18.0	7.30	8.27	7.1	8.0	30.0	31.5

(a) NA Not applicable.

(b) Data point out of range.

TABLE I.3. Test Results for All Replicates in 72-Hour Larval *M. edulis* Reference Toxicant Test, Oakland Harbor Intensive Study

Copper Concentration ($\mu\text{g/L}$)	Replicate	Mean Stocking Density	Number Normal	Proportion Normal	Number Surviving	Proportion Surviving	Mean Proportion Normal	Mean Proportion Surviving	Standard Deviation ^(a)
Test 1: COMP IC1-A, COMP IC1-B, COMP IC1-C and R-OS, SPP Testing									
0	1	280	209	0.75	231	0.83			
0	2	280	245	0.88	262	0.94			
0	3	280	206	0.74	225	0.80	0.79	0.86	0.07
3	1	280	221	0.79	252	0.90			
3	2	280	190	0.68	213	0.76			
3	3	280	206	0.74	226	0.81	0.74	0.82	0.07
9	1	280	3	0.01	182	0.65			
9	2	280	4	0.01	218	0.78			
9	3	280	11	0.04	177	0.63	0.02	0.69	0.08
30	1	280	0	0.00	58	0.21			
30	2	280	0	0.00	0	0.00			
30	3	280	0	0.00	16	0.06	0.00	0.09	0.11
100	1	280	0	0.00	0	0.00			
100	2	280	0	0.00	8	0.03			
100	3	280	0	0.00	0	0.00	0.00	0.01	0.02
Test 2: COMP IC1-B Special, COMP OC4-B, R-AM and R-BF, SPP Testing									
0	1	240	235	0.98	241	1.00 ^(b)			
0	2	240	222	0.93	229	0.96			
0	3	240	229	0.96	232	0.97	0.95	0.98	0.03
3	1	240	213	0.89	220	0.92			
3	2	240	233	0.97	235	0.98			
3	3	240	216	0.90	217	0.90	0.92	0.93	0.04
9	1	240	30	0.13	171	0.71			
9	2	240	69	0.29	205	0.86			
9	3	240	113	0.47	241	1.00 ^(b)	0.29	0.86	0.15
30	1	240	3	0.01	21	0.09			
30	2	240	0	0.00	0	0.00			
30	3	240	0	0.00	8	0.03	0.00	0.04	0.04

TABLE I.3. (contd)

<u>Copper Concentration ($\mu\text{g/L}$)</u>	<u>Replicate</u>	<u>Mean Stocking Density</u>	<u>Number Normal</u>	<u>Proportion Normal</u>	<u>Number Surviving</u>	<u>Proportion Surviving</u>	<u>Mean Proportion Normal</u>	<u>Mean Proportion Surviving</u>	<u>Standard (a) Deviation</u>
100	1	240	0	0.00	0	0.00			
100	2	240	0	0.00	0	0.00			
100	3	240	0	0.00	0	0.00	0.00	0.00	0.00

(a) Standard deviation is based on proportion surviving.

(b) When number normal or number surviving exceeded the stocking density, a proportion normal and/or proportion survival of 1.00 was used for mean calculations and statistical analysis.

TABLE I.4. Water Quality Summary for 72-Hour Larval *M. edulis*
Reference Toxicant Test, Oakland Inner Harbor
Intensive Study

Copper Concentration ($\mu\text{g/L}$)	Temperature ($^{\circ}\text{C}$)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	14.0	18.0	7.30	8.30	4.0	NA ^(a)	29.0	33.0
Test 1: COMP IC1-A, COMP IC1-B, COMP IC1-C and R-OS, SPP Testing								
0	15.3	16.7	7.48	8.06	7.6	8.4	30.0	31.0
3	15.4	16.6	7.80	8.05	7.7	8.4	30.0	30.5
9	15.3	16.6	7.76	8.06	7.6	8.4	30.0	31.0
30	15.3	16.6	7.50	8.08	7.8	8.4	30.0	31.0
100	15.4	16.6	7.94	8.07	7.6	8.3	30.0	31.0
Test 2: COMP IC1-B Special, COMP OC4-B, R-AM and R-BF, SPP Testing								
0	16.5	17.8	7.38	8.03	6.8	8.4	30.5	31.0
3	16.5	17.8	7.35	8.06	6.8	8.5	30.0	31.0
9	16.5	17.9	7.36	8.04	6.7	8.5	30.5	31.0
30	16.5	17.8	7.36	7.99	6.9	8.5	30.5	31.0
100	16.5	17.8	7.36	8.04	6.8	8.5	30.5	30.5

(a) NA Not applicable.

APPENDIX J

TISSUE CHEMISTRY AND QUALITY ASSURANCE DATA
FOR *MACOMA nasuta*

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH)
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Modified 8270	40% - 120%	≤30%	≤30%	20µg/kg

METHOD

Tissue samples were extracted with methylene chloride using a roller under ambient conditions following SOP MSL-042, Extraction and Clean-up of Tissue for Semivolatile Organics which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (Krahn et al. 1988). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) in the selected ion mode (SIM) following SOP MSL-M-043, Identification and Quantification of Polynuclear Aromatic Hydrocarbons by GC/MS which is based on EPA Method 8270 (EPA 1986).

HOLDING TIMES

Samples were received on 6/18/93 in good condition and placed into Battelle's log-in system and stored at approximately -20°C until extraction. Samples were extracted in two batches: 6/22-23/93 and 6/30/93. Extracts were analyzed by GC/MS on 7/13/93, within the established holding time of 40 days (EPA 1986).

DETECTION LIMITS

Target detection limits of 20 µg/kg wet weight were met for all PAH compounds. Actual detection limits, determined from multiplying the standard deviation of 7 spiked replicates by the student t-value, ranged from 1.0 µg/kg to 5.9 µg/kg.

METHOD BLANKS

Two method blanks were extracted with the tissue samples. Three out of 16 compounds were detected at levels well below the target detection limit in one of the two method blanks. Blank values for benzo(a)anthracene were slightly greater than 5 times the MDL; therefore, data associated with this blank were flagged with a "B" to indicate possible bias due to blank contamination.

SURROGATES

Five isotopically labeled compounds were added prior to extraction to assess the efficiency of the method. These were d8-naphthalene, d8-acenaphthene, d12-chrysene, d12-perylene and d14-dibenzo(a,h,i) anthracene. Recoveries of all surrogates were within the range of recovery limits of 40% to 120%.

QA/QC SUMMARY (contd)

MATRIX SPIKES

One sample from each batch was spiked with all PAH compounds. Matrix spike recoveries were within the range of recovery of 40% to 120% for all compounds with the exception of fluoranthene and pyrene from batch 1. Recoveries for these two compounds were 138% and 164%, respectively.

REPLICATES

One sample from each batch was extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs ranged from 0% to 12%, which is below the precision goal of $\leq 30\%$ indicating acceptable precision.

SRMs

The SRM 1974, a marine mussel tissue obtained by the National Institute of Standards and Technology, was analyzed with each batch. Five of the 16 PAH compounds analyzed are certified at levels above the MDLs. Of these, all compounds with the exception of benzo(b)fluoranthene, benzo(a)pyrene, and anthracene were detected within 30% of the certified mean. Benzo(b)fluoranthene often coelutes with other benzofluoranthenes which cannot be isolated by GC/MS alone. In fact, the certification provided by NIST for the benzofluoranthenes does not include the quantifications performed using MS. In light of this, the results of our SRM analyses are acceptable and indicate good accuracy.

Additional Note:

Some compounds are flagged to indicate that the ion ratio for that compound was outside of the QA/QC range. This is due primarily to low levels of the compound of interest. Because the confirmation ion is present at only a fraction of the level of the parent ion, the amount of error in the concentration measurement of the confirmation ion increases.

REFERENCES

Krahn et al. 1988. "New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants." NOAA Technical Memorandum NMFS F/NWC-153.

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA-955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Intensive Study
PARAMETER: Chlorinated Pesticides and PCB Aroclors
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Modified 8080	40% - 120%	≤30%	≤30%	2.0 - 30µg/kg

METHOD

Tissue samples were extracted with methylene chloride using a roller under ambient conditions following SOP MSL-M-079, "Extraction and Clean-up of Tissue for Semivolatile Organics following the Surrogate Internal Standard Method" based on EPA method 3510 and 8080 (EPA 1986) and NOAA status and trends methodology (Krahn et al. 1988). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were analyzed using gas chromatography/electron capture detection (GC/ECD) following SOP MSL-M-044, "Analysis of PCBs and Chlorinated Pesticides by GC/ECD" based on EPA Method 8080 (1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES

Samples were received on 6/18/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately -20°C until extraction. Samples were extracted in two batches: 6/22-23/93 and 6/30/93. Batch 1 extracts were analyzed by GC/ECD from 7/13-16/93 and batch 2 was analyzed from 7/17-20/93, within the established holding time of 40 days (EPA 1986).

DETECTION LIMITS

Target detection limits of 2 to 30 µg/kg wet weight for pesticides and 20 µg/kg wet weight for PCB Aroclors were met for all samples. Detection limits reported are based on an MDL study involving low level spikes of seven replicate extractions. The MDLs are defined as three times the standard deviation of the mean recovery.

METHOD BLANKS

Two method blanks were extracted with the tissue samples. No pesticides or PCBs were detected in the blank for either compound.

SURROGATES

Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Surrogate recoveries ranged from 46% to 95%, which is within the range of recovery of 40% to 120%.

MATRIX SPIKES

One sample from each batch was spiked with a subset of 16 pesticides. Matrix spike recoveries ranged from 46% to 121%. All recoveries were within the range from 40% to 120% with the exception of heptachlor epoxide in the spike from batch 2.

QA/QC SUMMARY (contd)

REPLICATES

One sample from each batch was extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. Only two pesticides, DDE and DDT, were detected in the replicates. The RSDs were 2% for both pesticides. No Aroclors were detected in any of the replicates; therefore, no RSD values were calculated for PCBs

SRMs

NOT APPLICABLE

Additional Note:

All pesticide and PCB detections are confirmed on a secondary column. Pesticides hits are confirmed if the values on both columns are less than or equal to 50% of one another and PCB Aroclor values are confirmed if the values on both columns are equal to 100% of one another. Note that the Aroclor detections are flagged with "E" to indicate that the values are estimates. PCB congener peaks are present; however, the pattern does not match well with any of the Aroclors. The closest match is with Aroclor 1254 and that is the Aroclor used to quantify the samples.

REFERENCES

Krahn et al. 1988. "New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants." NOAA Technical Memorandum NMFS F/NWC-153.

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA-955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Arsenic	XRF	NA	≤30%	≤20%	2.0
Cadmium	ICP/MS	75-125	≤30%	≤20%	0.1
Chromium	ICP/MS	75-125	≤30%	≤20%	1.0
Copper	XRF	NA	≤30%	≤20%	4.3
Lead	ICP/MS	75-125	≤30%	≤20%	1.0
Mercury	CVAA	75-125	≤30%	≤20%	0.01
Nickel	ICP/MS	75-125	≤30%	≤20%	1.0
Selenium	XRF	NA	≤30%	≤20%	01.0
Silver	ICP/MS	75-125	≤30%	≤20%	0.1
Zinc	XRF	NA	≤30%	≤20%	35

METHOD

A total of 10 metals was analyzed for the Oakland Intensive project: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se) and zinc (Zn). Four metals, As, Cu, Se, and Zn, were analyzed by energy diffusive x-ray fluorescence (XRF) following the method of Sanders (1992). Mercury was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Creclius (1983). Five metals, Cd, Cr, Pb, Ni and Ag, were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following SOP MSL-M-025, Metals and Trace Elements in Tissue by ICP/MS which is based on EPA Method 200.8 (EPA 1991).

HOLDING TIMES

Samples were received on 6/18/93 in good condition. Samples were placed into Battelle's log-in system, frozen to -80°C, and subsequently freeze dried within approximately 7 days of sample receipt. Samples were all analyzed within 180 days of collection. The following table summarizes all analysis dates:

<u>Task</u>	<u>Date Performed</u>
Sample Digestion	7/20/93
XRF Analysis	7/20/93
ICP/MS	7/28/93
CVAA (Hg)	7/26/93

DETECTION LIMITS Target detection limits were met for all metals.

QA/QC SUMMARY (contd)

- METHOD BLANKS** One method blank was analyzed for Ag, Cd, Cr, Hg, Ni and Pb. Levels detected were well below the target detection limits; therefore, no data was flagged and no corrective actions were taken. All ICP/MS and CVAA results are blank corrected. Method blanks are not analyzed by XRF; therefore, no blank results are reported for XRF metals.
- MATRIX SPIKES** Three samples were spiked with Ag, Cd, Cr, Hg, Ni and Pb. Matrix spike recoveries ranged from 73% to 157%. All recoveries were within the range of recovery of 75% to 125% with the exception of Cr at 157% in one of the three spiked samples and Ni at 73% in another of the three spikes. Samples for XRF are analyzed whole and cannot be spiked.
- REPLICATES** Three samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs ranged from 1% to 65%. The majority of metals was within the precision limits of $\pm 20\%$, with the exception of Ag in all three triplicates, Cd in two sets of triplicates, and Cr, Ni and Se in one of the triplicates.
- SRMs** The SRM 1566a (Oyster tissue from the National Institute of Standards and Technology), was analyzed for all metals. Results for all metals were within $\pm 30\%$ of mean certified value, indicating acceptable accuracy.

REFERENCES

- Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Marine Chemistry* 21:337-390.
- EPA (U.S. Environmental Protection Agency). 1991. *Methods for the Determination of Metals in Environmental Samples*. EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch.
- Sanders, R.W. 1990. *Procedures and Quality Control for Energy Dispersive X-Ray Fluorescence Spectroscopy Using the BFP Approach with the Kevex 0810A System*. PNL SOP #7-40.48, Battelle, Pacific Northwest Laboratory, Richland, Washington.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Unger et al.	40% - 120%	≤30%	≤30%	10 ng/g

METHOD Butyltin analyses were performed according to the method of Unger et al. (1986). Samples were homogenized prior to extraction using a Teckmar Tissuemizer. Tissue samples were extracted with methylene chloride using a roller under ambient conditions followed by derivatization using a Grignard reagent to change to a form compatible with gas chromatography. Sample extracts were then cleaned by passing through a florisil column. Extracts were analyzed using gas chromatography/flame photometric detection (GC/FPD).

HOLDING TIMES Samples were received on 6/18/93 in good condition. Samples were placed into Battelle's log-in system and stored at approximately -20°C until extraction. Ten samples were archived upon instructions from the project manager. A total of 44 samples was extracted in two batches: 6/21/93 and 6/29/93. Extracts were analyzed by GC/FPD 6/29/93 and 7/8/93.

DETECTION LIMITS Target detection limits of 10 ug/kg wet weight were met for all butyltin compounds. These detection limits represent the limit of quantitation (LOQ) defined as 10 times the standard deviation of results from seven replicate low level matrix spikes.

METHOD BLANKS Three method blanks were extracted with the tissue samples. No di- or tributyltins were detected in the blanks.

SURROGATES One compound, triphenyltin chloride, is added prior to extraction to assess the efficiency of the method. This compound also is used as an internal standard as all data is corrected for the recovery of the compound. Sample recoveries ranged from 87% to 125%, which is within the range of recovery of 40% to 120%, with the exception of one sample with a recovery of 125%.

MATRIX SPIKES One sample from each batch was spiked with mono-, di- and tributyltin. Matrix spike recoveries ranged from 99% to 104% for the tri and dibutyltins. The recovery for monobutyltin ranged from 56% to 64% also within the QC limits. These recoveries are within the range of recovery of 40% to 120%.

QA/QC SUMMARY (contd)

REPLICATES

One sample from each batch was extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs were 7% and 3% for tributyltin. No di- or monobutyltins were detected in any of the replicates; therefore, no RSDs were calculated.

SRMs

Not Applicable

REFERENCES

Unger, M.A., W.G. Macintyre, J. Reaves and R.J. Huggett. 1986. "GC Determination of Butyltins in Natural Waters by Flame Photometric Detection of Hexyl Derivatives with Mass Spectrometric Confirmation." *Chemosphere*. 15(4):461-470.

TABLE J.1. Total Detected Polynuclear Aromatic Hydrocarbons (PAHs), Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PAHs ($\mu\text{g/kg}$ dry weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP IC1-A	1	2	13.4	45	157	202
COMP IC1-A	2	1	12.8	47	195	242
COMP IC1-A	3	1	13.5	37	81	118
COMP IC1-A	4	1	13.1	38	92	130
COMP IC1-A	5	2	13.3	53	180	233
COMP IC1-B	1	2	14.5	41	83	124
COMP IC1-B	2	1	14.6	301	96	397
COMP IC1-B	3	1	14.0	21	114	135
COMP IC1-B	4	2	14.8	34	142	176
COMP IC1-B	5	1	14.1	35	156	191
COMP IC1-B Special Replicate 1	1	1	13.8	43	268	311
COMP IC1-B Special Replicate 2	1	1	13.8	51	290	341
COMP IC1-B Special Replicate 3	1	1	13.8	51	254	305
COMP IC1-B Special	2	1	13.8	43	283	326
COMP IC1-B Special	3	1	13.9	43	245	288
COMP IC1-B Special	4	2	15.3	39	268	307
COMP IC1-B Special	5	1	14.0	136	307	443
COMP IC1-C	1	2	15.7	83	306	389
COMP IC1-C	2	2	14.8	41	291	332
COMP IC1-C	3	2	15.2	39	243	282
COMP IC1-C	4	1	13.7	51	307	358
COMP IC1-C	5	1	14.4	35	264	299
COMP OC4-B	1	2	13.1	92	504	596
COMP OC4-B	2	1	12.3	106	699	805
COMP OC4-B	3	2	14.7	88	673	761
COMP OC4-B	4	1	13.2	45	485	530
COMP OC4-B	5	2	15.1	93	589	682
R-AM	1	1	14.7	136	1136	1272
R-AM Replicate 1	2	2	13.9	245	1914	2159
R-AM Replicate 2	2	2	13.9	252	1942	2194
R-AM Replicate 3	2	2	13.9	259	1914	2173
R-AM	3	1	14.0	50	2171	2221
R-AM	4	1	14.9	81	430	511
R-AM	5	2	14.9	134	1161	1295
R-BF	1	1	15.2	99	579	678
R-BF	2	2	15.4	117	604	721
R-BF	3	1	14.8	88	574	662
R-BF	4	1	15.8	120	576	696
R-BF	5	1	16.0	88	538	626
R-OS	1	2	12.9	47	194	241
R-OS	2	2	13.1	76	176	252
R-OS	3	2	14.3	42	147	189
R-OS	4	1	13.8	43	159	202
R-OS	5	NA ^(a)	NA	NI ^(b)	NI	NI

TABLE J.1. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PAHs ($\mu\text{g}/\text{kg}$ dry weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
<i>M. nasuta</i> Background	1	2	14.1	43	184	227
<i>M. nasuta</i> Background	2	2	15.6	71	244	315
<i>M. nasuta</i> Background	3	2	14.8	68	162	230
<i>M. nasuta</i> Background	4	2	15.8	44	177	221
<i>M. nasuta</i> Background	5	2	14.5	48	193	241

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE J.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ dry weight)					
				Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
COMP IC1-A	1	2	13.4	21.42 ^(a)	12.24 U ^(b)	11.64 U	20.52 U	24.78 ^(a)	33.28 U
COMP IC1-A	2	1	12.8	23.05 ^(a)	12.81 U	12.19 U	21.48 U	22.34 ^(a)	34.84 U
COMP IC1-A	3	1	13.5	18.74 ^(a)	12.15 U	11.56 U	20.37 U	21.93 ^(a)	33.04 U
COMP IC1-A	4	1	13.1	20.15 ^(a)	12.52 U	11.91 U	20.99 U	20.46 ^(a)	34.05 U
COMP IC1-A	5	2	13.3	22.93 ^(a)	12.33 U	11.73 U	20.68 U	26.77 ^(a)	33.53 U
COMP IC1-B	1	2	14.5	20.76 ^(a)	11.31 U	10.76 U	18.97 U	19.86 ^(a)	30.76 U
COMP IC1-B	2	1	14.6	18.63 ^(a)	11.23 U	10.68 U	18.84 U	17.88 ^(a)	30.55 U
COMP IC1-B	3	1	14.0	27.07 ^(a)	11.71 U	11.14 U	19.64 U	21.00 ^(a)	31.86 U
COMP IC1-B	4	2	14.8	17.91 ^(a)	11.08 U	10.54 U	18.58 U	19.12 ^(a)	30.14 U
COMP IC1-B	5	1	14.1	19.57 ^(a)	11.63 U	11.06 U	19.50 U	18.09 ^(a)	31.63 U
COMP IC1-B Special	Replicate 1	1	13.8	20.87 ^(a)	11.88 U	11.30 U	19.93 U	24.28 ^(a)	32.32 U
COMP IC1-B Special	Replicate 2	1	13.8	23.26 ^(a)	11.88 U	11.30 U	19.93 U	25.00 ^(a)	32.32 U
COMP IC1-B Special	Replicate 3	1	13.8	23.91 ^(a)	11.88 U	11.30 U	19.93 U	23.62 ^(a)	32.32 U
COMP IC1-B Special	2	1	13.8	21.01 ^(a)	11.88 U	11.30 U	19.93 U	19.35 ^(a)	32.32 U
COMP IC1-B Special	3	1	13.9	20.36 ^(a)	11.80 U	11.22 U	19.78 U	21.29 ^(a)	32.09 U
COMP IC1-B Special	4	2	15.3	17.52 ^(a)	10.72 U	10.20 U	17.97 U	21.90 ^(a)	29.15 U
COMP IC1-B Special	5	1	14.0	24.57 ^(a)	11.71 U	11.14 U	32.00 ^(a)	28.86	46.36 ^(a)
COMP IC1-C	1	2	15.7	19.49 ^(a)	10.45 U	9.94 U	17.52 U	21.02 ^(a)	43.12 ^(a)
COMP IC1-C	2	2	14.8	19.19 ^(a)	11.08 U	10.54 U	18.58 U	22.09 ^(a)	30.14 U
COMP IC1-C	3	2	15.2	19.67 ^(a)	10.79 U	10.26 U	18.09 U	19.67 ^(a)	29.34 U
COMP IC1-C	4	1	13.7	24.53 ^(a)	11.97 U	11.39 U	20.07 U	27.15 ^(a)	32.55 U
COMP IC1-C	5	1	14.4	18.40 ^(a)	11.39 U	10.83 U	19.10 U	18.75 ^(a)	30.97 U
COMP OC4-B	1	2	13.1	19.39 ^(a)	12.52 U	11.91 U	20.99 U	22.82 ^(a)	46.49 ^(a)
COMP OC4-B	2	1	12.3	25.85 ^(a)	13.33 U	12.68 U	22.36 U	27.15 ^(a)	54.55 ^(a)
COMP OC4-B	3	2	14.7	20.27 ^(a)	11.16 U	10.61 U	18.71 U	26.19	43.33 ^(a)
COMP OC4-B	4	1	13.2	20.76 ^(a)	12.42 U	11.82 U	20.83 U	23.86 ^(a)	33.79 U
COMP OC4-B	5	2	15.1	21.79 ^(a)	10.86 U	10.33 U	18.21 U	23.64 ^(a)	45.89 ^(a)
R-AM	1	1	14.7	17.21 ^(a)	11.16 U	10.61 U	24.90	40.75	49.46
R-AM Replicate 1	2	2	13.9	25.83 ^(a)	16.55 ^(a)	11.22 U	34.82 ^(a)	90.6	79.9
R-AM Replicate 2	2	2	13.9	21.58 ^(a)	17.48 ^(a)	11.22 U	35.54	92.8	83.5
R-AM Replicate 3	2	2	13.9	24.17 ^(a)	20.58 ^(a)	11.22 U	37.41 ^(a)	92.8	80.6
R-AM	3	1	14.0	30.07 ^(a)	19.43 ^(a)	11.14 U	44.29 ^(a)	124.3	99.3
R-AM	4	1	14.9	19.62 ^(a)	11.02 U	10.48 U	18.48 U	21.10 ^(a)	41.26 ^(a)
R-AM	5	2	14.9	20.74 ^(a)	11.01 U	10.47 U	18.46 U	51.48	60.13 ^(a)

TABLE J.2. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)					
				Naphtha- lene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
R-BF	1	1	15.2	24.74 ^(a)	10.79 U	10.26 U	18.09 U	25.26 ^(a)	46.84 ^(a)
R-BF	2	2	15.4	19.22 ^(a)	10.65 U	10.13 U	26.49	28.31	42.08 ^(a)
R-BF	3	1	14.8	18.24 ^(a)	11.08 U	10.54 U	18.58 U	25.07	43.11 ^(a)
R-BF	4	1	15.8	19.37 ^(a)	10.38 U	9.87 U	26.33	30.95	42.47 ^(a)
R-BF	5	1	16.0	20.81 ^(a)	10.25 U	9.75 U	17.19 U	25.44	43.19 ^(a)
R-OS	1	2	12.9	22.09 ^(a)	12.71 U	12.09 U	21.32 U	22.56 ^(a)	34.57 U
R-OS	2	2	13.1	21.30 ^(a)	12.52 U	11.91 U	32.75 ^(a)	22.92 ^(a)	34.05 U
R-OS	3	2	14.3	18.88 ^(a)	11.47 U	10.91 U	19.23 U	21.26 ^(a)	31.19 U
R-OS	4	1	13.8	23.48 ^(a)	11.88 U	11.30 U	19.93 U	20.14 ^(a)	32.32 U
R-OS	5	NA ^(c)	NA	NI ^(d)	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	14.1	19.79 ^(a)	11.63 U	11.06 U	19.50 U	21.28 ^(a)	31.63 U
<i>M. nasuta</i> Background	2	2	15.6	19.10 ^(a)	10.51 U	10.00 U	28.14 ^(a)	20.90	28.59 U
<i>M. nasuta</i> Background	3	2	14.8	19.05 ^(a)	11.08 U	10.54 U	26.62 ^(a)	19.73 ^(a)	30.14 U
<i>M. nasuta</i> Background	4	2	15.8	21.33 ^(a)	10.38 U	9.87 U	17.41 U	20.13	28.23 U
<i>M. nasuta</i> Background	5	2	14.5	21.59 ^(a)	11.31 U	10.76 U	18.97 U	25.52	30.76 U

(a) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE J.3. High Molecular Weight Polynuclear Hydrocarbons (HPAHs), (Elution Order Fluoranthene - Benzo(b)fluoranthene), Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)				
				Fluor-anthene	Pyrene	Benzo(a) anthra-cene	Chrysene	Benzo(b) fluor-anthene
COMP IC1-A	1	2	13.4	41.94 ^(a)	17.61 U ^(b)	52.91 B ^{(c)(a)}	9.78 U	58.81
COMP IC1-A	2	1	12.8	42.97 ^(a)	18.44 U	50.31 B ^(a)	10.63 ^(a)	62.27 ^(a)
COMP IC1-A	3	1	13.5	36.89 ^(a)	17.48 U	43.04 B ^(a)	9.70 U	4.15 U
COMP IC1-A	4	1	13.1	41.30 ^(a)	18.02 U	52.29 B ^(a)	10.00 U	4.27 ^(a)
COMP IC1-A	5	2	13.3	41.65	17.74 U	48.87 B ^(a)	9.85 U	58.65 ^(a)
COMP IC1-B	1	2	14.5	35.31 ^(a)	16.28 U	43.93 B ^(a)	9.03 U	3.86 U
COMP IC1-B	2	1	14.6	32.74 ^(a)	16.16 U	41.78 B ^(a)	8.97 U	3.84 U
COMP IC1-B	3	1	14.0	38.93 ^(a)	16.86 U	49.00 B ^(a)	9.36 U	4.00 U
COMP IC1-B	4	2	14.8	32.43 ^(a)	15.95 U	39.80 B ^(a)	8.85 U	47.57 ^(a)
COMP IC1-B	5	1	14.1	34.75 ^(a)	16.74 U	42.41 B ^(a)	9.29 U	50.21 ^(a)
COMP IC1-B Special Replicate 1	1	1	13.8	44.35 ^(a)	17.10 U ^(a)	47.90 B ^(a)	11.45 ^(a)	71.67
COMP IC1-B Special Replicate 2	1	1	13.8	42.90	21.30 ^(a)	47.68 B ^(a)	11.74 ^(a)	72.5
COMP IC1-B Special Replicate 3	1	1	13.8	42.54 ^(a)	17.10 U	50.14 B ^(a)	9.49 ^(a)	71.23
COMP IC1-B Special	2	1	13.8	38.26 ^(a)	17.10 U	44.49 B ^(a)	10.94 ^(a)	68.12
COMP IC1-B Special	3	1	13.9	40.22	18.78	45.47 B ^(a)	9.42 ^(a)	64.32
COMP IC1-B Special	4	2	15.3	39.41	18.17 ^(a)	44.05 B ^(a)	9.41 ^(a)	63.01
COMP IC1-B Special	5	1	14.0	53.43	30.21	51.64 B ^(a)	14.07 ^(a)	75.0
COMP IC1-C	1	2	15.7	46.56	40.96	49.24 B ^(a)	17.52 ^(a)	70.7
COMP IC1-C	2	2	14.8	41.76 ^(a)	39.39	45.54 B ^(a)	11.69 ^(a)	68.2
COMP IC1-C	3	2	15.2	34.34 ^(a)	33.16	46.25 B ^(a)	8.62 U	59.08
COMP IC1-C	4	1	13.7	45.04	42.04	59.56 B ^(a)	9.56 U	72.04
COMP IC1-C	5	1	14.4	37.64 ^(a)	39.44 ^(a)	48.82 B ^(a)	9.10 U	63.89
COMP OC4-B	1	2	13.1	77.9	163.4	54.89 B	27.02	90.8
COMP OC4-B	2	1	12.3	87.0	159.3	65.37 B	32.28	111.4
COMP OC4-B	3	2	14.7	98.6	217.7	59.46 B	37.35	104.8
COMP OC4-B	4	1	13.2	75.00	141.7	56.36 B	28.86	93.2
COMP OC4-B	5	2	15.1	80.8	157.6	55.96 B	28.81	96.0
R-AM	1	1	14.7	217.0	325.2	83.7 B	124.5	127.9
R-AM Replicate 1	2	2	13.9	395.0	623.7	148.2 B	189.9	187.8
R-AM Replicate 2	2	2	13.9	393.5	634.5	154.0 B	193.5	192.1
R-AM Replicate 3	2	2	13.9	396.4	624.5	151.8 B	195.0	187.8

TABLE J.3. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)				
				Fluor- anthene	Pyrene	Benzo(a) anthra- cene	Chrysene	Benzo(b) fluor- anthene
R-AM	3	1	14.0	426.4	625.7	195.0 B	243.6	223.6
R-AM	4	1	14.9	69.9	124.3	50.07 B	24.87	84.0
R-AM	5	2	14.9	197.3	265.1	109.4 B	140.3	153.7
R-BF	1	1	15.2	90.8	72.4	58.55 B	35.00	107.2
R-BF	2	2	15.4	107.8	86.4	57.66 B	38.96	107.1
R-BF	3	1	14.8	108.1	91.2 ^(a)	56.69 B	34.93	100.7
R-BF	4	1	15.8	105.7	84.2 ^(a)	60.00 B	38.54	105.7
R-BF	5	1	16.0	90.0	73.1	57.88 B	22.00	98.1
R-OS	1	2	12.9	42.87 ^(a)	18.29 U	50.16 B ^(a)	10.39 ^(a)	60.70 ^(a)
R-OS	2	2	13.1	38.40 ^(a)	18.02 U	43.97 B ^(a)	9.31	53.97
R-OS	3	2	14.3	35.24	16.50 U	41.33 B ^(a)	9.16 U	49.37 ^(a)
R-OS	4	1	13.8	35.29 ^(a)	17.10 U	42.75 B	9.49 U	50.87 ^(a)
R-OS	5	NA ^(d)	NA	NI ^(e)	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	14.1	49.79	16.74 U	44.96 B ^(a)	9.79 ^(a)	51.77 ^(a)
<i>M. nasuta</i> Background	2	2	15.6	52.31	15.13 U	44.29 B ^(a)	14.81	55.00
<i>M. nasuta</i> Background	3	2	14.8	42.70	15.95 U	39.66 B	10.54 ^(a)	48.24 ^(a)
<i>M. nasuta</i> Background	4	2	15.8	45.38	14.94 U	42.72 B ^(a)	10.76 ^(a)	51.65 ^(a)
<i>M. nasuta</i> Background	5	2	14.5	55.72	16.28 U	45.10 B ^(a)	9.10 ^(a)	55.72 ^(a)

(a) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(b) U Undetected above given concentration.

(c) B Analyte detected in blank at >5 times MDL.

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE J.4. High Molecular Weight Polynuclear Hydrocarbons (HPAHs), (Elution Order Benzo(k) fluoranthene - Benzo(g,h,i)-Perylene) Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)				
				Benzo(k) fluoranthene	Benzo(a)-pyrene	Indeno-(1,2,3-cd) pyrene	Dibenzo-(a,h) anthracene	Benzo-(g,h,i) perylene
COMP IC1-A	1	2	13.4	12.31 U ^(a)	11.79 U ^(b)	40.52 U	43.66 U	36.12 U
COMP IC1-A	2	1	12.8	12.89 U	26.02 ^(b)	42.42 U	45.70 U	37.81 U
COMP IC1-A	3	1	13.5	12.22 U	11.70 U	40.22 U	43.33 U	35.85 U
COMP IC1-A	4	1	13.1	12.60 U	12.06 U ^(b)	41.45 U	44.66 U	36.95 U
COMP IC1-A	5	2	13.3	12.41 U	31.65 ^(b)	40.83 U	43.98 U	36.39 U
COMP IC1-B	1	2	14.5	11.38 U	10.90 U ^(b)	37.45 U	40.34 U	33.38 U
COMP IC1-B	2	1	14.6	11.30 U	20.62 ^(b)	37.19 U	40.07 U	33.15 U
COMP IC1-B	3	1	14.0	11.79 U	28.79 ^(b)	38.79 U	41.79 U	34.57 U
COMP IC1-B	4	2	14.8	11.15 U	23.92 ^(b)	36.69 U	39.53 U	32.70 U
COMP IC1-B	5	1	14.1	11.70 U	27.16	38.51 U	41.49 U	34.33 U
COMP IC1-B Special Replicate 1	1	1	13.8	56.01 ^(b)	33.12	39.35 U	42.39 U	35.07 U
COMP IC1-B Special Replicate 2	1	1	13.8	56.38 ^(b)	33.55 ^(b)	39.35 U	42.39 U	35.07 U
COMP IC1-B Special Replicate 3	1	1	13.8	55.87 ^(b)	30.51 ^(b)	39.35 U	42.39 U	35.07 U
COMP IC1-B Special	2	1	13.8	51.45 ^(b)	32.46 ^(b)	38.70	42.39 U	35.07 U
COMP IC1-B Special	3	1	13.9	50.29 ^(b)	26.76 ^(b)	39.06 U	42.09 U	34.82 U
COMP IC1-B Special	4	2	15.3	50.39 ^(b)	26.80 ^(b)	19.54	38.24 U	31.63 U
COMP IC1-B Special	5	1	14.0	56.57 ^(b)	29.14 ^(b)	38.79 U	41.79 U	34.57 U
COMP IC1-C	1	2	15.7	51.91 ^(b)	26.50 ^(b)	34.59 U	37.26 U	30.83 U
COMP IC1-C	2	2	14.8	52.43 ^(b)	31.15	36.69 U	39.53 U	32.70 U
COMP IC1-C	3	2	15.2	45.33 ^(b)	25.00	35.72 U	38.49 U	31.84 U
COMP IC1-C	4	1	13.7	56.42 ^(b)	31.24 ^(b)	39.64 U	42.70 U	35.33 U
COMP IC1-C	5	1	14.4	48.33	27.71 ^(b)	37.71 U	40.63 U	33.61 U
COMP OC4-B	1	2	13.1	60.08	27.02 ^(b)	41.45 U	44.66 U	36.95 U
COMP OC4-B	2	1	12.3	71.30	66.50 ^(b)	53.98	47.56 U	47.64
COMP OC4-B	3	2	14.7	59.46	57.01	36.94 U	39.80 U	38.91
COMP OC4-B	4	1	13.2	60.08	28.18 ^(b)	41.14 U	44.32 U	36.67 U
COMP OC4-B	5	2	15.1	60.33	49.07	19.60	38.74 U	38.34
R-AM	1	1	14.7	64.8	98.0	48.30	39.80 U	46.39
R-AM Replicate 1	2	2	13.9	92.1	139.6	63.09	42.09 U	71.9
R-AM Replicate 2	2	2	13.9	93.5	144.6	69.21	42.09 U	70.36
R-AM Replicate 3	2	2	13.9	92.1	140.3	59.57	42.09 U	69.57

TABLE J.4. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ dry weight)				
				Benzo(k) fluor- anthene	Benzo(a)- pyrene	Indeno- (1,2,3- cd) pyrene	Dibenzo- (a,h) anthra- cene	Benzo- (g,h,i) perylene
R-AM	3	1	14.0	102.9	186.4	83.6	41.79 U	84.3
R-AM	4	1	14.9	53.49	24.60 ^(b)	36.49 U	39.31 U	32.53 U
R-AM	5	2	14.9	79.9	111.4	48.99	39.26 U	57.11
R-BF	1	1	15.2	63.42	53.22	43.36	38.49 U	54.08
R-BF	2	2	15.4	59.03	54.09	42.40	37.99 U	53.25
R-BF	3	1	14.8	58.45	23.04 ^(b)	49.80	39.53 U	50.00
R-BF	4	1	15.8	58.67	23.16 ^(b)	44.11	37.03 U	52.78
R-BF	5	1	16.0	59.13	47.13	41.81	36.56 U	49.56
R-OS	1	2	12.9	12.79 U	32.02 ^(b)	42.09 U	45.35 U	37.52 U
R-OS	2	2	13.1	12.60 U	27.86 ^(b)	41.45 U	44.66 U	36.95 U
R-OS	3	2	14.3	11.54 U	21.68 ^(b)	37.97 U	40.91 U	33.85 U
R-OS	4	1 ^(c)	13.8	11.96 U	27.25	39.35 U	42.39 U	35.07 U
R-OS	5	NA ^(c)	NA	NI ^(d)	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	14.1	11.70 U	26.74 ^(b)	38.51 U	41.49 U	34.33 U
<i>M. nasuta</i> Background	2	2	15.6	47.31 ^(b)	26.54 ^(b)	34.81 U	37.50 U	31.03 U
<i>M. nasuta</i> Background	3	2	14.8	11.15 U	19.59 ^(b)	36.69 U	39.53 U	32.70 U
<i>M. nasuta</i> Background	4	2	15.8	10.44 U	26.01 ^(b)	34.37 U	37.03 U	30.63 U
<i>M. nasuta</i> Background	5	2	14.5	11.38 U	29.17 ^(b)	37.45 U	40.34 U	33.38 U

(a) U Undetected above given concentration.

(b) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE J.5. Total Detected Polynuclear Aromatic Hydrocarbons (PAHs), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PAHs ($\mu\text{g/kg}$ wet weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP IC1-A	1	2	6	21	27
COMP IC1-A	2	1	6	25	31
COMP IC1-A	3	1	5	11	16
COMP IC1-A	4	1	5	12	17
COMP IC1-A	5	2	7	24	31
COMP IC1-B	1	2	6	12	18
COMP IC1-B	2	1	44	14	58
COMP IC1-B	3	1	3	16	19
COMP IC1-B	4	2	5	21	26
COMP IC1-B	5	1	5	22	27
COMP IC1-B Special Replicate 1	1	1	6	37	43
COMP IC1-B Special Replicate 2	1	1	7	40	47
COMP IC1-B Special Replicate 3	1	1	7	35	42
COMP IC1-B Special	2	1	6	39	45
COMP IC1-B Special	3	1	6	34	40
COMP IC1-B Special	4	2	6	41	47
COMP IC1-B Special	5	1	19	43	62
COMP IC1-C	1	2	13	48	61
COMP IC1-C	2	2	6	43	49
COMP IC1-C	3	2	6	37	43
COMP IC1-C	4	1	7	42	49
COMP IC1-C	5	1	5	38	43
COMP OC4-B	1	2	12	66	78
COMP OC4-B	2	1	13	86	99
COMP OC4-B	3	2	13	99	112
COMP OC4-B	4	1	6	64	70
COMP OC4-B	5	2	14	89	103
R-AM	1	1	20	167	187
R-AM Replicate 1	2	2	34	266	300
R-AM Replicate 2	2	2	35	270	305
R-AM Replicate 3	2	2	36	266	302
R-AM	3	1	7	304	311
R-AM	4	1	12	64	76
R-AM	5	2	20	173	193
R-BF	1	1	15	88	103
R-BF	2	2	18	93	111
R-BF	3	1	13	85	98
R-BF	4	1	19	91	110
R-BF	5	1	14	86	100
R-OS	1	2	6	25	31
R-OS	2	2	10	23	33
R-OS	3	2	6	21	27
R-OS	4	1	6	22	28
R-OS	5	NA ^(a)	NI ^(b)	NI	NI

TABLE J.5. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PAHs ($\mu\text{g}/\text{kg}$ wet weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
<i>M. nasuta</i> Background	1	2	6	26	32
<i>M. nasuta</i> Background	2	2	11	38	49
<i>M. nasuta</i> Background	3	2	10	24	34
<i>M. nasuta</i> Background	4	2	7	28	35
<i>M. nasuta</i> Background	5	2	7	28	35

(a) NA No data.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE J.6. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)					Anthracene
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	
Target DL ^(a)			20	20	20	20	20	20
Achieved DL			1.01	1.64	1.56	2.75	1.30	4.46
COMP IC1-A	1	2	2.87 ^(b)	1.64 U ^(c)	1.56 U	2.75 U	3.32 ^(b)	4.46 U
COMP IC1-A	2	1	2.95 ^(b)	1.64 U	1.56 U	2.75 U	2.86 ^(b)	4.46 U
COMP IC1-A	3	1	2.53 ^(b)	1.64 U	1.56 U	2.75 U	2.96 ^(b)	4.46 U
COMP IC1-A	4	1	2.64 ^(b)	1.64 U	1.56 U	2.75 U	2.68 ^(b)	4.46 U
COMP IC1-A	5	2	3.05 ^(b)	1.64 U	1.56 U	2.75 U	3.56 ^(b)	4.46 U
COMP IC1-B	1	2	3.01 ^(b)	1.64 U	1.56 U	2.75 U	2.88 ^(b)	4.46 U
COMP IC1-B	2	1	2.72 ^(b)	1.64 U	1.56 U	2.75 U	2.61 ^(b)	4.46 U
COMP IC1-B	3	1	3.79 ^(b)	1.64 U	1.56 U	2.75 U	2.94 ^(b)	4.46 U
COMP IC1-B	4	2	2.65 ^(b)	1.64 U	1.56 U	2.75 U	2.83 ^(b)	4.46 U
COMP IC1-B	5	1	2.76 ^(b)	1.64 U	1.56 U	2.75 U	2.55 ^(b)	4.46 U
COMP IC1-B Special	Replicate 1	1	2.88 ^(b)	1.64 U	1.56 U	2.75 U	3.35 ^(b)	4.46 U
COMP IC1-B Special	Replicate 2	1	3.21 ^(b)	1.64 U	1.56 U	2.75 U	3.45 ^(b)	4.46 U
COMP IC1-B Special	Replicate 3	1	3.30 ^(b)	1.64 U	1.56 U	2.75 U	3.26 ^(b)	4.46 U
COMP IC1-B Special	2	1	2.90 ^(b)	1.64 U	1.56 U	2.75 U	2.67 ^(b)	4.46 U
COMP IC1-B Special	3	1	2.83 ^(b)	1.64 U	1.56 U	2.75 U	2.96 ^(b)	4.46 U
COMP IC1-B Special	4	2	2.68 ^(b)	1.64 U	1.56 U	2.75 U	3.35 ^(b)	4.46 U
COMP IC1-B Special	5	1	3.44 ^(b)	1.64 U	1.56 U	4.48 ^(b)	4.04	6.49 ^(b)
COMP IC1-C	1	2	3.06 ^(b)	1.64 U	1.56 U	2.75 U	3.30 ^(b)	6.77 ^(b)
COMP IC1-C	2	2	2.84 ^(b)	1.64 U	1.56 U	2.75 U	3.27 ^(b)	4.46 U
COMP IC1-C	3	2	2.99 ^(b)	1.64 U	1.56 U	2.75 U	2.99 ^(b)	4.46 U
COMP IC1-C	4	1	3.36 ^(b)	1.64 U	1.56 U	2.75 U	3.72 ^(b)	4.46 U
COMP IC1-C	5	1	2.65 ^(b)	1.64 U	1.56 U	2.75 U	2.70 ^(b)	4.46 U
COMP OC4-B	1	2	2.54 ^(b)	1.64 U	1.56 U	2.75 U	2.99 ^(b)	6.09 ^(b)
COMP OC4-B	2	1	3.18 ^(b)	1.64 U	1.56 U	2.75 U	3.34 ^(b)	6.71 ^(b)
COMP OC4-B	3	2	2.98 ^(b)	1.64 U	1.56 U	2.75 U	3.85 ^(b)	6.37 ^(b)
COMP OC4-B	4	1	2.74 ^(b)	1.64 U	1.56 U	2.75 U	3.15 ^(b)	4.46 U
COMP OC4-B	5	2	3.29 ^(b)	1.64 U	1.56 U	2.75 U	3.57 ^(b)	6.93 ^(b)
R-AM	1	1	2.53 ^(b)	1.64 U	1.56 U	3.66 ^(b)	5.99	7.27
R-AM Replicate 1	2	2	3.59 ^(b)	2.30 ^(b)	1.56 U	4.84 ^(b)	12.6	11.1
R-AM Replicate 2	2	2	3.00 ^(b)	2.43 ^(b)	1.56 U	4.94 ^(b)	12.9	11.6
R-AM Replicate 3	2	2	3.36 ^(b)	2.86 ^(b)	1.56 U	5.20 ^(b)	12.9	11.2
R-AM	3	1	4.21 ^(b)	2.72 ^(b)	1.56 U	6.20 ^(b)	17.4	13.9
R-AM	4	1	2.92 ^(b)	1.64 U	1.56 U	2.75 U	3.14 ^(b)	6.14 ^(b)
R-AM	5	2	3.09 ^(b)	1.64 U	1.56 U	2.75 U	7.67	8.96 ^(b)
R-BF	1	1	3.76 ^(b)	1.64 U	1.56 U	2.75 U	3.84 ^(b)	7.12 ^(b)
R-BF	2	2	2.96 ^(b)	1.64 U	1.56 U	4.08	4.36	6.48 ^(b)
R-BF	3	1	2.70 ^(b)	1.64 U	1.56 U	2.75 U	3.71	6.38 ^(b)
R-BF	4	1	3.06 ^(b)	1.64 U	1.56 U	4.16	4.89	6.71 ^(b)
R-BF	5	1	3.33 ^(b)	1.64 U	1.56 U	2.75 U	4.07	6.91 ^(b)
R-OS	1	2	2.85 ^(b)	1.64 U	1.56 U	2.75 U	2.91 ^(b)	4.46 U
R-OS	2	2	2.79 ^(b)	1.64 U	1.56 U	4.29 ^(b)	2.99 ^(b)	4.46 U
R-OS	3	2	2.70 ^(b)	1.64 U	1.56 U	2.75 U	3.04 ^(b)	4.46 U
R-OS	4	1	3.24 ^(b)	1.64 U	1.56 U	2.75 U	2.78 ^(b)	4.46 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI	NI

TABLE J.6. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
			Naphtha- lene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
<i>M. nasuta</i> Background	1	2	2.79 ^(b)	1.64 U	1.56 U	2.75 U	3.00 ^(b)	4.46 U
<i>M. nasuta</i> Background	2	2	2.98 ^(b)	1.64 U	1.56 U	4.39 ^(b)	3.26	4.46 U
<i>M. nasuta</i> Background	3	2	2.82 ^(b)	1.64 U	1.56 U	3.94 ^(b)	2.92 ^(b)	4.46 U
<i>M. nasuta</i> Background	4	2	3.37 ^(b)	1.64 U	1.56 U	2.75 U	3.18	4.46 U
<i>M. nasuta</i> Background	5	2	3.13 ^(b)	1.64 U	1.56 U	2.75 U	3.70	4.46 U

- (a) DL Detection limit.
 (b) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.
 (c) U Undetected above given concentration.
 (d) NA Not applicable.
 (e) NI No information; insufficient sediment to test all five replicates.

TABLE J.7. High Molecular Weight Polynuclear Hydrocarbons (HPAHs), (Elution Order Fluoranthene - Benzo(b)fluoranthene), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)				
			Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene
Target DL (a)			20	20	20	20	20
Achieved DL			3.29	2.36	1.11	1.31	0.56
COMP IC1-A	1	2	5.62 (b)	2.36 U (c)	7.09 B (d) (b)	1.31 (b)	7.88 (b)
COMP IC1-A	2	1	5.50 (b)	2.36 U	6.44 B (b)	1.36 (b)	7.97 (b)
COMP IC1-A	3	1	4.98 (b)	2.36 U	5.81 B (b)	1.31 U	0.56 U
COMP IC1-A	4	1	5.41 (b)	2.36 U	6.85 B (b)	1.31 U	0.56 (b)
COMP IC1-A	5	2	5.54	2.36 U	6.50 B (b)	1.31 U	7.80 (b)
COMP IC1-B	1	2	5.12 (b)	2.36 U	6.37 B (b)	1.31 U	0.56 U
COMP IC1-B	2	1	4.78 (b)	2.36 U	6.10 B (b)	1.31 U	0.56 U
COMP IC1-B	3	1	5.45 (b)	2.36 U	6.86 B (b)	1.31 U	0.56 (b)
COMP IC1-B	4	2	4.80 (b)	2.36 U	5.89 B (b)	1.31 U	7.04 (b)
COMP IC1-B	5	1	4.90 (b)	2.36 U	5.98 B (b)	1.31 U	7.08 (b)
COMP IC1-B Special Replicate 1	1	1	6.12 (b)	2.36 (b)	6.61 B (b)	1.58 (b)	9.89
COMP IC1-B Special Replicate 2	1	1	5.92 (b)	2.94 (b)	6.58 B (b)	1.62 (b)	10.0
COMP IC1-B Special Replicate 3	1	1	5.87 (b)	2.36 U	6.92 B (b)	1.31 (b)	9.83
COMP IC1-B Special	2	1	5.28 (b)	2.36 U	6.14 B (b)	1.51 (b)	9.40
COMP IC1-B Special	3	1	5.59	2.61 (b)	6.32 B (b)	1.31 (b)	8.94
COMP IC1-B Special	4	2	6.03	2.78 (b)	6.74 B (b)	1.44 (b)	9.64
COMP IC1-B Special	5	1	7.48	4.23	7.23 B (b)	1.97 (b)	10.5
COMP IC1-C	1	2	7.31 (b)	6.43	7.73 B (b)	2.75 (b)	11.1
COMP IC1-C	2	2	6.18 (b)	5.83	6.74 B (b)	1.73 (b)	10.1
COMP IC1-C	3	2	5.22 (b)	5.04	7.03 B (b)	1.31 U	8.98
COMP IC1-C	4	1	6.17 (b)	5.76 (b)	8.16 B (b)	1.31 U	9.87
COMP IC1-C	5	1	5.42 (b)	5.68 (b)	7.03 B (b)	1.31 U	9.20
COMP OC4-B	1	2	10.2	21.4	7.19 B	3.54	11.9
COMP OC4-B	2	1	10.7	19.6	8.04 B	3.97	13.7
COMP OC4-B	3	2	14.5	32.0	8.74 B	5.49	15.4
COMP OC4-B	4	1	9.90	18.7	7.44 B	3.81	12.3
COMP OC4-B	5	2	12.2	23.8	8.45 B	4.35	14.5

TABLE J.7. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)				
			Fluor- anthene	Pyrene	Benzo(a) anthra- cene	Chrysene	Benzo(b) fluor- anthene
R-AM	1	1	31.9	47.8	12.3 B	18.3	18.8
R-AM Replicate 1	2	2	54.9	86.7	20.6 B	26.4	26.1
R-AM Replicate 2	2	2	54.7	88.2	21.4 B	26.9	26.7
R-AM Replicate 3	2	2	55.1	86.8	21.1 B	27.1	26.1
R-AM	3	1	59.7	87.6	27.3 B	34.1	31.3
R-AM	4	1	10.4	18.5	7.45 B	3.70	12.5
R-AM	5	2	29.4	39.5	16.3 B	20.9	22.9
R-BF	1	1	13.8	11.0	8.90 B	5.32	16.3
R-BF	2	2	16.6	13.3	8.88 B	6.00	16.5
R-BF	3	1	16.0	13.5 ^(b)	8.39 B	5.17	14.9
R-BF	4	1	16.7	13.3 ^(b)	9.48 B	6.09	16.7
R-BF	5	1	14.4	11.7	9.26 B	3.52	15.7
R-OS	1	2	5.53 ^(b)	2.36 U	6.47 B ^(b)	1.34 ^(b)	7.83 ^(b)
R-OS	2	2	5.03 ^(b)	2.36 U	5.76 B ^(b)	1.22	7.07
R-OS	3	2	5.04	2.36 U	5.91 B ^(b)	1.31 U	7.06 ^(b)
R-OS	4	1	4.87 ^(b)	2.36 U	5.90 B	1.31 U	7.02 ^(b)
R-OS	5	NA ^(e)	NI ^(f)	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	7.02	2.36 U	6.34 B ^(b)	1.38 ^(b)	7.30 ^(b)
<i>M. nasuta</i> Background	2	2	8.16	2.36 U	6.91 B ^(b)	2.31	8.58
<i>M. nasuta</i> Background	3	2	6.32	2.36 U	5.87 B	1.56 ^(b)	7.14 ^(b)
<i>M. nasuta</i> Background	4	2	7.17	2.36 U	6.75 B ^(b)	1.70 ^(b)	8.16 ^(b)
<i>M. nasuta</i> Background	5	2	8.08	2.36 U	6.54 B ^(b)	1.32 ^(b)	8.08 ^(b)

(a) DL Detection limit.

(b) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(c) U Undetected above given concentration.

(d) B Analyte detected in blank at >5 times MDL.

(e) NA Not applicable.

(f) NI No information; insufficient sediment to test all five replicates.

TABLE J.8. High Molecular Weight Polynuclear Hydrocarbons (HPAHs), (Elution Order Benzo(k) fluoranthene - Benzo(g,h,i)perylene), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
			Benzo(k) fluoranthene	Benzo(a) Pyrene	Indeno-(1,2,3-cd) pyrene	Dibenzo-(a,h) anthracene	Benzo-(g,h,i) perylene
Target DL ^(a)			20	20	20	20	20
Achieved DL			1.65	1.58	5.43	5.85	4.84
COMP IC1-A	1	2	1.65 U ^(b)	1.58 U ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-A	2	1	1.65 U	3.33 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-A	3	1	1.65 U	1.58 U	5.43 U	5.85 U	4.84 U
COMP IC1-A	4	1	1.65 U	1.58 U ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-A	5	2	1.65 U	4.21 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B	1	2	1.65 U	1.58 U ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B	2	1	1.65 U	3.01 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B	3	1	1.65 U	4.03 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B	4	2	1.65 U	3.54 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B	5	1	1.65 U	3.83	5.43 U	5.85 U	4.84 U
COMP IC1-B Special Replicate 1	1	1	7.73 ^(c)	4.57	5.43 U	5.85 U	4.84 U
COMP IC1-B Special Replicate 2	1	1	7.78 ^(c)	4.63	5.43 U	5.85 U	4.84 U
COMP IC1-B Special Replicate 3	1	1	7.71 ^(c)	4.21 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B Special	2	1	7.10 ^(c)	4.48	5.34	5.85 U	4.84 U
COMP IC1-B Special	3	1	6.99 ^(c)	3.72 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-B Special	4	2	7.71 ^(c)	4.10 ^(c)	2.99	5.85 U	4.84 U
COMP IC1-B Special	5	1	7.92 ^(c)	4.08 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-C	1	2	8.15 ^(c)	4.16 ^(c)	5.43 U	5.85 U	4.84 U
COMP IC1-C	2	2	7.76 ^(c)	4.61	5.43 U	5.85 U	4.84 U
COMP IC1-C	3	2	6.89 ^(c)	3.80	5.43 U	5.85 U	4.84 U
COMP IC1-C	4	1	7.73 ^(c)	4.28	5.43 U	5.85 U	4.84 U
COMP IC1-C	5	1	6.96	3.99 ^(c)	5.43 U	5.85 U	4.84 U
COMP OC4-B	1	2	7.87	3.54 ^(c)	5.43 U	5.85 U	4.84 U
COMP OC4-B	2	1	8.77	8.18 ^(c)	6.64	5.85 U	5.86
COMP OC4-B	3	2	8.74	8.38	5.43 U	5.85 U	5.72
COMP OC4-B	4	1	7.93	3.72 ^(c)	5.43 U	5.85 U	4.84 U
COMP OC4-B	5	2	9.11	7.41	2.96	5.85 U	5.79

TABLE J.8. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)				
			Benzo(k) fluor- anthene	Benzo(a) Pyrene	Indeno- (1,2,3- cd) pyrene	Dibenzo- (a,h) anthra- cene	Benzo- (g,h,i) perylene
R-AM	1	1	9.52	14.4	7.10	5.85 U	6.82
R-AM Replicate 1	2	2	12.8	19.4	8.77	5.85 U	10.0
R-AM Replicate 2	2	2	13.0	20.1	9.62	5.85 U	9.78
R-AM Replicate 3	2	2	12.8	19.5	8.28	5.85 U	9.67
R-AM	3	1	14.4	26.1	11.7	5.85 U	11.8
R-AM	4	1	7.96	3.66 ^(c)	5.43 U	5.85 U	4.84 U
R-AM	5	2	11.9	16.6	7.30	5.85 U	8.51
R-BF	1	1	9.64	8.09	6.59	5.85 U	8.22
R-BF	2	2	9.09	8.33	6.53	5.85 U	8.20
R-BF	3	1	8.65	3.41 ^(c)	7.37	5.85 U	7.40
R-BF	4	1	9.27	3.66 ^(c)	6.97	5.85 U	8.34
R-BF	5	1	9.46	7.54	6.69	5.85 U	7.93
R-OS	1	2	1.65 U	4.13	5.43 U	5.85 U	4.84 U
R-OS	2	2	1.65 U	3.65 ^(c)	5.43 U	5.85 U	4.84 U
R-OS	3	2	1.65 U	3.10 ^(c)	5.43 U	5.85 U	4.84 U
R-OS	4	1	1.65 U	3.76	5.43 U	5.85 U	4.84 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	1.65 U	3.77 ^(c)	5.43 U	5.85 U	4.84 U
<i>M. nasuta</i> Background	2	2	7.38 ^(c)	4.14 ^(c)	5.43 U	5.85 U	4.84 U
<i>M. nasuta</i> Background	3	2	1.65 U	2.90 ^(c)	5.43 U	5.85 U	4.84 U
<i>M. nasuta</i> Background	4	2	1.65 U	4.11 ^(c)	5.43 U	5.85 U	4.84 U
<i>M. nasuta</i> Background	5	2	1.65 U	4.23 ^(c)	5.43 U	5.85 U	4.84 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE J.9. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

			<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Analytical Batch</u>	<u>Naphthalene</u>	<u>Acenaphthylene</u>	<u>Acenaphthene</u>	<u>Fluorene</u>	<u>Phenanthrene</u>	<u>Anthracene</u>
<u>Method Blanks</u>								
Blank		1	1.88 ^(a)	1.64 U ^(b)	1.56 U	2.75 U	2.18 ^(a)	4.46 U
Blank		2	1.83 ^(a)	1.64 U	1.56 U	2.75 U	1.30 U	4.46 U
<u>Matrix Spikes</u>								
COMP OC4-B	2	1	3.18 ^(a)	1.64 U	1.56 U	2.75 U	3.34 ^(a)	6.71 ^(a)
COMP OC4-B MS	2	1	61.0	55.7	59.6	60.2	69.7	53.8
Concentration Recovered			57.8	55.7	59.6	60.2	66.4	47.1
Amount Spiked			61.4	58.8	63.4	60.8	61.1	46.3
Percent Recovery			94%	95%	94%	99%	109%	102%
<i>M. nasuta</i> Background	2	2	2.98 ^(a)	1.64 U	1.56 U	4.39 ^(a)	3.26	4.46 U
<i>M. nasuta</i> Background MS	2	2	66.9	62.4	65.2	67.9	69.7	57.2
Concentration Recovered			63.9	62.4	65.2	63.5	66.4	57.2
Amount Spiked			65.5	62.8	67.7	64.9	65.3	49.4
Percent Recovery			98%	99%	96%	98%	102%	116%
<u>Standard Reference Material</u>								
Certified Value SRM 1974			NC ^(c)	NC	NC	NC	5.6	0.75
			NC	NC	NC	NC	± 1.4	± 0.21
SRM 1974		1	NA ^(d)	NA	NA	NA	6.38	6.76 ^{(a)(e)}
SRM 1974		2	NA	NA	NA	NA	6.66	7.16 ^{(a)(e)}
<u>Analytical Replicates</u>								
COMP IC1-B Special Replicate 1	1	1	2.88 ^(a)	1.64 U	1.56 U	2.75 U	3.35 ^(a)	4.46 U
COMP IC1-B Special Replicate 2	1	1	3.21 ^(a)	1.64 U	1.56 U	2.75 U	3.45 ^(a)	4.46 U
COMP IC1-B Special Replicate 3	1	1	3.30 ^(a)	1.64 U	1.56 U	2.75 U	3.26 ^(a)	4.46 U
RSD			7%	NA	NA	NA	3%	NA
R-AM Replicate 1	2	2	3.59 ^(a)	2.30 ^(a)	1.56 U	4.84 ^(a)	12.6	11.1
R-AM Replicate 2	2	2	3.00 ^(a)	2.43 ^(a)	1.56 U	4.94 ^(a)	12.9	11.6
R-AM Replicate 3	2	2	3.36 ^(a)	2.86 ^(a)	1.56 U	5.20 ^(a)	12.9	11.2
RSD			9%	12%	NA	4%	1%	2%

(a) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(b) U Undetected above given concentration.

(c) NC Not certified.

(d) NA Not applicable.

(e) Value outside SRM range for certified value.

TABLE J.10. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution order Fluoranthene - Benzo(b)fluoranthene), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

			<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
Sediment Treatment	Replicate	Analytical Batch	Fluor-anthene	Pyrene	Benzo(a) anthra-cene	Chrysene	Benzo(b) fluor-anthene
<u>Method Blanks</u>							
Blank		1	3.29 U ^(a)	2.36 U	6.05 ^(b)	1.31 U	0.56 U
Blank		2	3.29 U	2.36 U	6.13 ^(b)	1.31 U	0.56 U
<u>Matrix Spikes</u>							
COMP OC4-B	2	1	10.7	19.6	8.04 B ^(c)	3.97	13.7
COMP OC4-B MS	2	1	95.3	120	73.7	75.4	86.5
Concentration Recovered			84.6	100.4	65.7	71.4	72.8
Amount Spiked			61.4	61.4	61.4	61.4	61.4
Percent Recovery			138% ^(d)	164% ^(d)	107%	116%	119%
<i>M. nasuta</i> Background	2	2	8.16	2.36 U	6.91 B ^(b)	2.31	8.58
<i>M. nasuta</i> Background MS	2	2	81.1	69.8	73.1	62.6	75.6
Concentration Recovered			72.9	69.8	66.2	60.3	67.0
Amount Spiked			65.5	65.4	56.7	65.7	65.5
Percent Recovery			111%	107%	117%	92%	102%
<u>Standard Reference Material</u>							
Certified Value SRM 1974			33.6 ± 5.8	34.1 ± 3.7	NC ^(e) NC	NC NC	6.5 ± 1.2
SRM 1974		1	36.9	30.8	NA ^(f)	NA	13.8 ^(g)
SRM 1974		2	39.9	32.1	NA	NA	13.7 ^(g)
<u>Analytical Replicates</u>							
COMP IC1-B Special Replicate 1	1	1	6.12 ^(b)	2.36 U ^(b)	6.61 B ^(b)	1.58 ^(b)	9.89
COMP IC1-B Special Replicate 2	1	1	5.92 ^(b)	2.94 ^(b)	6.58 B ^(b)	1.62 ^(b)	10.0
COMP IC1-B Special Replicate 3	1	1	5.87 ^(b)	2.36 U	6.92 B ^(b)	1.31 U	9.83
RSD			2%	NA	3%	NA	1%
R-AM Replicate 1	2	2	54.9	86.7	20.6 B	26.4	26.1
R-AM Replicate 2	2	2	54.7	88.2	21.4 B	26.9	26.7
R-AM Replicate 3	2	2	55.1	86.8	21.1 B	27.1	26.1
RSD			0%	1%	2%	1%	1%

(a) U Undetected above given concentration.

(b) Ratio of confirmation ion to primary ion is outside of the theoretical ratio of 20% established for EPA-CLP programs.

(c) B Analyte detected in blank at >5 times MDL.

(d) Value exceeds quality control range of (40% to 120%).

(e) NC Not certified.

(f) NA Not applicable.

(g) Value outside SRM range for certified value.

TABLE J.11. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution order Benzo(k) fluoranthene - Benzo(g,h,i)perylene), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

			<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
Sediment Treatment	Replicate	Analytical Batch	Benzo(k) fluoranthene	Benzo(a)-Pyrene	Indeno (1,2,3-cd) pyrene	Dibenzo-(a,h) anthracene	Benzo-(g,h,i) perylene
<u>Method Blanks</u>							
Blank		1	1.65 U ^(a)	1.58 U	5.43 U	5.85 U	4.84 U
Blank		2	1.65 U	1.58 U	5.43 U	5.85 U	4.84 U
<u>Matrix Spikes</u>							
COMP OC4-B	2	1	8.77	8.18 ^(b)	6.64	5.85 U	5.86
COMP OC4-B MS	2	1	64.3	70.0	58.9	40.6	54.5
Concentration Recovered			55.5	61.8	52.3	40.6	48.6
Amount Spiked			61.4	61.4	61.4	61.4	61.4
Percent Recovery			90%	101%	85%	66%	79%
<i>M. nasuta</i> Background	2	2	7.38 ^(b)	4.14 ^(b)	5.43 U	5.85 U	4.84 U
<i>M. nasuta</i> Background MS	2	2	64.8	57.0	65.4	49.6	59.3
Concentration Recovered			57.4	52.9	65.4	49.6	59.3
Amount Spiked			65.0	58.9	57.9	49.0	58.3
Percent Recovery			88%	90%	113%	101%	102%
<u>Standard Reference Material</u>							
Certified Value SRM 1974			NC ^(c)	2.29	1.80	NC	2.47
			NC	± 0.47	± 0.33	NC	± 0.28
SRM 1974		1	NA ^(d)	3.26 ^{(a)(e)}	5.43 U	NA	4.84 U
SRM 1974		2	NA	3.33 ^{(a)(e)}	5.43 U	NA	4.84 U
<u>Analytical Replicates</u>							
COMP IC1-B Special Replicate 1	1	1	7.73 ^(b)	4.57	5.43 U	5.85 U	4.84 U
COMP IC1-B Special Replicate 2	1	1	7.78 ^(b)	4.63 ^(b)	5.43 U	5.85 U	4.84 U
COMP IC1-B Special Replicate 3	1	1	7.71 ^(b)	4.21 ^(b)	5.43 U	5.85 U	4.84 U
RSD			0%	5%	NA	NA	NA
R-AM Replicate 1	2	2	12.8	19.4	8.77	5.85 U	10.0
R-AM Replicate 2	2	2	13.0	20.1	9.62	5.85 U	9.78
R-AM Replicate 3	2	2	12.8	19.5	8.28	5.85 U	9.67
RSD			1%	2%	8%	NA	2%

(a) U Undetected above given concentration.

(b) Ratio of confirmation ion to primary ion is outside of the theoretical ration of 20% established for EPA-CLP programs.

(c) NC Not certified.

(d) NA Not applicable.

(e) Value outside SRM range for certified value.

TABLE J.12. Surrogate Percent Recoveries for Polynuclear Aromatic Hydrocarbons (PAHs), Including Quality Control Data, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

			Surrogate Percent Recoveries					Dibenzo- (a,h,i) Anthracene
Sediment Treatment	Replicate	Analytical Batch	Naphtha- lene d8	Acenaph- thene d10	Chrysene d12	Perylene d12	d14	
COMP IC1-A	1	2	67	73	78	74	80	
COMP IC1-A	2	1	66	70	79	73	83	
COMP IC1-A	3	1	66	71	76	71	74	
COMP IC1-A	4	1	61	64	72	66	79	
COMP IC1-A	5	2	57	67	78	69	77	
COMP IC1-B	1	2	59	63	68	66	71	
COMP IC1-B	2	1	62	65	74	65	77	
COMP IC1-B	3	1	65	70	84	74	90	
COMP IC1-B	4	2	67	75	83	77	81	
COMP IC1-B	5	1	62	67	72	68	72	
COMP IC1-B Special	Replicate 1	1	65	68	74	69	75	
COMP IC1-B Special	Replicate 2	1	64	70	77	69	78	
COMP IC1-B Special	Replicate 3	1	60	65	69	64	76	
COMP IC1-B Special		2	65	69	80	66	76	
COMP IC1-B Special		3	63	67	75	69	75	
COMP IC1-B Special		4	63	68	75	71	77	
COMP IC1-B Special		5	65	70	79	72	80	
COMP IC1-C	1	2	65	71	74	68	61	
COMP IC1-C	2	2	65	71	81	74	81	
COMP IC1-C	3	2	58	64	70	65	68	
COMP IC1-C	4	1	64	71	75	71	73	
COMP IC1-C	5	1	58	63	71	62	68	
COMP OC4-B	1	2	70	76	83	77	83	
COMP OC4-B	2	1	58	62	75	64	73	
COMP OC4-B	3	2	68	75	82	72	80	
COMP OC4-B	4	1	58	63	68	62	71	
COMP OC4-B	5	2	60	68	80	74	81	
R-AM	1	1	63	68	81	69	82	
R-AM Replicate 1	2	2	59	68	75	71	75	
R-AM Replicate 2	2	2	56	67	76	69	73	
R-AM Replicate 3	2	2	63	68	78	71	77	
R-AM	3	1	70	74	89	74	89	
R-AM	4	1	64	67	78	68	81	
R-AM	5	2	59	68	81	72	80	
R-BF	1	1	53	57	63	57	61	
R-BF	2	2	69	75	84	74	79	
R-BF	3	1	71	76	83	79	89	
R-BF	4	1	58	64	77	65	77	
R-BF	5	1	65	71	84	77	79	
R-OS	1	2	65	71	80	76	82	
R-OS	2	2	64	70	81	74	79	
R-OS	3	2	70	76	86	76	85	
R-OS	4	1	61	68	78	74	80	
R-OS	5	NA ^(a)	NI ^(b)	NI	NI	NI	NI	

TABLE J.12. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries				
			Naphthalene d8	Acenaphthene d10	Chrysene d12	Perylene d12	Dibenzo-(a,h,i) Anthracene d14
<i>M. nasuta</i> Background	1	2	63	71	75	75	74
<i>M. nasuta</i> Background	2	2	66	73	78	75	75
<i>M. nasuta</i> Background	3	2	64	71	76	72	77
<i>M. nasuta</i> Background	4	2	61	69	77	74	75
<i>M. nasuta</i> Background	5	2	62	68	74	71	74

Quality Control DataMethod Blanks

Blank	1	70	71	84	83	86
Blank	2	77	79	85	85	87

Matrix Spikes

COMP OC4-B MS	2	1	63	67	81	68	84
<i>M. nasuta</i> Background MS	2	2	66	73	80	76	77

Analytical Replicates

COMP IC1-B Special Replicate 1	1	1	65	68	74	69	75
COMP IC1-B Special Replicate 2	1	1	64	70	77	69	78
COMP IC1-B Special Replicate 3	1	1	60	65	69	64	76
R-AM Replicate 1	2	2	59	68	75	71	75
R-AM Replicate 2	2	2	56	67	76	69	73
R-AM Replicate 3	2	2	63	68	78	71	77

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE J.13. Chlorinated Pesticides (alphabetical, Aldrin - 4,4' DDT), Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

				<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
COMP IC1-A	1	2	13.4	1.34 U ^(a)	3.73 U	3.73 U	3.73 U	1.79 U	224 U	3.51 U	1.04 U	3.28 U
COMP IC1-A	2	1	12.8	1.41 U	3.91 U	3.91 U	3.91 U	1.88 U	234 U	3.67 U	1.09 U	3.44 U
COMP IC1-A	3	1	13.5	1.33 U	3.70 U	3.70 U	3.70 U	1.78 U	222 U	8.07	1.04 U	3.26 U
COMP IC1-A	4	1	13.1	1.37 U	3.82 U	3.82 U	3.82 U	1.83 U	229 U	8.85	1.07 U	3.36 U
COMP IC1-A	5	2	13.3	1.35 U	3.76 U	3.76 U	3.76 U	1.80 U	226 U	8.87	1.05 U	3.31 U
COMP IC1-B	1	2	14.5	1.24 U	3.45 U	3.45 U	3.45 U	1.66 U	207 U	3.24 U	0.97 U	3.03 U
COMP IC1-B	2	1	14.6	1.23 U	3.42 U	3.42 U	3.42 U	1.64 U	205 U	3.22 U	0.96 U	3.01 U
COMP IC1-B	3	1	14.0	1.29 U	3.57 U	3.57 U	3.57 U	1.71 U	214 U	3.36 U	1.00 U	3.14 U
COMP IC1-B	4	2	14.8	1.22 U	3.38 U	3.38 U	3.38 U	1.62 U	203 U	3.18 U	0.95 U	2.97 U
COMP IC1-B	5	1	14.1	1.28 U	3.55 U	3.55 U	3.55 U	1.70 U	213 U	8.51	8.23	3.12 U
COMP IC1-B Special Replicate 1	1	1	13.8	1.30 U	3.62 U	3.62 U	3.62 U	1.74 U	217 U	3.41 U	7.90	3.19 U
COMP IC1-B Special Replicate 2	1	1	13.8	1.30 U	3.62 U	3.62 U	3.62 U	1.74 U	217 U	8.04	7.54	9.13
COMP IC1-B Special Replicate 3	1	1	13.8	1.30 U	3.62 U	3.62 U	3.62 U	1.74 U	217 U	3.41 U	1.01 U	3.19 U
COMP IC1-B Special	2	1	13.8	1.30 U	3.62 U	3.62 U	3.62 U	1.74 U	217 U	3.41 U	6.88	3.19 U
COMP IC1-B Special	3	1	13.9	1.29 U	3.60 U	3.60 U	3.60 U	1.73 U	216 U	3.38 U	15.04	6.83
COMP IC1-B Special	4	2	15.3	1.18 U	3.27 U	3.27 U	3.27 U	1.57 U	196 U	3.07 U	6.54	2.88 U
COMP IC1-B Special	5	1	14.0	1.29 U	3.57 U	3.57 U	3.57 U	1.71 U	214 U	3.36 U	1.00 U	3.14 U
COMP IC1-C	1	2	15.7	1.15 U	3.18 U	3.18 U	3.18 U	1.53 U	191 U	2.99 U	7.01	6.37
COMP IC1-C	2	2	14.8	1.22 U	3.38 U	3.38 U	3.38 U	1.62 U	203 U	7.77	7.23	2.97 U
COMP IC1-C	3	2	15.2	1.18 U	3.29 U	3.29 U	3.29 U	1.58 U	197 U	3.09 U	6.97	2.89 U
COMP IC1-C	4	1	13.7	1.31 U	3.65 U	3.65 U	3.65 U	1.75 U	219 U	8.76	1.17	3.21 U
COMP IC1-C	5	1	14.4	1.25 U	3.47 U	3.47 U	3.47 U	1.67 U	208 U	3.26 U	0.97 U	7.01
COMP OC4-B	1	2	13.1	1.37 U	3.82 U	3.82 U	3.82 U	1.83 U	229 U	12.60	15.50	12.37
COMP OC4-B	2	1	12.3	1.46 U	4.07 U	4.07 U	4.07 U	1.95 U	244 U	14.47	17.40	14.39
COMP OC4-B	3	2	14.7	1.22 U	3.40 U	3.40 U	3.40 U	1.63 U	204 U	14.76	18.37	14.22
COMP OC4-B	4	1	13.2	1.36 U	3.79 U	3.79 U	3.79 U	1.82 U	227 U	13.86	16.82	13.03
COMP OC4-B	5	2	15.1	1.19 U	3.31 U	3.31 U	3.31 U	1.59 U	199 U	12.65	15.89	13.25
R-AM	1	1	14.7	1.22 U	3.40 U	3.40 U	3.40 U	1.63 U	204 U	6.94	0.95 U	2.99 U
R-AM Replicate 1	2	2	13.9	1.29 U	3.60 U	3.60 U	3.60 U	1.73 U	216 U	3.38 U	7.91	9.50
R-AM Replicate 2	2	2	13.9	1.29 U	3.60 U	3.60 U	3.60 U	1.73 U	216 U	9.50	7.99	9.21
R-AM Replicate 3	2	2	13.9	1.29 U	3.60 U	3.60 U	3.60 U	1.73 U	216 U	3.38 U	7.70	9.14
R-AM	3	1	14.0	1.29 U	3.57 U	3.57 U	3.57 U	1.71 U	214 U	3.36 U	1.00 U	8.07
R-AM	4	1	14.9	1.21 U	3.36 U	3.36 U	3.36 U	1.61 U	202 U	11.83	14.25	11.49
R-AM	5	2	14.9	1.21 U	3.36 U	3.36 U	3.36 U	1.61 U	201 U	3.15 U	7.11	7.05

TABLE J.13. (contd)

<i>M. nasuta</i> Pesticides (<i>µg/kg</i> dry weight)												
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight									
				Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
R-BF	1	1	15.2	1.18 U	3.29 U	3.29 U	3.29 U	1.58 U	197 U	9.34	7.63	2.89 U
R-BF	2	2	15.4	1.17 U	3.25 U	3.25 U	3.25 U	1.56 U	195 U	3.05 U	0.91 U	10.39
R-BF	3	1	14.8	1.22 U	3.38 U	3.38 U	3.38 U	1.62 U	203 U	10.95	14.86	11.01
R-BF	4	1	15.8	1.14 U	3.16 U	3.16 U	3.16 U	1.52 U	190 U	8.61	13.35	10.32
R-BF	5	1	16.0	1.13 U	3.13 U	3.13 U	3.13 U	1.50 U	188 U	2.94 U	14.06	2.75 U
R-OS	1	2	12.9	1.40 U	3.88 U	3.88 U	3.88 U	1.86 U	233 U	3.64 U	10.78	3.41 U
R-OS	2	2	13.1	1.37 U	3.82 U	3.82 U	3.82 U	1.83 U	229 U	3.59 U	1.07 U	3.36 U
R-OS	3	2	14.3	1.26 U	3.50 U	3.50 U	3.50 U	1.68 U	210 U	3.29 U	12.31	3.08 U
R-OS	4	1(b)	13.8	1.30 U	3.62 U	3.62 U	3.62 U	1.74 U	217 U	3.41 U	12.03	3.19 U
R-OS	5	NA	NA	NI(c)	NI	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	14.1	1.28 U	3.55 U	3.55 U	3.55 U	1.70 U	213 U	3.33 U	0.99 U	3.12 U
<i>M. nasuta</i> Background	2	2	15.6	1.15 U	3.21 U	3.21 U	3.21 U	1.54 U	192 U	3.01 U	0.90 U	2.82 U
<i>M. nasuta</i> Background	3	2	14.8	1.22 U	3.38 U	3.38 U	3.38 U	1.62 U	203 U	3.18 U	0.95 U	2.97 U
<i>M. nasuta</i> Background	4	2	15.8	1.14 U	3.16 U	3.16 U	3.16 U	1.52 U	190 U	2.97 U	0.89 U	2.78 U
<i>M. nasuta</i> Background	5	2	14.5	1.24 U	3.45 U	3.45 U	3.45 U	1.66 U	207 U	3.24 U	0.97 U	3.03 U

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE J.14. Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

				<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)									
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Dieldrin	Endo-Sulfan I	Endo-Sulfan II	Endo-Sulfan Sulfate	Endrin	Endrin Aldehyde	Hepta-Chlor	Hepta-Chlor Epoxide	Toxa-Phene	
COMP IC1-A	1	2	13.4	2.39 U ^(a)	3.73 U	3.73 U	3.73 U	3.73 U	3.73 U	1.12 U	3.66 U	224 U	
COMP IC1-A	2	1	12.8	2.50 U	3.91 U	3.91 U	3.91 U	3.91 U	3.91 U	1.17 U	3.83 U	234 U	
COMP IC1-A	3	1	13.5	2.37 U	3.70 U	3.70 U	3.70 U	3.70 U	3.70 U	1.11 U	3.63 U	222 U	
COMP IC1-A	4	1	13.1	2.44 U	3.82 U	3.82 U	3.82 U	3.82 U	3.82 U	1.15 U	3.74 U	229 U	
COMP IC1-A	5	2	13.3	2.41 U	3.76 U	3.76 U	3.76 U	3.76 U	3.76 U	1.13 U	3.68 U	226 U	
COMP IC1-B	1	2	14.5	2.21 U	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	1.03 U	3.38 U	207 U	
COMP IC1-B	2	1	14.6	2.19 U	3.42 U	3.42 U	3.42 U	3.42 U	3.42 U	1.03 U	3.36 U	205 U	
COMP IC1-B	3	1	14.0	2.29 U	3.57 U	3.57 U	3.57 U	3.57 U	3.57 U	1.07 U	3.50 U	214 U	
COMP IC1-B	4	2	14.8	2.16 U	3.38 U	3.38 U	3.38 U	3.38 U	3.38 U	1.01 U	3.31 U	203 U	
COMP IC1-B	5	1	14.1	2.27 U	3.55 U	3.55 U	3.55 U	3.55 U	3.55 U	1.06 U	3.48 U	213 U	
COMP IC1-B Special	Replicate 1	1	13.8	2.32 U	3.62 U	3.62 U	3.62 U	3.62 U	3.62 U	1.09 U	3.55 U	217 U	
COMP IC1-B Special	Replicate 2	1	13.8	2.32 U	3.62 U	3.62 U	3.62 U	3.62 U	3.62 U	1.09 U	3.55 U	217 U	
COMP IC1-B Special	Replicate 3	1	13.8	2.32 U	3.62 U	3.62 U	3.62 U	3.62 U	3.62 U	1.09 U	3.55 U	217 U	
COMP IC1-B Special	2	1	13.8	2.32 U	3.62 U	3.62 U	3.62 U	3.62 U	3.62 U	1.09 U	3.55 U	217 U	
COMP IC1-B Special	3	1	13.9	2.30 U	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U	1.08 U	3.53 U	216 U	
COMP IC1-B Special	4	2	15.3	2.09 U	3.27 U	3.27 U	3.27 U	3.27 U	3.27 U	0.98 U	3.20 U	196 U	
COMP IC1-B Special	5	1	14.0	2.29 U	3.57 U	3.57 U	3.57 U	3.57 U	3.57 U	1.07 U	3.50 U	214 U	
COMP IC1-C	1	2	15.7	2.04 U	3.18 U	3.18 U	3.18 U	3.18 U	3.18 U	0.96 U	3.12 U	191 U	
COMP IC1-C	2	2	14.8	2.16 U	3.38 U	3.38 U	3.38 U	3.38 U	3.38 U	1.01 U	3.31 U	203 U	
COMP IC1-C	3	2	15.2	2.11 U	3.29 U	3.29 U	3.29 U	3.29 U	3.29 U	0.99 U	3.22 U	197 U	
COMP IC1-C	4	1	13.7	2.34 U	3.65 U	3.65 U	3.65 U	3.65 U	3.65 U	1.09 U	3.58 U	219 U	
COMP IC1-C	5	1	14.4	2.22 U	3.47 U	3.47 U	3.47 U	3.47 U	3.47 U	1.04 U	3.40 U	208 U	
COMP OC4-B	1	2	13.1	6.79	3.82 U	3.82 U	3.82 U	3.82 U	3.82 U	1.15 U	3.74 U	229 U	
COMP OC4-B	2	1	12.3	7.40	4.07 U	4.07 U	4.07 U	4.07 U	4.07 U	1.22 U	3.98 U	244 U	
COMP OC4-B	3	2	14.7	6.46	3.40 U	3.40 U	3.40 U	3.40 U	3.40 U	1.02 U	3.33 U	204 U	
COMP OC4-B	4	1	13.2	7.05	3.79 U	3.79 U	3.79 U	3.79 U	3.79 U	1.14 U	3.71 U	227 U	
COMP OC4-B	5	2	15.1	6.16	3.31 U	3.31 U	3.31 U	3.31 U	3.31 U	2.19	3.25 U	199 U	
R-AM	1	1	14.7	2.18 U	3.40 U	3.40 U	3.40 U	3.40 U	3.40 U	1.02 U	3.33 U	204 U	
R-AM Replicate 1	2	2	13.9	2.30 U	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U	1.08 U	3.53 U	216 U	
R-AM Replicate 2	2	2	13.9	2.30 U	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U	1.08 U	3.53 U	216 U	
R-AM Replicate 3	2	2	13.9	2.30 U	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U	1.08 U	3.53 U	216 U	
R-AM	3	1	14.0	2.29 U	3.57 U	3.57 U	3.57 U	3.57 U	3.57 U	1.71	3.50 U	214 U	
R-AM	4	1	14.9	5.85	3.36 U	3.36 U	3.36 U	3.36 U	3.36 U	1.01 U	3.29 U	202 U	
R-AM	5	2	14.9	2.15 U	3.36 U	3.36 U	3.36 U	3.36 U	3.36 U	1.01 U	3.29 U	201 U	

TABLE J.14. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
				Dieldrin	Endo-Sulfan I	Endo-Sulfan II	Endo-Sulfan Sulfate	Endrin Aldehyde	Hepta-Chlor	Hepta-Chlor Epoxide	Toxa-Phene	
R-BF	1	1	15.2	2.11 U	3.29 U	3.29 U	3.29 U	3.29 U	3.29 U	0.99 U	3.22 U	197 U
R-BF	2	2	15.4	6.30	3.25 U	3.25 U	3.25 U	3.25 U	3.25 U	0.97 U	3.18 U	195 U
R-BF	3	1	14.8	2.16 U	3.38 U	3.38 U	3.38 U	3.38 U	3.38 U	1.01 U	3.31 U	203 U
R-BF	4	1	15.8	4.56	3.16 U	3.16 U	3.16 U	3.16 U	3.16 U	0.95 U	3.10 U	190 U
R-BF	5	1	16.0	6.44	3.13 U	3.13 U	3.13 U	3.13 U	3.13 U	0.94 U	3.06 U	188 U
R-OS	1	2	12.9	2.48 U	3.88 U	3.88 U	3.88 U	3.88 U	3.88 U	1.16 U	3.80 U	233 U
R-OS	2	2	13.1	2.44 U	3.82 U	3.82 U	3.82 U	3.82 U	3.82 U	1.15 U	3.74 U	229 U
R-OS	3	2	14.3	2.24 U	3.50 U	3.50 U	3.50 U	3.50 U	3.50 U	1.05 U	3.43 U	210 U
R-OS	4	1	13.8	2.32 U	3.62 U	3.62 U	3.62 U	3.62 U	3.62 U	1.09 U	3.55 U	217 U
R-OS	5	NA ^(b)		NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	14.1	2.27 U	3.55 U	3.55 U	3.55 U	3.55 U	3.55 U	1.06 U	3.48 U	213 U
<i>M. nasuta</i> Background	2	2	15.6	2.05 U	3.21 U	3.21 U	3.21 U	3.21 U	3.21 U	0.96 U	3.14 U	192 U
<i>M. nasuta</i> Background	3	2	14.8	2.16 U	3.38 U	3.38 U	3.38 U	3.38 U	3.38 U	1.01 U	3.31 U	203 U
<i>M. nasuta</i> Background	4	2	15.8	2.03 U	3.16 U	3.16 U	3.16 U	3.16 U	3.16 U	0.95 U	3.10 U	190 U
<i>M. nasuta</i> Background	5	2	14.5	2.21 U	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	1.03 U	3.38 U	207 U

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE J.15. Chlorinated Pesticides (alphabetical, Aldrin - 4,4' DDT), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

			<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)								
Sediment Treatment	Replicate	Analytical Batch	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlordane	4,4' DDD	4,4' DDE	4,4' DDT
Target DL ^(a)			2	2	2	2	2	30	2	2	2
Achieved DL			0.18	0.50	0.50	0.50	0.24	30	0.47	0.14	0.44
COMP IC1-A	1	2	0.18 U ^(b)	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-A	2	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-A	3	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.09	0.14 U	0.44 U
COMP IC1-A	4	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.16	0.14 U	0.44 U
COMP IC1-A	5	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.18	0.14 U	0.44 U
COMP IC1-B	1	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-B	2	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-B	3	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-B	4	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-B	5	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.20	1.16	0.44 U
COMP IC1-B Special Replicate 1	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.09	0.44 U
COMP IC1-B Special Replicate 2	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.11	1.04	1.26
COMP IC1-B Special Replicate 3	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-B Special	2	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.95	0.44 U
COMP IC1-B Special	3	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	2.09	0.95
COMP IC1-B Special	4	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.00	0.44 U
COMP IC1-B Special	5	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
COMP IC1-C	1	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.10	1.00
COMP IC1-C	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.15	1.07	0.44 U
COMP IC1-C	3	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.06	0.44 U
COMP IC1-C	4	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.20	0.16	0.44 U
COMP IC1-C	5	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	1.01
COMP OC4-B	1	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.65	2.03	1.62
COMP OC4-B	2	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.78	2.14	1.77
COMP OC4-B	3	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	2.17	2.70	2.09
COMP OC4-B	4	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.83	2.22	1.72
COMP OC4-B	5	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.91	2.40	2.00
R-AM	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.02	0.14 U	0.44 U
R-AM Replicate 1	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.10	1.32
R-AM Replicate 2	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.32	1.11	1.28
R-AM Replicate 3	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.07	1.27

TABLE J.15. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)								
			Aldrin	Alpha- BHC	Beta- BHC	Delta- BHC	Gamma- BHC	Chlordane	4,4'- DDD	4,4'- DDE	4,4'- DDT
R-AM	3	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	1.13
R-AM	4	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.76	2.12	1.71
R-AM	5	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.06	1.05
R-BF	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.42	1.16	0.44 U
R-BF	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	1.60
R-BF	3	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.62	2.20	1.63
R-BF	4	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.36	2.11	1.63
R-BF	5	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	2.25	0.44 U
R-OS	1	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.39	0.44 U
R-OS	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
R-OS	3	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.76	0.44 U
R-OS	4	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.66	0.44 U
R-OS	5	NA ^(c)	NI ^(d)	NI	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
<i>M. nasuta</i> Background	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
<i>M. nasuta</i> Background	3	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
<i>M. nasuta</i> Background	4	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
<i>M. nasuta</i> Background	5	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE J.16. Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet weight)								
			Dieldrin	Endo-Sulfan I	Endo-Sulfan II	Endo-Sulfan Sulfate	Endrin	Endrin Aldehyde	Hepta-Chlor	Hepta-Chlor Epoxide	Toxa-Phene
Target DL ^(a)			2	2	2	2	2	2	2	2	30
Achieved DL			0.32	0.50	0.50	0.50	0.50	0.50	0.15	0.49	30
COMP IC1-A	1	2	0.32 U ^(a)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-A	2	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-A	3	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-A	4	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-A	5	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B	1	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B	2	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B	3	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B	4	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B	5	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special Replicate 1	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special Replicate 2	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special Replicate 3	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special	2	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special	3	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special	4	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special	5	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-C	1	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-C	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-C	3	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-C	4	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-C	5	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP OC4-B	1	2	0.89	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP OC4-B	2	1	0.91	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP OC4-B	3	2	0.95	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP OC4-B	4	1	0.93	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP OC4-B	5	2	0.93	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.33	0.49 U	30 U
R-AM	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-AM Replicate 1	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-AM Replicate 2	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-AM Replicate 3	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U

TABLE J.16. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)								
			Dieldrin	Endo- Sulfan I	Endo- Sulfan II	Endo- Sulfan Sulfate	Endrin	Endrin Aldehyde	Hepta- Chlor	Hepta- Chlor Epoxide	Toxa- Phene
R-AM	3	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.24	0.49 U	30 U
R-AM	4	1	0.87	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-AM	5	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-BF	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-BF	2	2	0.97	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-BF	3	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-BF	4	1	0.72	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-BF	5	1	1.03	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-OS	1	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-OS	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-OS	3	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-OS	4	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-OS	5	NA ^(b)	NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
<i>M. nasuta</i> Background	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
<i>M. nasuta</i> Background	3	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
<i>M. nasuta</i> Background	4	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
<i>M. nasuta</i> Background	5	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE J.17. Quality Control Data for Chlorinated Pesticides (alphabetical, Aldrin - 4,4' DDT), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	M. nasuta Pesticides (µg/kg wet weight)								
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlordane	4,4' DDD	4,4' DDE	4,4' DDT
Method Blanks											
Blank		1	0.18 U ^(a)	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
Blank		2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
Matrix Spikes											
COMP OC4-B	2	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.78	2.14	1.77
COMP OC4-B MS	2	1	4.34	2.88	4.55	3.23	2.05	NA ^(b)	4.46	4.30	4.16
Concentration Recovered			4.34	2.88	4.55	3.23	2.05	NA	2.68	2.16	2.39
Amount Spiked			4.50	4.50	4.50	4.50	4.50	NS ^(c)	4.50	4.50	4.50
Percent Recovery			96%	64%	101%	72%	46%	NA	60%	48%	53%
M. nasuta Background	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
M. nasuta Background MS	2	2	5.40	3.98	5.92	4.99	4.70	NA	4.59	4.54	4.43
Concentration Recovered			5.40	3.98	5.92	4.99	4.70	NA	4.59	4.54	4.43
Amount Spiked			5.00	5.00	5.00	5.00	5.00	NS	5.00	5.00	5.00
Percent Recovery			108%	80%	118%	100%	94%	NA	92%	91%	89%
Analytical Replicates											
COMP IC1-B Special Replicate 1	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.09	0.44 U
COMP IC1-B Special Replicate 2	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.11	1.04	1.26
COMP IC1-B Special Replicate 3	1	1	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	0.14 U	0.44 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.10	1.32
R-AM Replicate 2	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	1.32	1.11	1.28
R-AM Replicate 3	2	2	0.18 U	0.50 U	0.50 U	0.50 U	0.24 U	30 U	0.47 U	1.07	1.27
RSD			NA	NA	NA	NA	NA	NA	NA	2%	2%

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NS Not spiked.

TABLE J.18. Quality Control Data for Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

			<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)								
Sediment Treatment	Replicate	Analytical Batch	Dieldrin	Endo-Sulfan I	Endo-Sulfan II	Endo-Sulfan Sulfate	Endrin	Endrin Aldehyde	Hepta-Chlor	Hepta-Chlor Epoxide	Toxa-Phene
<u>Method Blanks</u>											
Blank		1	0.32 U ^(a)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
Blank		2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
<u>Matrix Spikes</u>											
COMP OC4-B	2	1	0.91	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP OC4-B MS	2	1	3.74	3.42	4.07	3.98	3.80	2.15	4.49	4.04	NA ^(b)
Concentration Recovered			2.83	3.42	4.07	3.98	3.80	2.15	4.49	4.04	NA ^(c)
Amount Spiked			4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	NS ^(c)
Percent Recovery			63%	76%	90%	88%	84%	48%	100%	90%	NA
<i>M. nasuta</i> Background	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
<i>M. nasuta</i> Background MS	2	2	4.54	3.70	3.98	4.50	4.29	3.32	5.96	6.07	NA
Concentration Recovered			4.54	3.70	3.98	4.50	4.29	3.32	5.96	6.07	NA
Amount Spiked			5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	NS
Percent Recovery			91%	74%	80%	90%	86%	66%	119%	121% ^(d)	NA
<u>Analytical Replicates</u>											
COMP IC1-B Special Replicate 1	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special Replicate 2	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
COMP IC1-B Special Replicate 3	1	1	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-AM Replicate 2	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
R-AM Replicate 3	2	2	0.32 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15 U	0.49 U	30 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NS Not spiked.

(d) Value exceeds quality control range of (40% to 120%).

TABLE J.19. Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs (Ug/kg dry weight)			
				Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
COMP IC1-A	1	2	13.4	20.9 U ^(a)	20.9 U	20.9 U	20.9 U
COMP IC1-A	2	1	12.8	21.9 U	21.9 U	21.9 U	21.9 U
COMP IC1-A	3	1	13.5	20.7 U	20.7 U	20.7 U	20.7 U
COMP IC1-A	4	1	13.1	21.4 U	21.4 U	21.4 U	21.4 U
COMP IC1-A	5	2	13.3	21.1 U	21.1 U	21.1 U	21.1 U
COMP IC1-B	1	2	14.5	19.3 U	19.3 U	19.3 U	19.3 U
COMP IC1-B	2	1	14.6	19.2 U	19.2 U	19.2 U	19.2 U
COMP IC1-B	3	1	14.0	20.0 U	20.0 U	20.0 U	20.0 U
COMP IC1-B	4	2	14.8	18.9 U	18.9 U	18.9 U	18.9 U
COMP IC1-B	5	1	14.1	19.9 U	19.9 U	19.9 U	19.9 U
COMP IC1-B Special Replicate 1	1	1	13.8	20.3 U	20.3 U	20.3 U	20.3 U
COMP IC1-B Special Replicate 2	1	1	13.8	20.3 U	20.3 U	20.3 U	20.3 U
COMP IC1-B Special Replicate 3	1	1	13.8	20.3 U	20.3 U	20.3 U	20.3 U
COMP IC1-B Special	2	1	13.8	20.3 U	20.3 U	20.3 U	20.3 U
COMP IC1-B Special	3	1	13.9	20.1 U	20.1 U	20.1 U	20.1 U
COMP IC1-B Special	4	2	15.3	18.3 U	18.3 U	18.3 U	18.3 U
COMP IC1-B Special	5	1	14.0	20.0 U	20.0 U	20.0 U	20.0 U
COMP IC1-C	1	2	15.7	17.8 U	17.8 U	17.8 U	17.8 U
COMP IC1-C	2	2	14.8	18.9 U	18.9 U	18.9 U	18.9 U
COMP IC1-C	3	2	15.2	18.4 U	18.4 U	18.4 U	18.4 U
COMP IC1-C	4	1	13.7	20.4 U	20.4 U	20.4 U	20.4 U
COMP IC1-C	5	1	14.4	19.4 U	19.4 U	19.4 U	19.4 U
COMP OC4-B	1	2	13.1	21.4 U	21.4 U	182.4 E ^(b)	21.4 U
COMP OC4-B	2	1	12.3	22.8 U	22.8 U	196.7 E	22.8 U
COMP OC4-B	3	2	14.7	19.0 U	19.0 U	249.7 E	19.0 U
COMP OC4-B	4	1	13.2	21.2 U	21.2 U	215.9 E	21.2 U
COMP OC4-B	5	2	15.1	18.5 U	18.5 U	197.4 E	18.5 U
R-AM	1	1	14.7	19.0 U	19.0 U	19.0 U	19.0 U
R-AM Replicate 1	2	2	13.9	20.1 U	20.1 U	20.1 U	20.1 U
R-AM Replicate 2	2	2	13.9	20.1 U	20.1 U	20.1 U	20.1 U
R-AM Replicate 3	2	2	13.9	20.1 U	20.1 U	20.1 U	20.1 U
R-AM	3	1	14.0	20.0 U	20.0 U	20.0 U	20.0 U
R-AM	4	1	14.9	18.8 U	18.8 U	164.0 E	18.8 U
R-AM	5	2	14.9	18.8 U	18.8 U	18.8 U	18.8 U
R-BF	1	1	15.2	18.4 U	18.4 U	103.9 E	18.4 U
R-BF	2	2	15.4	18.2 U	18.2 U	18.2 U	18.2 U
R-BF	3	1	14.8	18.9 U	18.9 U	127.7 E	18.9 U
R-BF	4	1	15.8	17.7 U	17.7 U	103.8 E	17.7 U
R-BF	5	1	16.0	17.5 U	17.5 U	17.5 U	17.5 U
R-OS	1	2	12.9	21.7 U	21.7 U	21.7 U	21.7 U
R-OS	2	2	13.1	21.4 U	21.4 U	21.4 U	21.4 U
R-OS	3	2	14.3	19.6 U	19.6 U	19.6 U	19.6 U
R-OS	4	1	13.8	20.3 U ^(d)	20.3 U	20.3 U	20.3 U
R-OS	5	NA ^(c)	NA	NI ^(d)	NI	NI	NI

TABLE J.19. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs ($\mu\text{g}/\text{kg}$ dry weight)			
				Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>M. nasuta</i> Background	1	2	14.1	19.9 U	19.9 U	19.9 U	19.9 U
<i>M. nasuta</i> Background	2	2	15.6	17.9 U	17.9 U	17.9 U	17.9 U
<i>M. nasuta</i> Background	3	2	14.8	18.9 U	18.9 U	18.9 U	18.9 U
<i>M. nasuta</i> Background	4	2	15.8	17.7 U	17.7 U	17.7 U	17.7 U
<i>M. nasuta</i> Background	5	2	14.5	19.3 U	19.3 U	19.3 U	19.3 U

- (a) U Undetected above given concentration.
 (b) E Value estimated; most similar aroclor pattern is 1254.
 (c) NA Not applicable.
 (d) NI No information; insufficient sediment to test all five replicates.

TABLE J.20. Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ wet weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL (a)			20	20	20	20
Achieved DL			2.8	2.8	2.8	2.8
COMP IC1-A	1	2	2.8 U ^(b)	2.8 U	2.8 U	2.8 U
COMP IC1-A	2	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-A	3	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-A	4	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-A	5	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B	1	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B	2	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B	3	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B	4	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B	5	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special Replicate 1	1	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special Replicate 2	1	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special Replicate 3	1	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special	2	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special	3	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special	4	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special	5	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-C	1	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-C	2	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-C	3	2	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-C	4	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-C	5	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP OC4-B	1	2	2.8 U	2.8 U	23.9 E ^(c)	2.8 U
COMP OC4-B	2	1	2.8 U	2.8 U	24.2 E	2.8 U
COMP OC4-B	3	2	2.8 U	2.8 U	36.7 E	2.8 U
COMP OC4-B	4	1	2.8 U	2.8 U	28.5 E	2.8 U
COMP OC4-B	5	2	2.8 U	2.8 U	29.8 E	2.8 U
R-AM	1	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 1	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 2	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 3	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-AM	3	1	2.8 U	2.8 U	2.8 U	2.8 U
R-AM	4	1	2.8 U	2.8 U	24.4 E	2.8 U
R-AM	5	2	2.8 U	2.8 U	2.8 U	2.8 U
R-BF	1	1	2.8 U	2.8 U	15.8 E	2.8 U
R-BF	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-BF	3	1	2.8 U	2.8 U	18.9 E	2.8 U
R-BF	4	1	2.8 U	2.8 U	16.4 E	2.8 U
R-BF	5	1	2.8 U	2.8 U	2.8 U	2.8 U
R-OS	1	2	2.8 U	2.8 U	2.8 U	2.8 U
R-OS	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-OS	3	2	2.8 U	2.8 U	2.8 U	2.8 U
R-OS	4	1	2.8 U	2.8 U	2.8 U	2.8 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI

TABLE J.20. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ wet weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>M. nasuta</i> Background	1	2	2.8 U	2.8 U	2.8 U	2.8 U
<i>M. nasuta</i> Background	2	2	2.8 U	2.8 U	2.8 U	2.8 U
<i>M. nasuta</i> Background	3	2	2.8 U	2.8 U	2.8 U	2.8 U
<i>M. nasuta</i> Background	4	2	2.8 U	2.8 U	2.8 U	2.8 U
<i>M. nasuta</i> Background	5	2	2.8 U	2.8 U	2.8 U	2.8 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) E Value is an estimate; most similar Aroclor pattern is 1254.

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE J.21. Quality Control Data for Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PCBs (µg/kg wet weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<u>Method Blanks</u>						
Blank		1	2.8 U ^(a)	2.8 U	2.8 U	2.8 U
Blank		2	2.8 U	2.8 U	2.8 U	2.8 U
<u>Analytical Replicates</u>						
COMP IC1-B Special Replicate 1	1	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special Replicate 2	1	1	2.8 U	2.8 U	2.8 U	2.8 U
COMP IC1-B Special Replicate 3	1	1	2.8 U	2.8 U	2.8 U	2.8 U
RSD			NA ^(b)	NA	NA	NA
R-AM Replicate 1	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 2	2	2	2.8 U	2.8 U	2.8 U	2.8 U
R-AM Replicate 3	2	2	2.8 U	2.8 U	2.8 U	2.8 U
RSD			NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) NA Not applicable.

TABLE J.22. Surrogate Recoveries for Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs), Including Quality Control Data, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries	
			PCB 103	PCB 198
COMP IC1-A	1	2	71	84
COMP IC1-A	2	1	71	84
COMP IC1-A	3	1	67	80
COMP IC1-A	4	1	64	
COMP IC1-A	5	2	69	71
COMP IC1-B	1	2	68	83
COMP IC1-B	2	1	60	75
COMP IC1-B	3	1	65	89
COMP IC1-B	4	2	74	95
COMP IC1-B	5	1	66	81
COMP IC1-B Special	Replicate 1	1	72	79
COMP IC1-B Special	Replicate 2	1	73	82
COMP IC1-B Special	Replicate 3	1	69	75
COMP IC1-B Special	2	1	46	81
COMP IC1-B Special	3	1	68	79
COMP IC1-B Special	4	2	70	81
COMP IC1-B Special	5	1	67	83
COMP IC1-C	1	2	69	81
COMP IC1-C	2	2	74	86
COMP IC1-C	3	2	69	81
COMP IC1-C	4	1	69	81
COMP IC1-C	5	1	52	75
COMP OC4-B	1	2	67	80
COMP OC4-B	2	1	69	80
COMP OC4-B	3	2	72	85
COMP OC4-B	4	1	62	72
COMP OC4-B	5	2	73	86
R-AM	1	1	71	87
R-AM Replicate 1	2	2	64	81
R-AM Replicate 2	2	2	69	81
R-AM Replicate 3	2	2	64	85
R-AM	3	1	60	88
R-AM	4	1	73	81
R-AM	5	2	73	85

TABLE J.22. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries	
			PCB 103	PCB 198
R-BF	1	1	57	67
R-BF	2	2	70	89
R-BF	3	1	66	93
R-BF	4	1	53	76
R-BF	5	1	67	87
R-OS	1	2	74	88
R-OS	2	2	76	89
R-OS	3	2	80	92
R-OS	4	1	70	84
R-OS	5	NA ^(a)	NI ^(b)	NI
<i>M. nasuta</i> Background	1	2	67	87
<i>M. nasuta</i> Background	2	2	66	81
<i>M. nasuta</i> Background	3	2	70	84
<i>M. nasuta</i> Background	4	2	62	72
<i>M. nasuta</i> Background	5	2	71	78

Quality Control DataMethod Blanks

Blank	1	77	83
Blank	2	85	91

Matrix Spikes

COMP OC4-B MS	2	1	67	80
<i>M. nasuta</i> Background MS	2	2	67	83

Analytical Replicates

COMP IC1-B Special Replicate 1	1	1	72	79
COMP IC1-B Special Replicate 2	1	1	73	82
COMP IC1-B Special Replicate 3	1	1	69	75
R-AM Replicate 1	2	2	64	81
R-AM Replicate 2	2	2	69	81
R-AM Replicate 3	2	2	64	85

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE J.23. Metals, Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Analytical		<i>M. nasuta</i> Metals (mg/kg dry weight)									
	Replicate	Batch	Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL ^(a)			0.1	2.0	0.1	1.0	4.3	0.01	1.0	1.0	1.0	35.0
Achieved DL			0.01	2.0	0.1	0.1	4.3	0.0014	0.1	0.04	1.00	35.0
COMP IC1-A	1	1	0.165	23.6	0.224	2.69	9.73	0.078	4.31	0.734	1.75	95.3
COMP IC1-A	2	1	0.214	29.9	0.240	4.61	17.2	0.106	6.08	1.30	1.94	80.0
COMP IC1-A	3	1	0.299	17.8	0.284	2.56	14.8	0.080	4.79	0.885	1.42	71.8
COMP IC1-A	4	1	0.146	30.3	0.212	2.73	11.7	0.081	4.61	0.657	2.00	80.0
COMP IC1-A	5	1	0.231	29.6	0.312	2.15	11.6	0.078	5.72	1.05	1.87	99.5
COMP IC1-B	1	1	0.218	24.7	0.275	2.14	15.2	0.071	5.67	1.03	1.94	76.6
COMP IC1-B	2	1	0.299	23.0	0.389	3.60	14.3	0.103	8.09	1.25	2.16	99.4
COMP IC1-B	3	1	0.176	29.3	0.311	2.16	13.2	0.099	6.38	1.10	2.12	88.0
COMP IC1-B	4	1	0.396	26.6	0.453	2.38	15.5	0.087	6.40	1.05	1.47	95.8
COMP IC1-B	5	1	0.402	27.1	0.435	3.12	14.0	0.083	8.77	1.73	1.67	86.3
COMP IC1-B Special	1	1	0.229	29.0	0.409	2.57	11.6	0.087	6.85	1.38	1.52	139
COMP IC1-B Special	2	1	0.165	30.4	0.246	2.84	14.2	0.089	6.20	1.19	1.20	97.3
COMP IC1-B Special	3	1	0.175	27.6	0.297	1.56	9.57	0.089	4.88	1.06	1.53	85.9
COMP IC1-B Special	4	1	0.359	33.3	0.461	3.21	18.0	0.098	5.32	1.30	2.32	95.4
COMP IC1-B Special Replicate 1	5	1	0.213	20.8	0.227	3.62	13.8	0.102	6.40	1.56	2.14	86.9
COMP IC1-B Special Replicate 2	5	1	0.785	23.5	1.212	3.70	15.2	0.101	8.51	1.76	1.87	87.5
COMP IC1-B Special Replicate 3	5	1	0.871	23.5	1.252	3.81	14.9	0.102	9.02	1.77	1.35	86.3
COMP IC1-C	1	1	0.230	24.2	0.265	2.42	9.62	0.093	4.66	1.05	1.56	84.7
COMP IC1-C	2	1	0.369	27.1	0.203	2.30	18.6	0.100	4.82	1.24	1.84	84.3
COMP IC1-C Replicate 1	3	1	0.210	27.8	0.400	2.91	10.4	0.091	4.75	1.10	1.67	122
COMP IC1-C Replicate 2	3	1	0.111	28.8	0.228	2.74	10.7	0.092	4.54	1.09	1.72	120
COMP IC1-C Replicate 3	3	1	0.128	28.0	0.222	2.99	10.2	0.091	3.69	0.945	1.82	125
COMP IC1-C	4	1	0.284	27.5	0.358	2.83	15.3	0.077	5.31	1.25	1.84	78.3
COMP IC1-C	5	1	0.226	31.0	0.332	2.62	12.5	0.082	5.42	1.14	1.27	83.6
COMP OC4-B	1	1	0.133	19.7	0.180	3.43	12.3	0.088	4.42	1.04	1.49	106
COMP OC4-B	2	1	0.231	24.1	0.275	1.96	13.7	0.090	3.60	1.35	1.07	117
COMP OC4-B	3	1	0.297	30.8	0.427	2.50	13.4	0.104	5.57	1.60	2.38	107
COMP OC4-B	4	1	0.218	23.5	0.225	2.77	12.2	0.082	3.93	1.20	2.41	87.4
COMP OC4-B	5	1	0.442	26.0	0.495	4.37	12.9	0.081	5.76	1.46	2.39	100
R-AM	1	1	0.157	26.5	0.213	1.21	13.0	0.099	2.64	1.13	1.59	85.9
R-AM	2	1	0.244	26.8	0.212	1.27	11.6	0.110	3.50	1.33	1.86	90.0
R-AM	3	1	0.159	27.0	0.287	1.24	10.5	0.115	3.87	1.32	1.64	144
R-AM	4	1	0.229	27.8	0.314	1.17	10.8	0.118	3.73	1.19	1.87	111
R-AM	5	1	0.236	27.6	0.254	1.37	12.3	0.101	3.11	1.27	1.93	118

TABLE J.23. (contd)

Sediment Treatment	Replicate	Analytical		<i>M. nasuta</i> Metals (mg/kg dry weight)									
		Batch		Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-BF	1	1		0.438	27.4	0.633	3.29	18.5	0.136	6.75	2.65	2.22	94.8
R-BF	2	1		0.190	28.6	0.190	2.07	13.6	0.118	4.33	1.68	1.84	94.6
R-BF	3	1		0.278	26.9	0.194	3.94	14.5	0.163	6.10	2.34	2.74	102
R-BF	4	1		0.113	25.6	0.241	3.07	11.2	0.127	5.60	2.07	2.51	90.8
R-BF	5	1		0.401	26.8	0.499	3.76	13.2	0.129	7.26	2.47	1.75	86.3
R-OS	1	1		0.235	27.0	0.353	2.41	10.7	0.103	4.34	0.859	1.85	95.8
R-OS	2	1		0.283	26.0	0.237	1.49	15.2	0.087	3.73	0.702	1.89	67.5
R-OS	3	1		0.243	23.0	0.204	1.94	11.4	0.099	4.85	0.82	1.36	95.0
R-OS	4	1	(b)	0.240	26.5	0.262	2.29	11.9	0.104	4.54	0.872	2.63	86.6
R-OS	5	NA		NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	1		0.138	21.5	0.256	1.51	10.1	0.088	3.49	0.953	1.60	78.1
<i>M. nasuta</i> Background	2	1		0.132	22.2	0.336	1.45	12.8	0.099	4.07	1.04	1.88	78.7
<i>M. nasuta</i> Background	3	1		0.115	26.2	0.220	2.05	14.5	0.090	4.81	2.35	1.55	94.4
<i>M. nasuta</i> Background	4	1		0.109	25.3	0.262	1.50	12.7	0.090	3.80	0.857	2.09	85.7
<i>M. nasuta</i> Background Replicate 1	5	1		0.097	24.2	0.320	1.62	10.7	0.100	3.83	0.942	1.89	87.2
<i>M. nasuta</i> Background Replicate 2	5	1		0.132	26.5	0.375	2.60	11.4	0.098	6.21	0.979	1.76	88.9
<i>M. nasuta</i> Background Replicate 3	5	1		0.079	25.8	0.250	2.42	12.9	0.101	3.83	0.872	2.48	89.2

(a) DL Detection limit.

(b) NA Not applicable.

(c) NI No information; insufficient data to test all five replicates.

TABLE J.24. Metals, Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> Metals (mg/kg wet weight)									
				Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP IC1-A	1	1	13.40	0.022	3.2	0.030	0.36	1.30	0.010	0.58	0.098	0.23	12.8
COMP IC1-A	2	1	12.80	0.027	3.8	0.031	0.59	2.2	0.014	0.78	0.17	0.25	10.2
COMP IC1-A	3	1	13.50	0.040	2.4	0.038	0.35	2.0	0.011	0.65	0.119	0.19	9.7
COMP IC1-A	4	1	13.10	0.019	4.0	0.028	0.36	1.5	0.011	0.60	0.086	0.26	10.5
COMP IC1-A	5	1	13.30	0.031	3.9	0.041	0.29	1.5	0.010	0.76	0.14	0.25	13.2
COMP IC1-B	1	1	14.50	0.032	3.6	0.040	0.31	2.2	0.010	0.82	0.15	0.28	11.1
COMP IC1-B	2	1	14.60	0.044	3.4	0.057	0.53	2.1	0.015	1.18	0.18	0.32	14.5
COMP IC1-B	3	1	14.00	0.025	4.1	0.044	0.30	1.8	0.014	0.89	0.15	0.30	12.3
COMP IC1-B	4	1	14.80	0.059	3.9	0.067	0.35	2.3	0.013	0.95	0.16	0.22	14.2
COMP IC1-B	5	1	14.10	0.057	3.8	0.061	0.44	2.0	0.012	1.24	0.24	0.24	12.2
COMP IC1-B Special	1	1	13.80	0.032	4.0	0.056	0.36	1.6	0.012	0.94	0.19	0.21	19
COMP IC1-B Special	2	1	13.80	0.023	4.2	0.034	0.39	2.0	0.012	0.86	0.16	0.17	13.4
COMP IC1-B Special	3	1	13.90	0.024	3.8	0.041	0.22	1.33	0.012	0.68	0.15	0.21	11.9
COMP IC1-B Special	4	1	15.30	0.055	5.1	0.071	0.49	2.8	0.015	0.81	0.20	0.35	14.6
COMP IC1-B Special Replicate 1	5	1	14.00	0.030	2.9	0.032	0.51	1.9	0.014	0.90	0.22	0.30	12.2
COMP IC1-B Special Replicate 2	5	1	14.00	0.110	3.3	0.170	0.52	2.1	0.014	1.19	0.25	0.26	12.3
COMP IC1-B Special Replicate 3	5	1	14.00	0.122	3.3	0.175	0.53	2.1	0.014	1.26	0.25	0.19	12.1
COMP IC1-C	1	1	15.70	0.036	3.8	0.042	0.38	1.51	0.015	0.73	0.17	0.24	13.3
COMP IC1-C	2	1	14.80	0.055	4.0	0.030	0.34	2.8	0.015	0.71	0.18	0.27	12.5
COMP IC1-C Replicate 1	3	1	15.20	0.032	4.2	0.061	0.44	1.6	0.014	0.72	0.17	0.25	19
COMP IC1-C Replicate 2	3	1	15.20	0.017	4.4	0.035	0.42	1.6	0.014	0.69	0.17	0.26	18
COMP IC1-C Replicate 3	3	1	15.20	0.019	4.3	0.034	0.45	1.6	0.014	0.56	0.144	0.28	19
COMP IC1-C	4	1	13.70	0.039	3.8	0.049	0.39	2.1	0.011	0.73	0.17	0.25	10.7
COMP IC1-C	5	1	14.40	0.033	4.5	0.048	0.38	1.8	0.012	0.78	0.16	0.18	12.0
COMP OC4-B	1	1	13.10	0.017	2.6	0.024	0.45	1.6	0.012	0.58	0.14	0.20	14
COMP OC4-B	2	1	12.30	0.028	3.0	0.034	0.24	1.7	0.011	0.44	0.17	0.13	14
COMP OC4-B	3	1	14.70	0.044	4.5	0.063	0.37	2.0	0.015	0.82	0.24	0.35	16
COMP OC4-B	4	1	13.20	0.029	3.1	0.030	0.37	1.6	0.011	0.52	0.16	0.32	11.5
COMP OC4-B	5	1	15.10	0.067	3.9	0.075	0.66	1.9	0.012	0.87	0.22	0.36	15
R-AM	1	1	14.70	0.023	3.9	0.031	0.18	1.9	0.015	0.39	0.17	0.23	12.6
R-AM	2	1	13.90	0.034	3.7	0.029	0.18	1.6	0.015	0.49	0.19	0.26	12.5
R-AM	3	1	14.00	0.022	3.8	0.040	0.17	1.5	0.016	0.54	0.19	0.23	20
R-AM	4	1	14.88	0.034	4.1	0.047	0.17	1.6	0.018	0.55	0.18	0.28	17
R-AM	5	1	14.90	0.035	4.1	0.038	0.20	1.8	0.015	0.46	0.19	0.29	18

TABLE J.24. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> Metals (mg/kg wet weight)									
				Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-BF	1	1	15.20	0.067	4.2	0.096	0.50	2.8	0.021	1.03	0.40	0.34	14.4
R-BF	2	1	15.40	0.029	4.4	0.029	0.32	2.1	0.018	0.67	0.26	0.28	14.6
R-BF	3	1	14.80	0.041	4.0	0.029	0.58	2.1	0.024	0.90	0.35	0.41	15
R-BF	4	1	15.80	0.018	4.0	0.038	0.49	1.8	0.020	0.88	0.33	0.40	14.3
R-BF	5	1	16.00	0.064	4.3	0.080	0.60	2.1	0.021	1.16	0.40	0.28	13.8
R-OS	1	1	12.90	0.030	3.5	0.046	0.31	1.4	0.013	0.56	0.111	0.24	12.4
R-OS	2	1	13.10	0.037	3.4	0.031	0.20	2.0	0.011	0.49	0.092	0.25	8.8
R-OS	3	1	14.30	0.035	3.3	0.029	0.28	1.6	0.014	0.69	0.12	0.19	13.6
R-OS	4	1	13.80	0.033	3.7	0.036	0.32	1.6	0.014	0.63	0.120	0.36	12.0
R-OS	5	NA ^(a)	NI ^(b)	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	1	14.10	0.019	3.0	0.036	0.21	1.4	0.012	0.49	0.134	0.23	11.0
<i>M. nasuta</i> Background	2	1	15.60	0.021	3.5	0.052	0.23	2.0	0.015	0.63	0.16	0.29	12.3
<i>M. nasuta</i> Background	3	1	14.80	0.017	3.9	0.033	0.30	2.1	0.013	0.71	0.35	0.23	14.0
<i>M. nasuta</i> Background	4	1	15.80	0.017	4.0	0.041	0.24	2.0	0.014	0.60	0.135	0.33	13.5
<i>M. nasuta</i> Background Replicate 1	5	1	14.50	0.014	3.5	0.046	0.24	1.6	0.015	0.55	0.137	0.27	12.6
<i>M. nasuta</i> Background Replicate 2	5	1	14.50	0.019	3.8	0.054	0.38	1.7	0.014	0.90	0.142	0.26	12.9
<i>M. nasuta</i> Background Replicate 3	5	1	14.50	0.011	3.7	0.036	0.35	1.9	0.015	0.55	0.126	0.36	12.9

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE J.25. Quality Control Data for Metals, Dry Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment	Analytical		<i>M. nasuta</i> Metals (mg/kg dry weight)									
Treatment	Replicate	Batch	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
<u>Method Blanks</u>												
Blank		1	0.004	NM ^(a)	0.097	0.160	NM	0.0014 U	0.034	0.005	NM	NM
Blank		1	0.004	NM	0.094	0.207	NM	0.0014 U	0.121	0.007	NM	NM
Blank		1	0.004	NM	0.102	0.194	NM	0.0014 U	0.067	0.007	NM	NM
<u>Matrix Spikes</u>												
COMP IC1-B Special ^(b)	5	1	0.428	26.5	0.616	3.13	14.3	0.097	7.98	1.444	1.74	89.9
COMP IC1-B Special MS	5	1	2.05	NA ^(c)	2.37	8.93	NA	0.766	10.8	3.144	NA	NA
Concentration Recovered			1.62	NA	1.76	5.81	NA	0.669	2.85	1.700	NA	NA
Amount Spiked			1.67	NS ^(d)	1.67	3.33	NS	0.818	3.33	1.670	NS	NS
Percent Recovery			97%	NA	105%	174% ^(e)	NA	82%	86%	1.018	NA	NA
COMP IC1-C ^(b)	3	1	0.250	26.5	0.364	3.08	11.7	0.120	5.73	1.802	2.04	91.0
COMP IC1-C MS	3	1	1.87	NA	2.09	5.87	NA	0.805	8.34	2.874	NA	NA
Concentration Recovered			1.62	NA	1.73	2.79	NA	0.685	2.61	1.072	NA	NA
Amount Spiked			1.67	NS	1.67	3.33	NS	0.836	3.33	1.670	NS	NS
Percent Recovery			97%	NA	103%	84%	NA	82%	78%	0.642	NA	NA
<i>M. nasuta</i> Background ^(b)	5	1	0.103	25.5	0.315	2.21	11.7	0.100	4.62	0.931	2.04	88.4
<i>M. nasuta</i> Background MS	5	1	1.81	NA	1.95	4.85	NA	0.754	7.06	2.434	NA	NA
Concentration Recovered			1.70	NA	1.64	2.64	NA	0.654	2.44	1.503	NA	NA
Amount Spiked			1.67	NS	1.67	3.33	NS	0.825	3.33	1.670	NS	NS
Percent Recovery			102%	NA	98%	79%	NA	79%	73% ^(e)	0.900	NA	NA
<u>Standard Reference Material</u>												
Certified			1.68	14.0	4.15	1.43	66.3	0.0642	2.25	0.371	2.21	830.0
Value SRM 1566a			±0.15	±1.2	±0.38	±0.46	±4.3	±0.0067	±0.44	±0.014	±0.24	±57
SRM 1566a		1	1.79	15.8	4.39	1.25	66.7	0.062	2.16	0.396	2.45	840.0
SRM 1566a		1	1.75	15.5	4.08	1.29	66.7	0.061	2.21	0.327	2.40	865.0

TABLE J.25. (contd)

Sediment			Analytical		TABLE 3-13. (Cont'd)								
Treatment	Replicate	Batch	M. nasuta Metals (mg/kg dry weight)										
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	
Analytical Replicates													
COMP IC1-B Special Replicate 1	5	1	0.213	20.8	0.227	3.62	13.8	0.102	6.40	1.564	2.14	86.9	
COMP IC1-B Special Replicate 2	5	1	0.785	23.5	1.212	3.70	15.2	0.101	8.51	1.764	1.87	87.5	
COMP IC1-B Special Replicate 3	5	1	0.871	23.5	1.252	3.81	14.9	0.102	9.02	1.774	1.35	86.3	
RSD			57%(f)	7%	65%(f)	3%	5%	1%	17%	7%	22%(f)	1%	
COMP IC1-C Replicate 1	3	1	0.210	27.8	0.400	2.91	10.4	0.091	4.75	1.104	1.67	122.0	
COMP IC1-C Replicate 2	3	1	0.111	28.8	0.228	2.74	10.7	0.092	4.54	1.094	1.72	120.0	
COMP IC1-C Replicate 3	3	1	0.128	28.0	0.222	2.99	10.2	0.091	3.69	0.945	1.82	125.0	
RSD			35%(f)	2%	36%(f)	4%	2%	1%	13%	9%	4%	2%	
M. nasuta Background Replicate 1	5	1	0.097	24.2	0.320	1.62	10.7	0.100	3.83	0.942	1.89	87.2	
M. nasuta Background Replicate 2	5	1	0.132	26.5	0.375	2.60	11.4	0.098	6.21	0.979	1.76	88.9	
M. nasuta Background Replicate 3	5	1	0.079	25.8	0.250	2.42	12.9	0.101	3.83	0.872	2.48	89.2	
RSD			26%(f)	5%	20%	24%(f)	10%	2%	30%(f)	6%	19%	1%	

(a) NM Not measured.

(b) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(c) NA Not applicable.

(d) NS Not spiked.

(e) Value exceeds quality control range of (75% to 125%).

(f) Value exceeds relative precision goal of $\leq 20\%$.

TABLE J.26. Butyltin Results, Dry and Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Triphenyltin (%) Internal Standard	(µg/kg wet weight)			Percent Dry Weight	(µg/kg dry weight)		
				Tri-Butyltin	Di-Butyltin	Mono-Butyltin		Tri-Butyltin	Di-Butyltin	Mono-Butyltin
Target DL (a)			NA (b)	10	10	10	NA	NA	NA	NA
Achieved DL			NA	0.48	1.39	0.39	NA	NA	NA	NA
COMP IC1-A	1	2	87	2.30	4.6 U (c)	0.90 J (d)	13.4	17.16	34.3 U	6.72 J
COMP IC1-A	2	1	104	2.05	4.6 U	0.95 J	12.8	16.02	35.9 U	7.42 J
COMP IC1-A	3	1	141	1.74	4.6 U	1.3 U	13.5	12.89	34.1 U	9.6 U
COMP IC1-A	4	1	98	2.37	4.6 U	1.22 J	13.1	18.09	35.1 U	9.31 J
COMP IC1-A Replicate 1	5	2	90	2.29	4.6 U	1.04 J	13.3	17.22	34.6 U	7.82 J
COMP IC1-A Replicate 2	5	2	109	2.27	4.6 U	0.97 J	13.3	17.07	34.6 U	7.29 J
COMP IC1-A Replicate 3	5	2	103	2.41	4.6 U	1.03 J	13.3	18.12	34.6 U	7.74 J
COMP IC1-B	1	2	94	1.81	4.6 U	1.3 U	14.5	12.48	31.7 U	9.0 U
COMP IC1-B	2	2	105	1.91	4.6 U	0.52 J	14.6	13.08	31.5 U	3.56 J
COMP IC1-B	3	1	109	1.52 J	4.6 U	0.63 J	14.0	10.86 J	32.9 U	4.50 J
COMP IC1-B	4	2	93	2.09	4.6 U	1.04 J	14.8	14.12	31.1 U	7.03 J
COMP IC1-B	5	1	99	1.71	4.6 U	1.3 U	14.1	12.13	32.6 U	9.2 U
COMP IC1-B Special	1	1	95	3.60	4.6 U	1.02 J	13.8	26.09	33.3 U	7.39 J
COMP IC1-B Special	2	1	106	3.17	4.6 U	0.55 J	13.8	22.97	33.3 U	3.99 J
COMP IC1-B Special	3	2	107	4.17	4.6 U	0.43 J	13.9	30.00	33.1 U	3.09 J
COMP IC1-B Special	4	2	112	3.65	4.6 U	0.95 J	15.3	23.86	30.1 U	6.21 J
COMP IC1-B Special	5	1	100	3.65	4.6 U	0.95 J	14.0	26.07	32.9 U	6.79 J
COMP IC1-C	1	2	113	2.20	4.6 U	1.3 U	15.7	14.01	29.3 U	8.3 U
COMP IC1-C	2	2	93	2.01	4.6 U	1.3 U	14.8	13.58	31.1 U	8.8 U
COMP IC1-C	3	2	98	2.28	4.6 U	1.3 U	15.2	15.00	30.3 U	8.6 U
COMP IC1-C	4	1	87	2.59	4.6 U	1.3 U	13.7	18.91	33.6 U	9.5 U
COMP IC1-C	5	1	100	1.78	4.6 U	0.59 J	14.4	12.36	31.9 U	4.10 J
COMP OC4-B	1	2	112	3.48	4.6 U	1.31	13.1	26.56	35.1 U	10.00
COMP OC4-B Replicate 1	2	1	112	3.18	4.6 U	1.38	12.3	25.85	37.4 U	11.22
COMP OC4-B Replicate 2	2	1	114	2.77	4.6 U	1.3 U	12.3	22.52	37.4 U	10.6 U
COMP OC4-B Replicate 3	2	1	125 (e)	3.04	4.6 U	0.61 J	12.3	24.72	37.4 U	4.96 J
COMP OC4-B	3	2	111	4.09	4.6 U	1.3 U	14.7	27.82	31.3 U	8.8 U
COMP OC4-B	4	1	93	3.9	1.2	1.3 U	13.2	29.5	9.1	9.8 U
COMP OC4-B	5	2	102	4.15	4.6 U	1.3 U	15.1	27.48	30.5 U	8.6 U

TABLE J.26. (contd)

Sediment Treatment	Replicate	Analytical Batch	Triphenyltin (%) Internal Standard	(µg/kg wet weight)			Percent Dry Weight	(µg/kg dry weight)		
				Tri- Butyltin	Di- Butyltin	Mono- Butyltin		Tri- Butyltin	Di- Butyltin	Mono- Butyltin
R-AM	1	1	103	2.89	4.6 U	0.94 J	14.7	19.66	31.3 U	6.39 J
R-AM	2	2	97	3.08	4.6 U	1.3 U	13.9	22.16	33.1 U	9.4 U
R-AM	3	1	119	3.12	4.6 U	0.92 J	14.0	22.29	32.9 U	6.57 J
R-AM	4	1	97	3.39	4.6 U	0.80 J	14.9	22.78	30.9 U	5.38 J
R-AM	5	2	97	2.80	4.6 U	1.3 U	14.9	18.79	30.9 U	8.7 U
R-BF	1	1	108	3.78	4.6 U	0.90 J	15.2	24.87	30.3 U	5.92 J
R-BF	2	2	86	4.41	4.6 U	1.14 J	15.4	28.64	29.9 U	7.40 J
R-BF	3	1	103	3.90	4.6 U	1.3 U	14.8	26.35	31.1 U	8.8 U
R-BF	4	1	103	4.09	4.6 U	0.81 J	15.8	25.89	29.1 U	5.13 J
R-BF	5	1	102	4.27	4.6 U	1.3 U	16.0	26.69	28.8 U	8.1 U
R-OS	1	2	106	1.61	4.6 U	0.44 J	12.9	12.48	35.7 U	3.41 J
R-OS	2	2	94	1.62	4.6 U	0.39 J	13.1	12.37	35.1 U	2.98 J
R-OS	3	2	98	1.68	4.6 U	1.3 U	14.3	11.75	32.2 U	9.1 U
R-OS	4	1	106	1.42 J	4.6 U	1.3 U	13.8	10.29 J	33.3 U	9.4 U
R-OS	5	NA	NI ^(f)	NI	NI	NI	NI	NI	NI	NI
<i>M. nasuta</i> Background	1	2	113	1.41 J	4.6 U	0.76 J	14.1	10.00 J	32.6 U	5.39 J
<i>M. nasuta</i> Background	2	2	111	1.63	4.6 U	1.3 U	15.6	10.45	29.5 U	8.3 U
<i>M. nasuta</i> Background	3	2	103	1.66	4.6 U	1.3 U	14.8	11.22	31.1 U	8.8 U
<i>M. nasuta</i> Background	4	2	110	1.51 J	4.6 U	1.07 J	15.8	9.56 J	29.1 U	6.77 J
<i>M. nasuta</i> Background	5	2	113	1.82	4.6 U	1.43	14.5	12.55	31.7 U	9.86

(a) DL Detection limit.

(b) NA Not applicable.

(c) U Undetected above given concentration.

(d) J Value detected below limit of quantitation but above method detection limit.

(e) Value exceeds quality control range of (40% to 120%).

(f) NI No information; insufficient sediment to test all five replicates.

TABLE J.27. Quality Control Data for Butyltin Results, Wet Weight, in Tissues of *M. nasuta*, Oakland Harbor Intensive Study

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Analytical Batch</u>	<u>Triphenyltin (%) Internal Standard</u>	<u>Butyltin Species ($\mu\text{g}/\text{kg}$ wet weight)</u>		
				<u>Tri-Butyltin</u>	<u>Di-Butyltin</u>	<u>Mono-Butyltin</u>
<u>Method Blanks</u>						
Blank		1	107	1.6 U ^(a)	4.6 U	1.3 U
Blank		2	101	1.6 U	4.6 U	1.21 J ^(b)
Blank		3	111	1.6 U	4.6 U	1.3 U
<u>Matrix Spikes</u>						
R-OS		1	106	1.42 J	4.6 U	1.3 U
R-OS MS			83	53.3	49.4	31.8
Concentration Recovered				51.9	49.4	31.8
Amount Spiked				49.7	49.7	49.7
Percent Recovery				104%	99%	64%
COMP OC4-B		2	112	3.48	4.6 U	1.31
COMP OC4-B MS			99	53.0	49.4	29.4
Concentration Recovered				49.5	49.4	28.1
Amount Spiked				49.8	49.8	49.8
Percent Recovery				99%	99%	56%
<u>Analytical Replicates</u>						
COMP OC4-B Replicate 1	1	1	112	3.18	4.6 U	1.38
COMP OC4-B Replicate 2	2	1	114	2.77	4.6 U	1.3 U
COMP OC4-B Replicate 3	3	1	125 ^(c)	3.04	4.6 U	0.61 J
RSD			NA ^(d)	7%	NA	NA
COMP IC1-A Replicate 1	1	2	90	2.29	4.6 U	1.04 J
COMP IC1-A Replicate 2	2	2	109	2.27	4.6 U	0.97 J
COMP IC1-A Replicate 3	3	2	103	2.41	4.6 U	1.03 J
RSD			NA	3%	NA	4%

(a) U Undetected above given concentration.

(b) J Value detected below limit of quantitation but above method detection limit.

(c) Value exceeds quality control range of (40% to 120%).

(d) NA Not applicable.

APPENDIX K

TISSUE CHEMISTRY AND QUALITY ASSURANCE DATA
FOR *NEPHTYS caecoides*

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH)
LABORATORY: Battelle/Ocean Sciences Laboratory, Duxbury, Massachusetts
MATRIX: *Nephthys caecoides* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Modified 8270	40% - 120%	≤30%	≤30%	20 µg/kg

METHOD Analysis for PAHs were conducted by gas chromatography/mass spectrometry. After extraction, the samples were concentrated and further processed through the size-exclusion HPLC. Following HPLC, the tissue extracts were spiked with a set of recovery internal standard (RIS) compounds. This spiked samples was then transferred to GC/MS for PAH analysis.

HOLDING TIMES Samples were received on 6/24/93 in good condition. The samples were extracted in three batches on 6/28 through 7/1/93. All samples were analyzed within 40 days as specified by EPA (1986).

DETECTION LIMITS Target detection limits of 20 µg/kg were met for all tissue samples.

METHOD BLANKS Three method blanks were analyzed with the tissue samples. All concentrations were either undetected or detected below the method detection limit.

SURROGATES Three isotopically labeled compounds were added prior to extraction to assess the efficiency of the method. These were d8-naphthalene, d8-acenaphthene, and d12-benzo(a)pyrene. Recoveries of all surrogates were within the range of recovery limits of 40% to 120%.

MATRIX SPIKES Three samples were spiked with all 16 PAH compounds. Matrix spike recoveries ranged from 58% to 95%. All recoveries were within the range of recovery of 40% to 120%.

REPLICATES Three samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs ranged from 3% to 54%, with two samples exceeding the precision limit of ≤ 30%. The RSD results indicate acceptable precision.

SRMs The SRM NIST 1974 was analyzed for eight PAH compounds. Results for all metals were within ±30% of mean certified value with the exception of one of the two SRM values for anthracene, phenanthrene, fluoranthene, pyrene, benzo(a)pyrene, and indeno(1,2,3-c,d)pyrene. In all cases the variance never exceeded 45%.

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QA/QC SUMMARY (contd)

REFERENCES

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA 955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Pesticides and Polychlorinated Biphenyls (PCBs)
LABORATORY: Battelle/Ocean Sciences Laboratory, Duxbury, Massachusetts
MATRIX: *Nephtys caecoides* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Modified 8080	40% - 120%	≤30%	≤30%	2.0 - 30 µg/kg

METHOD Analysis for pesticides and PCBs were conducted by gas chromatography with electron capture (GC/ECD). After extraction, the samples were concentrated and further processed through the size-exclusion HPLC. Following HPLC, the tissue extracts were spiked with a set of recovery internal standard (RIS) compounds. This spiked samples was then transferred to GC/ECD for pesticide and PCB analysis.

HOLDING TIMES Samples were received on 6/24/93 in good condition. The samples were extracted in three batches on 6/28 through 7/1/93. All samples were analyzed within 40 days as specified by EPA (1986).

DETECTION LIMITS Target detection limits of 2 µg/kg to 20 µg/kg were met for all tissue samples except chlordane, 4,4'-DDE, 4,4'-DDT, endosulfan I and II, endosulfan sulfate, endrin aldehyde, and toxaphene. These exceedances were due to the limited amount of *N. caecoides* tissue available to chemical analyses.

METHOD BLANKS Three method blanks were analyzed with the tissue samples. The blank concentrations were undetected below the method detection limit for all compounds except chlordane and toxaphene. These two exceptions were undetected at less than five times the MDL; therefore, as specified in the QA Plan, no corrective action was taken.

SURROGATES Three isotopically labeled compounds were added prior to extraction to assess the efficiency of the method. These were DBFOFB, CL5(112) and CL5(103). Recoveries of all surrogates were within the range of recovery limits of 40% to 120% for two of the three matrix spikes.

MATRIX SPIKES Three samples were spiked with 16 pesticide and Aroclor 1254 compounds. Matrix spike recoveries ranged from 5% to 81%. One parameter (endrin aldehyde) was outside of the range of recovery of 40% to 120%.

REPLICATES Three samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs ranged from 5% to 30%, which is within the precision limit of ≤30%.

QA/QC SUMMARY (contd)

SRMs

NOT APPLICABLE

REFERENCES

EPA (U.S. Environmental Protection Agency). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. EPA 955-001-00000, U.S. Government Printing Office, Washington, D.C.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *Nephthys caecoides* Tissue

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (mg/kg dry wt)</u>
Arsenic	XRF	NA	≤30%	≤20%	2.0
Cadmium	ICP/MS	75-125	≤30%	≤20%	0.1
Chromium	ICP/MS	75-125	≤30%	≤20%	1.0
Copper	XRF	NA	≤30%	≤20%	4.3
Lead	ICP/MS	75-125	≤30%	≤20%	1.0
Mercury	CVAA	75-125	≤30%	≤20%	0.01
Nickel	ICP/MS	75-125	≤30%	≤20%	1.0
Selenium	XRF	NA	≤30%	≤20%	01.0
Silver	ICP/MS	75-125	≤30%	≤20%	0.1
Zinc	XRF	NA	≤30%	≤20%	35

METHOD

A total of 10 metals was analyzed for the Oakland Intensive project: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se) and zinc (Zn). Four metals, As, Cu, Se and Zn, were analyzed by energy diffusive x-ray fluorescence (XRF) following the method of Sanders (1992). Mercury was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). Five metals, Cd, Cr, Pb, Ni and Ag, were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following SOP MSL-M-025, Metals and Trace Elements in Sediment and Tissue by ICP/MS which is based on EPA Method 200.8 (EPA 1991)

HOLDING TIMES

Samples were received on 6/18/93 in good condition. Samples were placed into Battelle's log-in system, frozen to -80°C and subsequently freeze dried within approximately 7 days of sample receipt. Samples were all analyzed within 180 days of collection. The following table summarizes all analysis dates:

<u>Task</u>	<u>Date Performed</u>
Sample Digestion	8/04/93
XRF Analysis	7/15 -19/93
ICP/MS	8/05/93
CVAA (Hg)	8/05/93

DETECTION LIMITS Target detection limits were met for all metals with the exception of Cd and Hg. All sample results for these metals were detectable above the MDL; therefore, no data were compromised.

QA/QC SUMMARY (contd)

- METHOD BLANKS** One method blank was analyzed for Ag, Cd, Cr, Hg, Ni and Pb. Levels detected were well below the target detection limits; therefore, no data was flagged and no corrective actions were taken. All ICP/MS and CVAA results are blank corrected. Method blanks are not analyzed by XRF; therefore, no blank results are reported for XRF metals.
- MATRIX SPIKES** Three samples were spiked with Ag, Cd, Cr, Hg, Ni and Pb. Matrix spike recoveries ranged from 82% to 121%. All recoveries were within the range of recovery of 75% to 125%. Samples for XRF are analyzed whole and cannot be spiked.
- REPLICATES** Three samples were analyzed in triplicate. All three of these samples were analyzed by ICP/MS, and two of the three sets of triplicates were analyzed for XRF. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. The RSDs ranged from 1% to 14%, indicating acceptable precision.
- SRMs** The SRM 1566a (Oyster tissue from the National Institute of Standards and Technology), was analyzed for all metals. Results for all metals were within $\pm 30\%$ of mean certified value with the exception of Cr in two of the three SRM analyses. The Cr results for these samples were somewhat below the lower certified range, however, all other data for this metal were acceptable and no other action was taken.

REFERENCES

- Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Marine Chemistry* 21:337-390.
- EPA (U.S. Environmental Protection Agency). 1991. *Methods for the Determination of Metals in Environmental Samples*. EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch.
- Sanders, R.W. 1992. *Procedures and Quality Control for Energy Dispersive X-Ray Fluorescence Spectroscopy Using the BFP Approach with the Kevex 0810A System*. PNL SOP #7-40.48, Battelle, Pacific Northwest Laboratory, Richland, Washington.

QA/QC SUMMARY

PROGRAM: Oakland Harbor Intensive Study
PARAMETER: Butyltins
LABORATORY: Battelle/Ocean Sciences Laboratory, Duxbury, Massachusetts
MATRIX: *Nephtys caecoides* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Unger et al.	40% - 120%	≤30%	≤30%	10 ng/g

METHOD Butyltin analyses were performed according to the method of Unger et al. (1986). Tissue samples were extracted with hexane-0.05% trolopone. Sample extracts were then cleaned by passing through a florisil column. Extracts were analyzed using gas chromatography/flame photometric detection (GC/FPD).

HOLDING TIMES Samples were received on 6/24/93 in good condition. The samples were extracted in three batches on 6/28 through 7/1/93. All samples were analyzed within 40 days as specified by EPA (1986).

DETECTION LIMITS Target detection limits of 10 µg/kg wet weight were not met for all samples and is due to the limited amount of *N. caecoides* tissue that was available for analysis.

METHOD BLANKS One method blank was extracted with the tissue samples. No di- or tributyltins were detected in the blanks. Because butyltins were not detected above the detection limit in any of the tissue samples, no corrective action was taken.

SURROGATES One compound, triphenyltin chloride, is added prior to extraction to assess the efficiency of the method. This compound also is used as an internal standard as all data is corrected for the recovery of the compound. Sample recoveries ranged from 7% to 97%, with 12 of the surrogates falling outside of the range of recovery of 40% to 120%.

MATRIX SPIKES One sample from each batch was spiked with mono-, di- and tributyltin. Matrix spike recoveries ranged from 0% to 142% with 3 monobutyltin and 2 tributyltin concentrations outside the range of recovery of 40% to 120%.

REPLICATES One sample from each batch was extracted in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. All of the triplicate values were undetected; therefore, no RSDs were calculated.

SRMs NOT APPLICABLE

QA/QC SUMMARY (contd)

REFERENCES

Unger, M.A., W.G. Macintyre, J. Reaves and R.J. Huggett. 1986. "GC Determination of Butyltins in Natural Waters by Flame Photometric Detection of Hexyl Derivatives with Mass Spectrometric Confirmation." *Chemosphere*. 15(4):461-470.

TABLE K.1. Total Polynuclear Aromatic Hydrocarbons (PAHs), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> PAHs ($\mu\text{g}/\text{kg}$ dry weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP IC1-A	1	3	11.50	18	10	28
COMP IC1-A	2	1	16.99	17	5	22
COMP IC1-A	3	1	16.51	16	9	25
COMP IC1-A	4	1	17.12	13	6	19
COMP IC1-A	5	2	13.68	13	5	18
COMP IC1-B	1	3	12.38	8	3	11
COMP IC1-B	2	1	15.62	23	13	36
COMP IC1-B	3	1	14.97	15	5	20
COMP IC1-B	4	3	13.81	5	11	16
COMP IC1-B	5	2	13.23	13	12	25
COMP IC1-B Special	1	1	16.00	20	17	37
COMP IC1-B Special	2	1	16.75	14	21	35
COMP IC1-B Special	3	2	12.98	15	12	27
COMP IC1-B Special	4	3	14.08	10	13	23
COMP IC1-B Special	5	2	12.74	13	12	25
COMP IC1-C	1	3	13.11	19	19	38
COMP IC1-C	2	2	15.52	12	15	27
COMP IC1-C	3	3	13.33	15	14	29
COMP IC1-C	4	1	15.14	19	15	34
COMP IC1-C	5	1	16.89	31	16	47
COMP OC4-B	1	3	13.54	13	42	55
COMP OC4-B	2	1	15.76	13	52	65
COMP OC4-B	3	2	15.52	15	49	64
COMP OC4-B	4	2	12.87	16	62	78
COMP OC4-B	5	3	13.50	17	39	56
R-AM	1	1	16.02	44	187	231
R-AM	2	2	16.39	24	178	202
R-AM	3	1	14.33	39	130	169
R-AM	4	1	14.40	37	197	234
R-AM	5	2	14.71	24	101	125
R-BF	1	3	16.19	15	45	60
R-BF Replicate 1	2	2	13.37	41	47	88
R-BF Replicate 2	2	2	13.37	38	60	98
R-BF Replicate 3	2	2	13.37	20	49	69
R-BF	3	1	17.11	12	33	45
R-BF Replicate 1	4	1	14.93	32	47	79
R-BF Replicate 2	4	1	14.93	24	45	69
R-BF Replicate 3	4	1	14.93	21	43	64
R-BF	5	2	14.62	15	33	48
R-OS	1	3	13.44	10	4	14
R-OS	2	2	15.31	14	7	21
R-OS	3	2	14.42	22	5	27
R-OS	4	2	12.12	12	7	19
R-OS	5	NA ^(a)	NA	NI ^(b)	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	15	8	23
<i>N. caecoides</i> Background	2	3	16.67	14	5	19
<i>N. caecoides</i> Background	3	3	17.04	21	7	28

TABLE K.1. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> PAHs ($\mu\text{g}/\text{kg}$ dry weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
<i>N. caecoides</i> Background	4	3	16.50	10	5	15
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	19	7	26
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	13	6	19
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	12	5	17

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE K.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs),
Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)					
				Naphtha- lene	Acenaph- thylene	Acenaph- thene-	Fluorene	Phenan- threne	Anthra- cene
COMP IC1-A	1	3	11.50	7.79 J ^(a)	23.30 U ^(b)	1.75 J	1.79 J	5.83 J	0.66 J
COMP IC1-A	2	1	16.99	11.97 J	36.08 U	13.68 U	23.02 U	4.94 J	19.62 U
COMP IC1-A	3	1	16.51	12.37 J	42.76 U	16.21 U	27.29 U	3.86 J	23.26 U
COMP IC1-A	4	1	17.12	8.65 J	28.99 U	10.99 U	18.50 U	4.60 J	15.77 U
COMP IC1-A	5	2	13.68	6.29 J	23.97 U	9.09 U	1.17 J	5.64 J	13.04 U
COMP IC1-B	1	3	12.38	5.18 J	21.36 U	9.10 U	13.63 U	2.80 J	11.62 U
COMP IC1-B	2	1	15.62	16.49 J	53.04 U	20.11 U	33.85 U	6.03 J	28.85 U
COMP IC1-B	3	1	14.97	10.91 J	33.28 U	12.62 U	21.24 U	4.36 J	18.10 U
COMP IC1-B	4	3	13.81	57.45 U	53.04 U	20.11 U	1.21 J	3.64 J	28.85 U
COMP IC1-B	5	2	13.23	6.52 J	31.05 U	11.77 U	19.81 U	6.39 J	16.89 U
COMP IC1-B Special	1	1	16.00	11.81 J	30.55 U	11.58 U	1.75 J	6.06 J	16.62 U
COMP IC1-B Special	2	1	16.75	9.69 J	27.79 U	10.54 U	17.74 U	4.18 J	15.12 U
COMP IC1-B Special	3	2	12.98	6.90 J	31.01 U	11.75 U	1.79 J	5.67 J	0.84 J
COMP IC1-B Special	4	3	14.08	5.38 J	21.49 U	8.15 U	0.74 J	3.75 J	0.58 J
COMP IC1-B Special	5	2	12.74	6.40 J	24.93 U	9.45 U	1.11 J	4.63 J	0.43 J
COMP IC1-C	1	3	13.11	9.41 J	28.99 U	10.99 U	1.62 J	6.85 J	0.87 J
COMP IC1-C	2	2	15.52	4.61 J	22.96 U	1.20 J	1.26 J	3.56 J	0.95 J
COMP IC1-C	3	3	13.33	10.90 J	44.20 U	16.76 U	28.21 U	2.95 J	0.82 J
COMP IC1-C	4	1	15.14	12.90 J	52.05 U	19.73 U	33.22 U	5.92 J	28.31 U
COMP IC1-C	5	1	16.89	24.21 J	72.26 U	27.39 U	46.12 U	6.82 J	39.30 U
COMP OC4-B	1	3	13.54	6.63 J	22.56 U	0.85 J	0.92 J	4.02 J	0.91 J
COMP OC4-B	2	1	16.76	7.90 J	29.57 U	11.21 U	18.87 U	5.14 J	16.09 U
COMP OC4-B	3	2	15.52	6.97 J	27.79 U	10.54 U	1.49 J	5.60 J	0.89 J
COMP OC4-B	4	2	12.87	7.42 J	29.89 U	11.33 U	1.40 J	6.67 J	0.72 J
COMP OC4-B	5	3	13.50	7.39 J	32.76 U	12.42 U	1.58 J	6.92 J	1.00 J
R-AM	1	1	16.02	10.37 J	1.12 J	1.55 J	2.65 J	21.86	6.11 J
R-AM	2	2	16.39	20.95 U	19.34 U	7.33 U	1.84 J	19.41	3.12 J
R-AM	3	1	14.33	17.24 J	74.64 U	28.29 U	47.63 U	21.91 J	40.60 U
R-AM	4	1	14.40	10.43 J	31.88 U	12.08 U	20.35 U	21.38 J	5.16 J
R-AM	5	2	14.71	9.84 J	39.45 U	14.95 U	25.17 U	12.10 J	2.42 J
R-BF	1	3	16.19	5.32 J	22.68 U	1.06 J	1.31 J	6.14 J	1.26 J
R-BF Replicate 1	2	2	13.37	31.79 J	143.28 U	54.31 U	91.44 U	8.87 J	77.93 U
R-BF Replicate 2	2	2	13.37	26.89 J	135.49 U	51.36 U	86.47 U	9.04 J	2.04 J
R-BF Replicate 3	2	2	13.37	8.90 J	64.09 U	24.29 U	1.66 J	7.75 J	1.35 J
R-BF	3	1	17.11	6.59 J	27.82 U	10.55 U	17.76 U	5.45 J	15.13 U

TABLE K.2. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> LPAHs ($\mu\text{g/kg}$ dry weight)					
				Naphtha- lene	Acenaph- thylene	Acenaph- thene-	Fluorene	Phenan- threne	Anthra- cene
R-BF Replicate 1	4	1	14.93	21.50 J	65.61 U	24.87 U	41.87 U	8.68 J	1.42 J
R-BF Replicate 2	4	1	14.93	16.15 J	66.30 U	25.13 U	42.31 U	8.09 J	36.06 U
R-BF Replicate 3	4	1	14.93	12.73 J	65.95 U	25.00 U	42.09 U	8.13 J	35.87 U
R-BF	5	2	14.62	7.53 J	19.40 U	7.35 U	1.40 J	5.69 J	0.85 J
R-OS	1	3	13.44	7.29 J	31.64 U	11.99 U	20.19 U	2.47 J	17.21 U
R-OS	2	2	15.31	5.41 J	20.81 U	1.31 J	1.16 J	5.71 J	0.35 J
R-OS	3	2	14.42	16.05 J	88.09 U	33.39 U	56.22 U	5.67 J	47.92 U
R-OS	4	2	12.12	7.04 J	24.66 U	9.35 U	15.74 U	3.91 J	0.55 J
R-OS	5	NA ^(c)	NI ^(d)	NI	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	4.38 J	15.48 U	1.25 J	1.67 J	7.47 J	8.42 U
<i>N. caecoides</i> Background	2	3	16.67	4.98 J	13.05 U	1.06 J	1.98 J	6.44 J	7.10 U
<i>N. caecoides</i> Background	3	3	17.04	13.75 J	16.81 U	6.37 U	10.73 U	6.91 J	9.14 U
<i>N. caecoides</i> Background	4	3	16.50	4.07 J	16.99 U	1.02 J	1.05 J	3.60 J	9.24 U
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	12.53 J	58.52 U	22.18 U	37.35 U	6.76 J	31.83 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	8.28 J	37.83 U	14.34 U	24.14 U	5.12 J	20.58 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	5.77 J	27.10 U	10.27 U	1.48 J	5.04 J	14.74 U

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.3. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution Order, Fluoranthene - Benzo(b)fluoranthene), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

K.5

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)				
				Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene
COMP IC1-A	1	3	11.50	2.83 J ^(a)	3.42 J	20.08 U ^(b)	1.64 J	1.02 J
COMP IC1-A	2	1	16.99	1.82 J	2.15 J	31.10 U	0.90 J	35.11 U
COMP IC1-A	3	1	16.51	1.11 J	3.19 J	36.86 U	1.75 J	2.44 J
COMP IC1-A	4	1	17.12	1.55 J	3.24 J	24.99 U	0.85 J	28.21 U
COMP IC1-A	5	2	13.68	1.56 J	2.59 J	20.66 U	1.18 J	23.33 U
COMP IC1-B	1	3	12.38	1.05 J	1.43 J	18.41 U	0.84 J	20.79 U
COMP IC1-B	2	1	15.62	5.23 J	5.23 J	45.72 U	2.46 J	51.62 U
COMP IC1-B	3	1	14.97	1.58 J	2.50 J	28.69 U	0.86 J	32.39 U
COMP IC1-B	4	3	13.81	2.39 J	4.75 J	45.72 U	2.33 J	51.62 U
COMP IC1-B	5	2	13.23	3.60 J	4.07 J	26.76 U	1.89 J	1.98 J
COMP IC1-B Special	1	1	16.00	3.11 J	9.06 J	26.34 U	2.28 J	1.86 J
COMP IC1-B Special	2	1	16.75	4.48 J	11.38 J	23.96 U	1.17 J	2.17 J
COMP IC1-B Special	3	2	12.98	2.82 J	9.16 J	26.73 U	30.56 U	30.17 U
COMP IC1-B Special	4	3	14.08	2.44 J	7.54 J	18.53 U	1.60 J	1.05 J
COMP IC1-B Special	5	2	12.74	2.37 J	7.17 J	21.49 U	2.31 J	24.26 U
COMP IC1-C	1	3	13.11	3.59 J	13.07 J	24.99 U	2.06 J	28.21 U
COMP IC1-C	2	2	15.52	1.64 J	8.85 J	19.79 U	0.95 J	1.53 J
COMP IC1-C	3	3	13.33	1.57 J	7.15 J	38.10 U	1.83 J	2.10 J
COMP IC1-C	4	1	15.14	2.60 J	11.14 J	44.86 U	1.60 J	50.65 U
COMP IC1-C	5	1	16.89	68.17 U	14.51 J	62.29 U	1.39 J	70.32 U
COMP OC4-B	1	3	13.54	3.89 J	32.06	19.45 U	6.40 J	21.95 U
COMP OC4-B	2	1	16.76	6.01 J	37.85	25.49 U	7.91 J	28.78 U
COMP OC4-B	3	2	15.52	4.43 J	34.40	23.96 U	7.99 J	1.42 J
COMP OC4-B	4	2	12.87	6.42 J	46.54	25.77 U	9.40 J	29.09 U
COMP OC4-B	5	3	13.50	4.73 J	25.59	28.24 U	5.65 J	1.85 J
R-AM	1	1	16.02	32.55	125.76	26.40 U	25.90 J	2.14 J
R-AM	2	2	16.39	29.97	119.03	16.67 U	24.68	2.14 J
R-AM	3	1	14.33	17.60 J	82.10	64.34 U	30.39 J	72.63 U
R-AM	4	1	14.40	27.78 J	141.14	27.48 U	28.01 J	31.02 U
R-AM	5	2	14.71	10.46 J	49.03	21.75 J	17.58 J	2.23 J

TABLE K.3. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ dry weight)				
				Fluor- anthene	Pyrene	Benzo(a) anthra- cene	Chrysene	Benzo(b) fluoran- thene
R-BF	1	3	16.19	9.37 J	22.28	19.55 U	11.75 J	1.79 J
R-BF Replicate 1	2	2	13.37	9.91 J	24.30 J	123.51 U	12.92 J	139.43 U
R-BF Replicate 2	2	2	13.37	11.16 J	25.01 J	116.79 U	14.59 J	5.70 J
R-BF Replicate 3	2	2	13.37	9.60 J	22.97 J	3.31 J	9.67 J	2.31 J
R-BF	3	1	17.11	6.44 J	18.17 J	23.98 U	7.93 J	27.08 U
R-BF Replicate 1	4	1	14.93	10.18 J	22.65 J	56.55 U	13.89 J	63.84 U
R-BF Replicate 2	4	1	14.93	9.57 J	23.92 J	57.15 U	11.92 J	64.52 U
R-BF Replicate 3	4	1	14.93	62.22 U	23.00 J	4.64 J	11.46 J	3.85 J
R-BF	5	2	14.62	6.13 J	18.97	16.72 U	8.11 J	18.88 U
R-OS	1	3	13.44	0.91 J	1.39 J	27.27 U	1.16 J	0.88 J
R-OS	2	2	15.31	2.15 J	3.33 J	17.94 U	0.86 J	0.73 J
R-OS	3	2	14.42	2.12 J	3.13 J	75.94 U	86.82 U	85.72 U
R-OS	4	2	12.12	1.68 J	2.58 J	21.26 U	1.69 J	0.95 J
R-OS	5	NA ^(c)	NI ^(b)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	3.15 J	3.08 J	13.35 U	2.23 J	15.07 U
<i>N. caecoides</i> Background	2	3	16.67	1.79 J	2.16 J	11.25 U	1.22 J	12.70 U
<i>N. caecoides</i> Background	3	3	17.04	2.96 J	4.53 J	14.49 U	16.57 U	16.36 U
<i>N. caecoides</i> Background	4	3	16.50	1.92 J	2.17 J	14.65 U	0.89 J	16.54 U
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	3.34 J	3.52 J	50.45 U	57.68 U	56.95 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	2.09 J	2.48 J	32.61 U	1.80 J	36.81 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	2.09 J	2.53 J	23.36 U	26.71 U	26.37 U

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.4. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution Order, Benzo(k)fluoranthene - Benzo(g,h,i)perylene), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ dry weight)				
				Benzo(k)-fluoranthene	Benzo(a)pyrene	Ideno-(1,2,3-c,d)pyrene	Dibenzo-(a,h)anthracene	Benzo-(g,h,i)-perylene
COMP IC1-A	1	3	11.50	0.59 J ^(a)	8.44 U ^(b)	18.48 U	16.66 U	15.53 U
COMP IC1-A	2	1	16.99	16.43 U	13.07 U	28.61 U	25.80 U	24.05 U
COMP IC1-A	3	1	16.51	0.90 J	15.49 U	33.91 U	30.58 U	28.51 U
COMP IC1-A	4	1	17.12	13.20 U	10.50 U	22.99 U	20.73 U	19.33 U
COMP IC1-A	5	2	13.68	10.91 U	8.68 U	19.01 U	17.14 U	15.98 U
COMP IC1-B	1	3	12.38	9.73 U	7.74 U	16.94 U	15.28 U	14.24 U
COMP IC1-B	2	1	15.62	24.15 U	19.21 U	42.06 U	37.94 U	35.36 U
COMP IC1-B	3	1	14.97	15.15 U	12.06 U	26.40 U	23.81 U	22.19 U
COMP IC1-B	4	3	13.81	1.79 J	19.21 U	42.06 U	37.94 U	35.36 U
COMP IC1-B	5	2	13.23	0.62 J	11.25 U	24.62 U	22.20 U	20.70 U
COMP IC1-B Special	1	1	16.00	0.73 J	11.07 U	24.23 U	21.85 U	20.37 U
COMP IC1-B Special	2	1	16.75	1.39 J	10.07 U	22.04 U	19.88 U	18.53 U
COMP IC1-B Special	3	2	12.98	14.12 U	11.23 U	24.59 U	22.18 U	20.67 U
COMP IC1-B Special	4	3	14.08	9.78 U	7.78 U	17.04 U	15.37 U	14.33 U
COMP IC1-B Special	5	2	12.74	11.35 U	9.03 U	19.77 U	17.83 U	16.62 U
COMP IC1-C	1	3	13.11	13.20 U	10.50 U	22.99 U	20.73 U	19.33 U
COMP IC1-C	2	2	15.52	0.64 J	8.31 U	18.20 U	16.42 U	1.26 J
COMP IC1-C	3	3	13.33	0.90 J	16.01 U	35.05 U	31.61 U	29.47 U
COMP IC1-C	4	1	15.14	23.70 U	18.85 U	41.27 U	37.22 U	34.70 U
COMP IC1-C	5	1	16.89	32.90 U	26.17 U	57.30 U	51.68 U	48.17 U
COMP OC4-B	1	3	13.54	10.27 U	8.17 U	17.89 U	16.14 U	15.04 U
COMP OC4-B	2	1	16.76	13.46 U	10.71 U	23.45 U	21.15 U	19.72 U
COMP OC4-B	3	2	15.52	0.67 J	10.07 U	22.04 U	19.88 U	18.53 U
COMP OC4-B	4	2	12.87	13.61 U	10.83 U	23.71 U	21.38 U	19.93 U
COMP OC4-B	5	3	13.50	0.79 J	11.87 U	25.98 U	23.43 U	21.84 U
R-AM	1	1	16.02	0.61 J	11.09 U	24.29 U	21.90 U	20.42 U
R-AM	2	2	16.39	1.77 J	7.01 U	15.34 U	13.83 U	12.89 U
R-AM	3	1	14.33	33.98 U	27.04 U	59.19 U	53.38 U	49.76 U
R-AM	4	1	14.40	14.51 U	11.55 U	25.28 U	22.80 U	21.25 U
R-AM	5	2	14.71	17.96 U	14.29 U	31.28 U	28.21 U	26.30 U

TABLE K.4. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)				
				Benzo(k)- fluor- anthene	Benzo(a) pyrene	Ideno- (1,2,3- c,d) pyrene	Dibenzo- (a,h) anthracene	Benzo- (g,h,i)- perylene
R-BF	1	3	16.19	10.33 U	8.22 U	17.99 U	16.22 U	15.12 U
R-BF Replicate 1	2	2	13.37	65.23 U	51.90 U	113.62 U	102.47 U	95.52 U
R-BF Replicate 2	2	2	13.37	3.42 J	49.08 U	107.45 U	96.90 U	90.33 U
R-BF Replicate 3	2	2	13.37	1.31 J	23.21 U	50.82 U	45.84 U	42.72 U
R-BF	3	1	17.11	12.67 U	10.08 U	22.06 U	19.90 U	18.55 U
R-BF Replicate 1	4	1	14.93	29.87 U	23.76 U	52.03 U	46.92 U	43.74 U
R-BF Replicate 2	4	1	14.93	30.19 U	24.02 U	52.58 U	47.42 U	44.20 U
R-BF Replicate 3	4	1	14.93	30.03 U	23.89 U	52.30 U	47.17 U	43.97 U
R-BF	5	2	14.62	8.83 U	7.03 U	15.39 U	13.88 U	12.93 U
R-OS	1	3	13.44	14.40 U	11.46 U	25.09 U	22.63 U	21.09 U
R-OS	2	2	15.31	0.29 J	7.54 U	16.50 U	14.88 U	13.87 U
R-OS	3	2	14.42	40.11 U	31.91 U	69.86 U	63.00 U	58.73 U
R-OS	4	2	12.12	11.23 U	8.93 U	19.55 U	17.64 U	16.44 U
R-OS	5	NA ^(c)	NI ^(d)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	7.05 U	5.61 U	12.28 U	11.07 U	10.32 U
<i>N. caecoides</i> Background	2	3	16.67	5.94 U	4.73 U	10.35 U	9.34 U	8.70 U
<i>N. caecoides</i> Background	3	3	17.04	7.65 U	6.09 U	13.33 U	12.02 U	11.21 U
<i>N. caecoides</i> Background	4	3	16.50	7.74 U	6.16 U	13.48 U	12.15 U	11.33 U
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	26.64 U	21.20 U	46.41 U	41.85 U	39.01 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	17.22 U	13.70 U	30.00 U	27.06 U	25.22 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	12.34 U	9.82 U	21.49 U	19.38 U	18.07 U

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.5. Total Polynuclear Aromatic Hydrocarbons (PAHs), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> PAHs ($\mu\text{g}/\text{kg}$ wet weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP IC1-A	1	3	2	1	3
COMP IC1-A	2	1	3	1	4
COMP IC1-A	3	1	3	1	4
COMP IC1-A	4	1	2	1	3
COMP IC1-A	5	2	2	1	3
COMP IC1-B	1	3	1	0	1
COMP IC1-B	2	1	4	2	6
COMP IC1-B	3	1	2	1	3
COMP IC1-B	4	3	1	2	3
COMP IC1-B	5	2	2	2	4
COMP IC1-B Special	1	1	3	3	6
COMP IC1-B Special	2	1	2	4	6
COMP IC1-B Special	3	2	2	2	4
COMP IC1-B Special	4	3	1	2	3
COMP IC1-B Special	5	2	2	2	4
COMP IC1-C	1	3	2	2	4
COMP IC1-C	2	2	2	2	4
COMP IC1-C	3	3	2	2	4
COMP IC1-C	4	1	3	2	5
COMP IC1-C	5	1	5	3	8
COMP OC4-B	1	3	2	6	8
COMP OC4-B	2	1	2	9	11
COMP OC4-B	3	2	2	8	10
COMP OC4-B	4	2	2	8	10
COMP OC4-B	5	3	2	5	7
R-AM	1	1	7	30	37
R-AM	2	2	4	29	33
R-AM	3	1	6	19	25
R-AM	4	1	5	28	33
R-AM	5	2	4	15	19
R-BF	1	3	2	7	9
R-BF Replicate 1	2	2	5	6	11
R-BF Replicate 2	2	2	5	8	13
R-BF Replicate 3	2	2	3	7	10
R-BF	3	1	2	6	8
R-BF Replicate 1	4	1	5	7	12
R-BF Replicate 2	4	1	4	7	11
R-BF Replicate 3	4	1	3	6	9
R-BF	5	2	2	5	7
R-OS	1	3	1	1	2
R-OS	2	2	2	1	3
R-OS	3	2	3	1	4
R-OS	4	2	1	1	2
R-OS	5	NA ^(a)	NI ^(b)	NI	NI
<i>N. caecoides</i> Background	1	3	2	1	3
<i>N. caecoides</i> Background	2	3	2	1	3
<i>N. caecoides</i> Background	3	3	4	1	5

TABLE K.5. (contd)

Sediment Treatment	Replicate	Analytical Batch	<u><i>N. caecoides</i> PAHs ($\mu\text{g/kg}$ wet weight)</u>		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
<i>N. caecoides</i> Background	4	3	2	1	3
<i>N. caecoides</i> Background Replicate 1	5	3	3	1	4
<i>N. caecoides</i> Background Replicate 2	5	3	2	1	3
<i>N. caecoides</i> Background Replicate 3	5	3	2	1	3

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE K.6. Low Molecular Weight Polynuclear Aromatic Hydrocarbons, Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Target DL ^(a)			20	20	20	20	20	20
Achieved DL High			20.77	19.18	7.27	12.24	13.58	10.43
Achieved DL Low			2.34	2.16	0.82	1.38	1.53	1.18
COMP IC1-A	1	3	0.90 J ^(b)	2.68 U ^(c)	0.20 J	0.21 J	0.67 J	0.08 J
COMP IC1-A	2	1	2.03 J	6.13 U	2.32 U	3.91 U	0.84 J	3.33 U
COMP IC1-A	3	1	2.04 J	7.06 U	2.68 U	4.51 U	0.64 J	3.84 U
COMP IC1-A	4	1	1.48 J	4.97 U	1.88 U	3.17 U	0.79 J	2.70 U
COMP IC1-A	5	2	0.86 J	3.28 U	1.24 U	0.16 J	0.77 J	1.78 U
COMP IC1-B	1	3	0.64 J	2.65 U	1.00 U	1.69 U	0.35 J	1.44 U
COMP IC1-B	2	1	2.58 J	8.29 U	3.14 U	5.29 U	0.94 J	4.51 U
COMP IC1-B	3	1	1.63 J	4.98 U	1.89 U	3.18 U	0.65 J	2.71 U
COMP IC1-B	4	3	7.94 U	7.33 U	2.78 U	0.17 J	0.50 J	3.99 U
COMP IC1-B	5	2	0.86 J	4.11 U	1.56 U	2.62 U	0.85 J	2.23 U
COMP IC1-B Special	1	1	1.89 J	4.89 U	1.85 U	0.28 J	0.97 J	2.66 U
COMP IC1-B Special	2	1	1.62 J	4.66 U	1.77 U	2.97 U	0.70 J	2.53 U
COMP IC1-B Special	3	2	0.90 J	4.03 U	1.53 U	0.23 J	0.74 J	0.11 J
COMP IC1-B Special	4	3	0.76 J	3.03 U	1.15 U	0.10 J	0.53 J	0.08 J
COMP IC1-B Special	5	2	0.82 J	3.18 U	1.20 U	0.14 J	0.59 J	0.05 J
COMP IC1-C	1	3	1.23 J	3.80 U	1.44 U	0.21 J	0.90 J	0.11 J
COMP IC1-C	2	2	0.72 J	3.56 U	0.19 J	0.20 J	0.55 J	0.15 J
COMP IC1-C	3	3	1.45 J	5.89 U	2.23 U	3.76 U	0.39 J	0.11 J
COMP IC1-C	4	1	1.95 J	7.87 U	2.98 U	5.02 U	0.90 J	4.28 U
COMP IC1-C	5	1	4.08 J	12.19 U	4.62 U	7.78 U	1.15 J	6.63 U
COMP OC4-B	1	3	0.90 J	3.06 U	0.12 J	0.12 J	0.54 J	0.12 J
COMP OC4-B	2	1	1.32 J	4.96 U	1.88 U	3.16 U	0.86 J	2.70 U
COMP OC4-B	3	2	1.08 J	4.31 U	1.64 U	0.23 J	0.87 J	0.14 J
COMP OC4-B	4	2	0.95 J	3.85 U	1.46 U	0.18 J	0.86 J	0.09 J
COMP OC4-B	5	3	1.00 J	4.42 U	1.68 U	0.21 J	0.93 J	0.13 J
R-AM	1	1	1.66 J	0.18 J	0.25 J	0.42 J	3.50	0.98 J
R-AM	2	2	3.44 U	3.17 U	1.20 U	0.30 J	3.18	0.51 J
R-AM	3	1	2.47 J	10.69 U	4.05 U	6.82 U	3.14 J	5.82 U
R-AM	4	1	1.50 J	4.59 U	1.74 U	2.93 U	3.08 J	0.74 J
R-AM	5	2	1.45 J	5.80 U	2.20 U	3.70 U	1.78 J	0.36 J
R-BF	1	3	0.86 J	3.67 U	0.17 J	0.21 J	0.99 J	0.20 J
R-BF Replicate 1	2	2	4.25 J	19.18 U	7.27 U	12.24 U	1.19 J	10.43 U
R-BF Replicate 2	2	2	3.59 J	18.07 U	6.85 U	11.53 U	1.21 J	0.27 J
R-BF Replicate 3	2	2	1.19 J	8.57 U	3.25 U	0.22 J	1.04 J	0.18 J
R-BF	3	1	1.13 J	4.76 U	1.81 U	3.04 U	0.93 J	2.59 U
R-BF Replicate 1	4	1	3.21 J	9.80 U	3.72 U	6.26 U	1.30 J	0.21 J
R-BF Replicate 2	4	1	2.41 J	9.90 U	3.75 U	6.32 U	1.21 J	5.39 U
R-BF Replicate 3	4	1	1.90 J	9.86 U	3.74 U	6.29 U	1.22 J	5.36 U
R-BF	5	2	1.10 J	2.84 U	1.07 U	0.20 J	0.83 J	0.12 J
R-OS	1	3	0.98 J	4.25 U	1.61 U	2.71 U	0.33 J	2.31 U
R-OS	2	2	0.83 J	3.19 U	0.20 J	0.18 J	0.87 J	0.05 J
R-OS	3	2	2.32 J	12.72 U	4.82 U	8.12 U	0.82 J	6.92 U
R-OS	4	2	0.85 J	2.99 U	1.13 U	1.91 U	0.47 J	0.07 J
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI	NI

TABLE K.6. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
			Naphtha- lene	Acenaph- thylene	Acenaph- thene-	Fluorene	Phenan- threne	Anthra- cene
<i>N. caecoides</i> Background	1	3	0.61 J	2.16 U	0.17 J	0.23 J	1.04 J	1.18 U
<i>N. caecoides</i> Background	2	3	0.83 J	2.18 U	0.18 J	0.33 J	1.07 J	1.18 U
<i>N. caecoides</i> Background	3	3	2.34 J	2.87 U	1.09 U	1.83 U	1.18 J	1.56 U
<i>N. caecoides</i> Background	4	3	0.67 J	2.80 U	0.17 J	0.17 J	0.59 J	1.52 U
<i>N. caecoides</i> Background Replicate 1	5	3	2.03 J	9.48 U	3.59 U	6.05 U	1.09 J	5.16 U
<i>N. caecoides</i> Background Replicate 2	5	3	1.34 J	6.13 U	2.32 U	3.91 U	0.83 J	3.33 U
<i>N. caecoides</i> Background Replicate 3	5	3	0.93 J	4.39 U	1.66 U	0.24 J	0.82 J	2.39 U

(a) DL Detection limit.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) U Undetected above given concentration.

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE K.7. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution Order, Fluoranthene - Benzo(b) fluoranthene), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
			Fluor-anthene	Pyrene	Benzo(a) anthra-cene	Chrysene	Benzo(b) fluor-anthene
Target DL ^(a)			20	20	20	20	20
Achieved DL High			18.09	13.02	16.53	18.90	18.66
Achieved DL Low			2.04	1.47	1.86	2.13	2.10
COMP IC1-A	1	3	0.33 J ^(b)	0.39 J	2.31 U ^(c)	0.19 J	0.12 J
COMP IC1-A	2	1	0.31 J	0.37 J	5.28 U	0.15 J	5.96 U
COMP IC1-A	3	1	0.18 J	0.53 J	6.09 U	0.29 J	0.40 J
COMP IC1-A	4	1	0.27 J	0.55 J	4.28 U	0.15 J	4.83 U
COMP IC1-A	5	2	0.21 J	0.35 J	2.83 U	0.16 J	3.19 U
COMP IC1-B	1	3	0.13 J	0.18 J	2.28 U	0.10 J	2.58 U
COMP IC1-B	2	1	0.82 J	0.82 J	7.15 U	0.38 J	8.07 U
COMP IC1-B	3	1	0.24 J	0.37 J	4.30 U	0.13 J	4.85 U
COMP IC1-B	4	3	0.33 J	0.66 J	6.32 U	0.32 J	7.14 U
COMP IC1-B	5	2	0.48 J	0.54 J	3.54 U	0.25 J	0.26 J
COMP IC1-B Special	1	1	0.50 J	1.45 J	4.22 U	0.36 J	0.30 J
COMP IC1-B Special	2	1	0.75 J	1.91 J	4.02 U	0.20 J	0.36 J
COMP IC1-B Special	3	2	0.37 J	1.19 J	3.47 U	3.97 U	3.92 U
COMP IC1-B Special	4	3	0.34 J	1.06 J	2.61 U	0.23 J	0.15 J
COMP IC1-B Special	5	2	0.30 J	0.91 J	2.74 U	0.29 J	3.09 U
COMP IC1-C	1	3	0.47 J	1.71 J	3.28 U	0.27 J	3.70 U
COMP IC1-C	2	2	0.25 J	1.37 J	3.07 U	0.15 J	0.24 J
COMP IC1-C	3	3	0.21 J	0.95 J	5.08 U	0.24 J	0.28 J
COMP IC1-C	4	1	0.39 J	1.68 J	6.78 U	0.24 J	7.66 U
COMP IC1-C	5	1	11.50 U	2.45 J	10.51 U	0.23 J	11.86 U
COMP OC4-B	1	3	0.53 J	4.34	2.63 U	0.87 J	2.97 U
COMP OC4-B	2	1	1.01 J	6.34	4.27 U	1.33 J	4.82 U
COMP OC4-B	3	2	0.69 J	5.34	3.72 U	1.24 J	0.22 J
COMP OC4-B	4	2	0.83 J	5.99	3.32 U	1.21 J	3.74 U
COMP OC4-B	5	3	0.64 J	3.45	3.81 U	0.76 J	0.25 J
R-AM	1	1	5.22	20.16	4.23 U	4.15 J	0.34 J
R-AM	2	2	4.91	19.52	2.73 U	4.05	0.35 J
R-AM	3	1	2.52 J	11.76	9.22 U	4.35 J	10.41 U
R-AM	4	1	4.00 J	20.33	3.96 U	4.03 J	4.47 U
R-AM	5	2	1.54 J	7.21	3.20 J	2.58 J	0.33 J
R-BF	1	3	1.52 J	3.61	3.16 U	1.90 J	0.29 J
R-BF Replicate 1	2	2	1.33 J	3.25 J	16.53 U	1.73 J	18.66 U
R-BF Replicate 2	2	2	1.49 J	3.33 J	15.57 U	1.95 J	0.76 J
R-BF Replicate 3	2	2	1.28 J	3.07 J	0.44 J	1.29 J	0.31 J
R-BF	3	1	1.10 J	3.11 J	4.11 U	1.36 J	4.64 U
R-BF Replicate 1	4	1	1.52 J	3.38 J	8.45 U	2.08 J	9.54 U
R-BF Replicate 2	4	1	1.43 J	3.57 J	8.54 U	1.78 J	9.64 U
R-BF Replicate 3	4	1	9.30 U	3.44 J	0.69 J	1.71 J	0.58 J
R-BF	5	2	0.90 J	2.77	2.44 U	1.19 J	2.76 U

TABLE K.7. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
			Fluor- anthene	Pyrene	Benzo(a) anthra- cene	Chrysene	Benzo(b) fluor- anthene
R-OS	1	3	0.12 J	0.19 J	3.67 U	0.16 J	0.12 J
R-OS	2	2	0.33 J	0.51 J	2.75 U	0.13 J	0.11 J
R-OS	3	2	0.31 J	0.45 J	10.96 U	12.54 U	12.38 U
R-OS	4	2	0.20 J	0.31 J	2.58 U	0.20 J	0.12 J
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	0.44 J	0.43 J	1.86 U	0.31 J	2.10 U
<i>N. caecoides</i> Background	2	3	0.30 J	0.36 J	1.88 U	0.20 J	2.12 U
<i>N. caecoides</i> Background	3	3	0.50 J	0.77 J	2.47 U	2.82 U	2.79 U
<i>N. caecoides</i> Background	4	3	0.32 J	0.36 J	2.42 U	0.15 J	2.73 U
<i>N. caecoides</i> Background Replicate 1	5	3	0.54 J	0.57 J	8.17 U	9.34 U	9.22 U
<i>N. caecoides</i> Background Replicate 2	5	3	0.34 J	0.40 J	5.28 U	0.29 J	5.96 U
<i>N. caecoides</i> Background Replicate 3	5	3	0.34 J	0.41 J	3.78 U	4.33 U	4.27 U

(a) DL Detection limit.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) U Undetected above given concentration.

(d) NA Not applicable.

(e) NI Not information; insufficient sediment to test all five replicates.

TABLE K.8. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution Order, Benzo(k)fluoranthene - Benzo(g,h,i) perylene), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
			Benzo(k)-fluoranthene	Benzo(a)pyrene	Ideno-(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo-(g,h,i)-perylene
Target DL ^(a)			20	20	20	20	20
Achieved DL High			8.73	6.95	15.21	13.72	12.78
Achieved DL Low			0.98	0.78	1.71	1.55	1.44
COMP IC1-A	1	3	0.07 J ^(b)	0.97 U ^(c)	2.13 U	1.92 U	1.79 U
COMP IC1-A	2	1	2.79 U	2.22 U	4.86 U	4.38 U	4.08 U
COMP IC1-A	3	1	0.15 J	2.56 U	5.60 U	5.05 U	4.71 U
COMP IC1-A	4	1	2.26 U	1.80 U	3.94 U	3.55 U	3.31 U
COMP IC1-A	5	2	1.49 U	1.19 U	2.60 U	2.35 U	2.19 U
COMP IC1-B	1	3	1.21 U	0.96 U	2.10 U	1.89 U	1.76 U
COMP IC1-B	2	1	3.77 U	3.00 U	6.57 U	5.93 U	5.53 U
COMP IC1-B	3	1	2.27 U	1.81 U	3.95 U	3.56 U	3.32 U
COMP IC1-B	4	3	0.25 J	2.66 U	5.81 U	5.24 U	4.89 U
COMP IC1-B	5	2	0.08 J	1.49 U	3.26 U	2.94 U	2.74 U
COMP IC1-B Special	1	1	0.12 J	1.77 U	3.88 U	3.50 U	3.26 U
COMP IC1-B Special	2	1	0.23 J	1.69 U	3.69 U	3.33 U	3.11 U
COMP IC1-B Special	3	2	1.83 U	1.46 U	3.19 U	2.88 U	2.68 U
COMP IC1-B Special	4	3	1.38 U	1.10 U	2.40 U	2.16 U	2.02 U
COMP IC1-B Special	5	2	1.45 U	1.15 U	2.52 U	2.27 U	2.12 U
COMP IC1-C	1	3	1.73 U	1.38 U	3.01 U	2.72 U	2.53 U
COMP IC1-C	2	2	0.10 J	1.29 U	2.82 U	2.55 U	0.20 J
COMP IC1-C	3	3	0.12 J	2.13 U	4.67 U	4.21 U	3.93 U
COMP IC1-C	4	1	3.58 U	2.85 U	6.24 U	5.63 U	5.25 U
COMP IC1-C	5	1	5.55 U	4.41 U	9.67 U	8.72 U	8.13 U
COMP OC4-B	1	3	1.39 U	1.11 U	2.42 U	2.19 U	2.04 U
COMP OC4-B	2	1	2.26 U	1.80 U	3.93 U	3.55 U	3.31 U
COMP OC4-B	3	2	0.10 J	1.56 U	3.42 U	3.09 U	2.88 U
COMP OC4-B	4	2	1.75 U	1.39 U	3.05 U	2.75 U	2.57 U
COMP OC4-B	5	3	0.11 J	1.60 U	3.51 U	3.16 U	2.95 U
R-AM	1	1	0.10 J	1.78 U	3.89 U	3.51 U	3.27 U
R-AM	2	2	0.29 J	1.15 U	2.52 U	2.27 U	2.11 U
R-AM	3	1	4.87 U	3.87 U	8.48 U	7.65 U	7.13 U
R-AM	4	1	2.09 U	1.66 U	3.64 U	3.28 U	3.06 U
R-AM	5	2	2.64 U	2.10 U	4.60 U	4.15 U	3.87 U
R-BF	1	3	1.67 U	1.33 U	2.91 U	2.63 U	2.45 U
R-BF Replicate 1	2	2	8.73 U	6.95 U	15.21 U	13.72 U	12.78 U
R-BF Replicate 2	2	2	0.46 J	6.54 U	14.33 U	12.92 U	12.04 U
R-BF Replicate 3	2	2	0.18 J	3.10 U	6.79 U	6.13 U	5.71 U
R-BF	3	1	2.17 U	1.73 U	3.78 U	3.41 U	3.18 U
R-BF Replicate 1	4	1	4.46 U	3.55 U	7.77 U	7.01 U	6.54 U
R-BF Replicate 2	4	1	4.51 U	3.59 U	7.85 U	7.08 U	6.60 U
R-BF Replicate 3	4	1	4.49 U	3.57 U	7.82 U	7.05 U	6.57 U
R-BF	5	2	1.29 U	1.03 U	2.25 U	2.03 U	1.89 U

TABLE K.8. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)				
			Benzo(k)- fluor- anthene	Benzo(a) pyrene	Ideno- (1,2,3- c,d) pyrene	Dibenzo (a,h) anthra- cene	Benzo- (g,h,i)- perylene
R-OS	1	3	1.94 U	1.54 U	3.37 U	3.04 U	2.84 U
R-OS	2	2	0.04 J	1.16 U	2.53 U	2.28 U	2.12 U
R-OS	3	2	5.79 U	4.61 U	10.09 U	9.10 U	8.48 U
R-OS	4	2	1.36 U	1.08 U	2.37 U	2.14 U	1.99 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	0.98 U	0.78 U	1.71 U	1.55 U	1.44 U
<i>N. caecoides</i> Background	2	3	0.99 U	0.79 U	1.73 U	1.56 U	1.45 U
<i>N. caecoides</i> Background	3	3	1.30 U	1.04 U	2.27 U	2.05 U	1.91 U
<i>N. caecoides</i> Background	4	3	1.28 U	1.02 U	2.22 U	2.00 U	1.87 U
<i>N. caecoides</i> Background Replicate 1	5	3	4.32 U	3.43 U	7.52 U	6.78 U	6.32 U
<i>N. caecoides</i> Background Replicate 2	5	3	2.79 U	2.22 U	4.86 U	4.38 U	4.08 U
<i>N. caecoides</i> Background Replicate 3	5	3	2.00 U	1.59 U	3.48 U	3.14 U	2.93 U

(a) DL Detection limit.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) U Undetected above given concentration.

(d) NA Not applicable.

(e) NI Not information; insufficient sediment to test all five replicates.

TABLE K.9. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)					
			Naphtha- lene	Acenaph- thylene	Acenaph- thene-	Fluorene	Phenan- threne	Anthra- cene
<u>Method Blanks</u>								
Blank		1	12.80 J ^(a)	39.63 U ^(b)	15.02 U	25.29 U	3.55 J	1.10 J
Blank		2	33.46 U	30.89 U	11.71 U	19.71 U	21.88 U	16.80 U
Blank		3	3.80 J	24.18 U	9.17 U	15.43 U	1.31 J	13.15 U
<u>Matrix Spikes</u>								
COMP IC1-C	4	1	12.90 J	52.05 U	19.73 J	33.22 U	5.92 J	28.31 U
COMP IC1-C MS	4	1	2604.87	2553.20	2517.19	2447.85	2618.06	2629.60
Concentration Recovered			2591.97	2553.20	2517.19	2447.85	2612.14	2629.60
Amount Spiked			3125.00	3125.00	3125.00	3125.00	3125.00	3125.00
Percent Recovery			83%	82%	81%	78%	84%	84%
R-OS	3	2	16.05 J	88.09 U	33.39 U	56.22 U	5.67 J	47.92 U
R-OS MS	3	2	4367.30	3744.64	4077.96	3830.47	4123.76	3879.40
Concentration Recovered			4351.25	3744.64	4077.96	3830.47	4118.09	3879.40
Amount Spiked			6000.00	6000.00	6000.00	6000.00	6000.00	6000.00
Percent Recovery			73%	62%	68%	64%	69%	65%
<i>N. caecoides</i> Background	3	3	13.75 J	16.81 U	6.37 U	10.73 U	6.91 J	9.14 U
<i>N. caecoides</i> Background MS	3	3	1008.45	1030.31	1006.30	999.22	1006.42	961.81
Concentration Recovered			994.7	1030.31	1006.30	999.22	999.51	961.81
Amount Spiked			1666.67	1666.67	1666.67	1666.67	1666.67	1666.67
Percent Recovery			60%	62%	60%	60%	60%	58%
<u>Standard Reference Material</u>								
Certified Value			NC ^(c)	NC	NC	NC	45.0 ±11	6.1 ±1.7
NIST 1974		1	NA ^(d)	NA	NA	NA	33.75	5.81 J
NIST 1974		2	NA	NA	NA	NA	26.64 ^(e)	6.37 J
NIST 1974		3	NA	NA	NA	NA	37.43	8.83 ^(e)

TABLE K.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> LPAHs ($\mu\text{g/kg}$ dry weight)					
			Naphthalene	Acenaphthylene	Acenaphthene-	Fluorene	Phenanthrene	Anthracene
<u>Analytical Replicates</u>								
R-BF Replicate 1	4	1	21.50 J	65.61 U	24.87 U	41.87 U	8.68 J	1.42 J
R-BF Replicate 2	4	1	16.15 J	66.30 U	25.13 U	42.31 U	8.09 J	36.06 U
R-BF Replicate 3	4	1	12.73 J	65.95 U	25.00 U	42.09 U	8.13 J	35.87 U
RSD			26%	NA ^(c)	NA	NA	4%	NA
R-BF Replicate 1	2	2	31.79 J	143.28 U	54.31 U	91.44 U	8.87 J	77.93 U
R-BF Replicate 2	2	2	26.89 J	135.49 U	51.36 U	86.47 U	9.04 J	2.04 J
R-BF Replicate 3	2	2	8.90 J	64.09 U	24.29 U	1.66 J	7.75 J	1.35 J
RSD			54% ^(f)	NA	NA	NA	8%	NA
<i>N. caecoides</i> Background Replicate 1	5	3	12.53 J	58.52 U	22.18 U	37.35 U	6.76 J	31.83 U
<i>N. caecoides</i> Background Replicate 2	5	3	8.28 J	37.83 U	14.34 U	24.14 U	5.12 J	20.58 U
<i>N. caecoides</i> Background Replicate 3	5	3	5.77 J	27.10 U	10.27 U	1.48 J	5.04 J	14.74 U
RSD			39% ^(f)	NA	NA	NA	17%	NA

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NC Not certified.

(e) Value outside SRM range for certified value.

(f) Value exceeds relative precision goal of $\leq 30\%$.

TABLE K.10. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution order Fluoranthene - Benzo(b)fluoranthene), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

		<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ dry weight)					
Sediment Treatment	Replicate	Analytical Batch	Fluor-anthene	Pyrene	Benzo(a) anthra-cene	Chrysene	Benzo(b) fluor-anthene
<u>Method Blanks</u>							
Blank		1	2.10 J ^(a)	3.17 J	34.17 U ^(b)	2.34 J	2.53 J
Blank		2	29.14 U	9.51 J	26.63 U	30.45 U	30.06 U
Blank		3	0.92 J	1.50 J	20.84 U	0.64 J	23.53 U
<u>Matrix Spikes</u>							
COMP IC1-C	4	1	2.60 J	11.14 J	44.86 U	1.60 J	50.65 U
COMP IC1-C MS	4	1	2803.07	2851.53	2840.33	2955.05	2862.26
Concentration Recovered			2800.47	2840.39	2840.33	2953.45	2862.26
Amount Spiked			3125.00	3125.00	3125.00	3125.00	3125.00
Percent Recovery			90%	91%	91%	95%	92%
R-OS	3	2	2.12 J	3.13 J	75.94 U	86.82 U	85.72 U
R-OS MS	3	2	4138.99	4266.61	3964.51	4056.83	4335.67
Concentration Recovered			4136.87	4263.48	3964.51	4056.83	4335.67
Amount Spiked			6000.00	6000.00	6000.00	6000.00	6000.00
Percent Recovery			69%	71%	66%	68%	72%
<i>N. caecoides</i> Background	3	3	2.96 J	4.53 J	14.49 U	16.57 U	16.36 U
<i>N. caecoides</i> Background MS	3	3	1038.97	1026.37	1013.33	1062.81	1050.88
Concentration Recovered			1036.01	1021.84	1013.33	1062.81	1050.88
Amount Spiked			1666.67	1666.67	1666.67	1666.67	1666.67
Percent Recovery			62%	61%	61%	64%	63%
<u>Standard Reference Material</u>							
Certified Value			272 ±47	276 ±30	NC ^(c)	NC	52.3 ±9.4
NIST 1974		1	239.30	232.62	NA ^(d)	NA	50.51
NIST 1974		2	185.15 ^(e)	187.32 ^(e)	NA	NA	41.08
NIST 1974		3	229.49	226.5	NA	NA	52.83
<u>Analytical Replicates</u>							
R-BF Replicate 1	4	1	10.18 J	22.65 J	56.55 U	13.89 J	63.84 U
R-BF Replicate 2	4	1	9.57 J	23.92 J	57.15 U	11.92 J	64.52 U
R-BF Replicate 3	4	1	62.22 U	23.00 J	4.64 J	11.46 J	3.85 J
RSD			NA ^(c)	3%	NA	10%	NA
R-BF Replicate 1	2	2	9.91 J	24.30 J	123.51 U	12.92 J	139.43 U
R-BF Replicate 2	2	2	11.16 J	25.01 J	116.79 U	14.59 J	5.70 J
R-BF Replicate 3	2	2	9.60 J	22.97 J	3.31 J	9.67 J	2.31 J
RSD			8%	4%	NA	20%	NA

TABLE K.10. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ dry weight)				
			Fluor- anthene	Pyrene	Benzo(a) anthra- cene	Chrysene	Benzo(b) fluor- anthene
<i>N. caecoides</i> Background Replicate 1	5	3	3.34 J	3.52 J	50.45 U	57.68 U	56.95 U
<i>N. caecoides</i> Background Replicate 2	5	3	2.09 J	2.48 J	32.61 U	1.80 J	36.81 U
<i>N. caecoides</i> Background Replicate 3	5	3	2.09 J	2.53 J	23.36 U	26.71 U	26.37 U
RSD			29%	21%	NA	NA	NA

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) U Undetected above given concentration.
 (c) NC Not certified.
 (d) NA Not applicable.
 (e) Value outside SRM range for certified value.

TABLE K.11. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), (Elution Order, Benzo(k) fluoranthene - Benzo(g,h,i)perylene), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)							
Sediment Treatment	Replicate	Analytical Batch	Benzo(k)-fluoranthene	Benzo(a)pyrene	Indeno-(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo-(g,h,i)-perylene
<u>Method Blanks</u>							
Blank		1	1.45 J ^(a)	1.98 J	31.43 U ^(b)	28.35 U	11.80 J
Blank		2	14.06 U	11.19 U	24.50 U	22.09 U	20.59 U
Blank		3	11.01 U	8.76 U	19.18 U	17.29 U	16.12 U
<u>Matrix Spikes</u>							
COMP IC1-C	4	1	23.70 U	18.85 U	41.27 U	37.22 U	34.70 U
COMP IC1-C MS	4	1	2896.85	2933.65	2749.35	2609.50	2634.51
Concentration Recovered			2896.85	2933.65	2749.35	2609.50	2634.51
Amount Spiked			3125.00	3125.00	3125.00	3125.00	3125.00
Percent Recovery			93%	94%	88%	84%	84%
R-OS	3	2	40.11 U	31.91 U	69.86 U	63.00 U	58.73 U
R-OS MS	3	2	3985.00	4258.76	4673.88	4403.25	4727.42
Concentration Recovered			3985.00	4258.76	4673.88	4403.25	4727.42
Amount Spiked			6000.00	6000.00	6000.00	6000.00	6000.00
Percent Recovery			66%	71%	78%	73%	79%
<i>N. caecoides</i> Background	3	3	7.65 U	6.09 U	13.33 U	12.02 U	11.21 U
<i>N. caecoides</i> Background MS	3	3	1080.03	996.13	965.63	1002.68	983.14
Concentration Recovered			1080.03	996.13	965.63	1002.68	983.14
Amount Spiked			1666.67	1666.67	1666.67	1666.67	1666.67
Percent Recovery			65%	60%	58%	60%	59%
<u>Standard Reference Material</u>							
Certified Value			NC ^(c)	18.6 ± 3.8	14.6 ± 2.7	NC	20.0 ± 2.3
NIST 1974		1	NA ^(d)	11.87	11.93	NA	15.36
NIST 1974		2	NA	10.81 ^(e)	9.97 J ^(e)	NA	16.61
NIST 1974		3	NA	13.03	10.99 J	NA	20.03
<u>Analytical Replicates</u>							
R-BF Replicate 1	4	1	29.87 U	23.76 U	52.03 U	46.92 U	43.74 U
R-BF Replicate 2	4	1	30.19 U	24.02 U	52.58 U	47.42 U	44.20 U
R-BF Replicate 3	4	1	30.03 U	23.89 U	52.30 U	47.17 U	43.97 U
RSD			NA	NA	NA	NA	NA
R-BF Replicate 1	2	2	65.23 U	51.90 U	113.62 U	102.47 U	95.52 U
R-BF Replicate 2	2	2	3.42 J	49.08 U	107.45 U	96.90 U	90.33 U
R-BF Replicate 3	2	2	1.31 J	23.21 U	50.82 U	45.84 U	42.72 U
RSD			NA	NA	NA	NA	NA

TABLE K.11. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)				
			Benzo(k)- fluor- anthene	Benzo(a) pyrene	Indeno- (1,2,3- c,d) pyrene	Dibenzo (a,h) anthra- cene	Benzo- (g,h,i)- perylene
<i>N. caecoides</i> Background Replicate 1	5	3	26.64 U	21.20 U	46.41 U	41.85 U	39.01 U
<i>N. caecoides</i> Background Replicate 2	5	3	17.22 U	13.70 U	30.00 U	27.06 U	25.22 U
<i>N. caecoides</i> Background Replicate 3	5	3	12.34 U	9.82 U	21.49 U	19.38 U	18.07 U
RSD			NA	NA	NA	NA	NA

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(b) U Undetected above given concentration.

(c) NC Not certified.

(d) NA Not applicable.

(e) Value outside SRM range for certified value.

TABLE K.12. Surrogate Percent Recoveries for Polynuclear Aromatic Hydrocarbons (PAHs), Including Quality Control Data, in Tissues of *N. caecoides* Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) pyrene d12
COMP IC1-A	1	3	67	65	69
COMP IC1-A	2	1	72	70	78
COMP IC1-A	3	1	72	71	77
COMP IC1-A	4	1	76	75	80
COMP IC1-A	5	2	67	62	61
COMP IC1-B	1	3	56	54	50
COMP IC1-B	2	1	75	72	78
COMP IC1-B	3	1	74	72	76
COMP IC1-B	4	3	60	58	57
COMP IC1-B	5	2	71	65	70
COMP IC1-B Special	1	1	72	71	76
COMP IC1-B Special	2	1	73	71	73
COMP IC1-B Special	3	2	71	65	61
COMP IC1-B Special	4	3	48	52	52
COMP IC1-B Special	5	2	66	62	62
COMP IC1-C	1	3	60	63	66
COMP IC1-C	2	2	57	57	59
COMP IC1-C	3	3	65	63	61
COMP IC1-C	4	1	73	73	79
COMP IC1-C	5	1	76	74	79
COMP OC4-B	1	3	63	61	59
COMP OC4-B	2	1	74	73	77
COMP OC4-B	3	2	69	65	62
COMP OC4-B	4	2	66	61	61
COMP OC4-B	5	3	54	54	54
R-AM	1	1	72	70	78
R-AM	2	2	60	59	63
R-AM	3	1	75	74	81
R-AM	4	1	73	72	80
R-AM	5	2	71	63	65
R-BF	1	3	67	65	65
R-BF Replicate 1	2	2	60	55	53
R-BF Replicate 2	2	2	62	56	54
R-BF Replicate 3	2	2	63	58	59
R-BF	3	1	72	70	75
R-BF Replicate 1	4	1	74	72	73
R-BF Replicate 2	4	1	76	74	77
R-BF Replicate 3	4	1	75	72	81
R-BF	5	2	73	67	69
R-OS	1	3	65	62	61
R-OS	2	2	70	64	70
R-OS	3	2	70	64	63
R-OS	4	2	71	66	69
R-OS	5	NA (a)	NI (b)	NI	NI
<i>N. caecoides</i> Background	1	3	63	66	67
<i>N. caecoides</i> Background	2	3	66	64	66
<i>N. caecoides</i> Background	3	3	74	70	66

Table K.12. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) pyrene d12
<i>N. caecoides</i> Background	4	3	61	63	75
<i>N. caecoides</i> Background Replicate 1	5	3	55	54	67
<i>N. caecoides</i> Background Replicate 2	5	3	66	65	76
<i>N. caecoides</i> Background Replicate 3	5	3	63	63	79
<u>Quality Control Data</u>					
<u>Method Blanks</u>					
Blank		1	81	77	78
Blank		2	92	82	81
Blank		3	51	52	56
<u>Matrix Spikes</u>					
COMP IC1-C MS	4	1	79	78	83
R-OS MS	3	2	69	65	60
<i>N. caecoides</i> Background MS	3	3	57	56	57
<u>Analytical Replicates</u>					
R-BF Replicate 1	2	2	60	55	53
R-BF Replicate 2	2	2	62	56	54
R-BF Replicate 3	2	2	63	58	59
R-BF Replicate 1	4	1	74	72	73
R-BF Replicate 2	4	1	76	74	77
R-BF Replicate 3	4	1	75	72	81
<i>N. caecoides</i> Background Replicate 1	5	3	55	54	67
<i>N. caecoides</i> Background Replicate 2	5	3	66	65	76
<i>N. caecoides</i> Background Replicate 3	5	3	63	63	79

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE K.13. Chlorinated Pesticides (alphabetical, Aldrin - Chlordane), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
				Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC (Lindane)	Chlordane
COMP IC1-A	1	3	11.50	1.54 U ^(a)	0.57 J ^(b)	2.36 U	2.36 U	2.36 U	46.41 U
COMP IC1-A	2	1	16.99	2.38 U	0.50 J	3.65 U	3.65 U	3.65 U	71.86 U
COMP IC1-A	3	1	16.51	2.82 U	0.63 J	4.33 U	4.33 U	4.33 U	85.17 U
COMP IC1-A	4	1	17.12	1.91 U	2.94 U	2.94 U	2.94 U	2.94 U	57.74 U
COMP IC1-A	5	2	13.68	1.58 U	0.64 J	2.27 J	2.43 U	0.25 J	47.74 U
COMP IC1-B	1	3	12.38	1.41 U	0.41 J	1.20 J	2.16 U	2.16 U	42.55 U
COMP IC1-B	2	1	15.62	3.50 U	5.37 U	5.37 U	5.37 U	5.37 U	105.65 U
COMP IC1-B	3	1	14.97	2.19 U	3.37 U	3.37 U	3.37 U	3.37 U	66.29 U
COMP IC1-B	4	3	13.81	3.50 U	5.37 U	0.59 J	5.37 U	5.37 U	105.65 U
COMP IC1-B	5	2	13.23	2.05 U	0.46 J	3.14 U	3.14 U	3.14 U	61.84 U
COMP IC1-B Special	1	1	16.00	2.01 U	0.54 J	3.09 U	3.09 U	0.28 J	60.85 U
COMP IC1-B Special	2	1	16.75	1.83 U	0.67 J	2.82 U	2.82 U	0.32 J	55.36 U
COMP IC1-B Special	3	2	12.98	2.04 U	0.81 J	1.90 J	3.14 U	3.14 U	61.76 U
COMP IC1-B Special	4	3	14.08	1.42 U	0.44 J	2.18 U	2.18 U	2.18 U	42.81 U
COMP IC1-B Special	5	2	12.74	1.64 U	0.63 J	1.60 J	2.53 U	2.53 U	49.65 U
COMP IC1-C	1	3	13.11	1.91 U	0.55 J	6.21	2.94 U	2.94 U	57.74 U
COMP IC1-C	2	2	15.52	1.51 U	0.46 J	2.33 U	2.33 U	2.33 U	45.72 U
COMP IC1-C	3	3	13.33	2.91 U	4.48 U	4.48 U	4.48 U	4.48 U	88.04 U
COMP IC1-C	4	1	15.14	3.43 U	5.27 U	5.27 U	5.27 U	5.27 U	103.66 U
COMP IC1-C	5	1	16.89	4.76 U	7.32 U	7.32 U	7.32 U	7.32 U	143.93 U
COMP OC4-B	1	3	13.54	1.49 U	0.64 J	2.29 U	2.29 U	2.29 U	44.94 U
COMP OC4-B	2	1	16.76	1.95 U	1.12 J	3.00 U	3.00 U	0.27 J	58.90 U
COMP OC4-B	3	2	15.52	1.83 U	0.72 J	1.98 J	2.82 U	2.82 U	55.36 U
COMP OC4-B	4	2	12.87	1.97 U	0.89 J	3.03 U	3.03 U	0.26 J	59.54 U
COMP OC4-B	5	3	13.50	2.16 U	0.87 J	1.94 J	3.32 U	0.18 J	65.25 U
R-AM	1	1	16.02	2.02 U	3.10 U	3.10 U	3.10 U	3.10 U	61.00 U
R-AM	2	2	16.39	1.28 U	0.43 J	1.96 U	1.96 U	1.96 U	38.52 U
R-AM	3	1	14.33	4.92 U	7.56 U	7.56 U	7.56 U	7.56 U	148.67 U
R-AM	4	1	14.40	2.10 U	0.78 J	3.23 U	3.23 U	3.23 U	63.50 U
R-AM	5	2	14.71	2.60 U	0.35 J	4.00 U	4.00 U	4.00 U	78.57 U
R-BF	1	3	16.19	1.50 U	0.78 J	2.30 U	2.30 U	2.30 U	45.18 U
R-BF Replicate 1	2	2	13.37	9.44 U	14.51 U	14.51 U	14.51 U	14.51 U	285.37 U
R-BF Replicate 2	2	2	13.37	8.93 U	13.72 U	13.72 U	13.72 U	13.72 U	269.86 U
R-BF Replicate 3	2	2	13.37	4.22 U	6.49 U	6.49 U	6.49 U	6.49 U	127.65 U

TABLE K.13. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
				Aldrin	Alpha- BHC	Beta- BHC	Delta- BHC	(Lindane) Gamma- BHC	Chlordane
R-BF	3	1	17.11	1.83 U	0.50 J	2.82 U	2.82 U	0.35 J	55.42 U
R-BF Replicate 1	4	1	14.93	4.32 U	6.65 U	6.65 U	6.65 U	6.65 U	130.67 U
R-BF Replicate 2	4	1	14.93	4.37 U	6.72 U	6.72 U	6.72 U	6.72 U	132.06 U
R-BF Replicate 3	4	1	14.93	4.35 U	6.68 U	6.68 U	6.68 U	6.68 U	131.36 U
R-BF	5	2	14.62	1.28 U	0.66 J	2.15	1.97 U	1.97 U	38.64 U
R-OS	1	3	13.44	2.09 U	0.37 J	0.71 J	3.20 U	3.20 U	63.01 U
R-OS	2	2	15.31	1.37 U	0.50 J	2.11 U	2.11 U	2.11 U	41.45 U
R-OS	3	2	14.42	5.81 U	8.92 U	8.92 U	8.92 U	8.92 U	175.46 U
R-OS	4	2	12.12	1.63 U	0.56 J	1.69 J	2.50 U	2.50 U	49.11 U
R-OS	5	NA ^(c)	NA	NI ^(d)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	1.02 U	0.40 J	4.19	1.57 U	1.57 U	30.84 U
<i>N. caecoides</i> Background	2	3	16.67	0.86 U	0.41 J	0.76 J	1.32 U	1.32 U	26.00 U
<i>N. caecoides</i> Background	3	3	17.04	1.11 U	1.70 U	1.70 U	1.70 U	1.70 U	33.48 U
<i>N. caecoides</i> Background	4	3	16.50	1.12 U	0.27 J	1.72 U	1.72 U	1.72 U	33.85 U
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	3.86 U	5.93 U	5.93 U	5.93 U	5.93 U	116.56 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	2.49 U	3.83 U	3.83 U	3.83 U	3.83 U	75.35 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	1.79 U	2.75 U	2.75 U	2.75 U	2.75 U	53.97 U

(a) U Undetected above given concentration.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.14. Chlorinated Pesticides (alphabetical, 4,4'-DDD - Endosulfan II), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
				4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endo-sulfan I	Endo-sulfan II
COMP IC1-A	1	3	11.50	2.22 J ^(a)	1.59 J	4.86 U ^(b)	1.90 U	4.64 U	4.64
COMP IC1-A	2	1	16.99	2.03 J	1.29 J	7.53 U	2.94 U	7.19 U	7.19 U
COMP IC1-A	3	1	16.51	5.67	3.04 J	8.92 U	3.49 U	8.52 U	8.52 U
COMP IC1-A	4	1	17.12	2.51 J	1.45 J	6.05 U	0.21 J	5.77 U	5.77 U
COMP IC1-A	5	2	13.68	2.01 J	1.15 J	0.44 J	0.18 J	4.77 U	4.77 U
COMP IC1-B	1	3	12.38	2.50	1.00 J	4.46 U	1.74 U	4.25 U	4.25 U
COMP IC1-B	2	1	15.62	2.64 J	1.25 J	11.07 U	4.33 U	10.56 U	10.56 U
COMP IC1-B	3	1	14.97	1.09 J	1.12 J	6.95 U	2.71 U	6.63 U	6.63 U
COMP IC1-B	4	3	13.81	2.01 J	0.94 J	11.07 U	4.33 U	10.56 U	10.56 U
COMP IC1-B	5	2	13.23	1.72 J	0.68 J	6.48 U	2.53 U	6.18 U	6.18 U
COMP IC1-B Special	1	1	16.00	2.56 J	2.42 J	6.38 U	2.49 U	6.09 U	6.09 U
COMP IC1-B Special	2	1	16.75	3.59	2.49 J	0.64 J	2.27 U	5.54 U	5.54 U
COMP IC1-B Special	3	2	12.98	2.51 J	2.31 J	6.47 U	0.27 J	6.18 U	6.18 U
COMP IC1-B Special	4	3	14.08	2.91	2.00 J	4.48 U	1.75 U	4.28 U	4.28 U
COMP IC1-B Special	5	2	12.74	2.43 J	1.93 J	5.20 U	2.03 U	4.97 U	4.97 U
COMP IC1-C	1	3	13.11	1.43 J	1.74 J	6.05 U	2.36 U	5.77 U	5.77 U
COMP IC1-C	2	2	15.52	1.90 J	1.79 J	4.79 U	0.17 J	4.57 U	4.57 U
COMP IC1-C	3	3	13.33	2.53 J	2.07 J	9.22 U	3.61 U	8.80 U	8.80 U
COMP IC1-C	4	1	15.14	3.46 J	2.34 J	10.86 U	4.24 U	10.37 U	10.37 U
COMP IC1-C	5	1	16.89	2.63 J	2.13 J	15.08 U	5.89 U	14.39 U	14.39 U
COMP OC4-B	1	3	13.54	6.22	6.98	4.71 U	1.84 U	4.49 U	4.49 U
COMP OC4-B	2	1	16.76	7.32	7.83	6.17 U	2.41 U	5.89 U	5.89 U
COMP OC4-B	3	2	15.52	6.78	6.65	0.66 J	2.27 U	5.54 U	5.54 U
COMP OC4-B	4	2	12.87	5.83	6.12 J	6.24 U	0.46 J	5.95 U	5.95 U
COMP OC4-B	5	3	13.50	6.72	6.75 J	6.84 U	0.51 J	6.52 U	6.52 U
R-AM	1	1	16.02	8.35	3.40 J	6.39 U	2.50 U	6.10 U	6.10 U
R-AM	2	2	16.39	2.88	1.78 J	4.04 U	1.58 U	3.85 U	3.85 U
R-AM	3	1	14.33	4.57 J	2.66 J	2.34 J	6.09 U	14.87 U	14.87 U
R-AM	4	1	14.40	4.26	2.28 J	1.81 J	1.06 J	6.35 U	6.35 U
R-AM	5	2	14.71	2.62 J	2.05 J	2.56 J	3.22 U	7.86 U	7.86 U
R-BF	1	3	16.19	2.80	4.67 J	4.73 U	1.85 U	4.52 U	4.52 U
R-BF Replicate 1	2	2	13.37	5.84 J	4.13 J	29.90 U	11.68 U	28.53 U	28.53 U
R-BF Replicate 2	2	2	13.37	7.65 J	30.34 U	28.27 U	11.05 U	26.98 U	26.98 U
R-BF Replicate 3	2	2	13.37	5.24 J	14.35 U	13.37 U	5.23 U	12.76 U	12.76 U

TABLE K.14. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
				4,4'- DDD	4,4'- DDE	4,4'- DDT	Dieldrin	Endo- sulfan I	Endo- sulfan II
R-BF	3	1	17.11	4.75	4.38 J	5.81 U	2.27 U	5.54 U	5.54 U
R-BF Replicate 1	4	1	14.93	4.54 J	4.31 J	13.69 U	5.35 U	13.07 U	13.07 U
R-BF Replicate 2	4	1	14.93	3.85 J	4.04 J	13.84 U	5.41 U	13.21 U	13.21 U
R-BF Replicate 3	4	1	14.93	4.39 J	4.69 J	13.76 U	5.38 U	13.14 U	13.14 U
R-BF	5	2	14.62	3.55	3.73 J	4.05 U	1.58 U	3.86 U	3.86 U
R-OS	1	3	13.44	1.35 J	3.65 J	6.60 U	2.58 U	6.30 U	6.30 U
R-OS	2	2	15.31	1.05 J	2.91 J	4.34 U	1.70 U	4.14 U	4.14 U
R-OS	3	2	14.42	1.84 J	3.30 J	18.38 U	7.18 U	17.54 U	17.54 U
R-OS	4	2 ^(c)	12.12	1.48 J	3.39 J	5.15 U	2.01 U	4.91 U	4.91 U
R-OS	5	NA ^(c)	NA	NI ^(d)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	1.56 U	1.27 J	3.23 U	1.26 U	3.08 U	3.08 U
<i>N. caecoides</i> Background	2	3	16.67	0.31 J	1.39 J	2.72 U	1.06 U	2.60 U	2.60 U
<i>N. caecoides</i> Background	3	3	17.04	1.70 U	1.74 J	3.51 U	1.37 U	3.35 U	3.35 U
<i>N. caecoides</i> Background	4	3	16.50	1.71 U	1.55 J	3.55 U	1.39 U	3.38 U	3.38 U
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	1.68 J	1.82 J	12.21 U	4.77 U	11.66 U	11.66 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	0.99 J	1.64 J	7.89 U	3.09 U	7.53 U	7.53 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	1.08 J	1.72 J	5.65 U	2.21 U	5.40 U	5.40 U

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.15. Chlorinated Pesticides (alphabetical, Endosulfan sulfate - Toxaphene), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
				Endo-sulfan sulfate	Endrin	Endrin aldehyde	Hepta-chlor	Hepta-chlor epoxide	Toxaphene
COMP IC1-A	1	3	11.50	4.64 U ^(a)	1.95 U	4.64 U	2.52 U	2.23 U	46.41 U
COMP IC1-A	2	1	16.99	7.19 U	3.01 U	7.19 U	3.90 U	3.46 U	71.86 U
COMP IC1-A	3	1	16.51	8.52 U	3.57 U	8.52 U	4.62 U	4.10 U	85.17 U
COMP IC1-A	4	1	17.12	5.77 U	2.42 U	5.77 U	3.13 U	2.78 U	57.74 U
COMP IC1-A	5	2	13.68	4.77 U	2.00 U	4.77 U	2.59 U	2.30 U	47.74 U
COMP IC1-B	1	3	12.38	4.25 U	1.79 U	4.25 U	2.31 U	2.05 U	42.55 U
COMP IC1-B	2	1	15.62	10.56 U	4.43 U	10.56 U	5.73 U	5.08 U	105.65 U
COMP IC1-B	3	1	14.97	6.63 U	2.78 U	6.63 U	3.60 U	3.19 U	66.29 U
COMP IC1-B	4	3	13.81	10.56 U	4.43 U	10.56 U	5.73 U	5.08 U	105.65 U
COMP IC1-B	5	2	13.23	6.18 U	2.59 U	6.18 U	3.36 U	2.98 U	61.84 U
COMP IC1-B Special	1	1	16.00	6.09 U	2.55 U	6.09 U	3.30 U	2.93 U	60.85 U
COMP IC1-B Special	2	1	16.75	5.54 U	2.32 U	5.54 U	3.00 U	2.66 U	55.36 U
COMP IC1-B Special	3	2	12.98	6.18 U	2.59 U	6.18 U	3.35 U	2.97 U	61.76 U
COMP IC1-B Special	4	3	14.08	4.28 U	1.80 U	4.28 U	2.32 U	2.06 U	42.81 U
COMP IC1-B Special	5	2	12.74	4.97 U	2.08 U	4.97 U	2.69 U	2.39 U	49.65 U
COMP IC1-C	1	3	13.11	5.77 U	2.42 U	5.77 U	3.13 U	2.78 U	57.74 U
COMP IC1-C	2	2	15.52	4.57 U	1.92 U	4.57 U	2.48 U	2.20 U	45.72 U
COMP IC1-C	3	3	13.33	8.80 U	3.69 U	8.80 U	4.78 U	4.24 U	82.04 U
COMP IC1-C	4	1	15.14	10.37 U	4.35 U	10.37 U	5.62 U	4.99 U	103.66 U
COMP IC1-C	5	1	16.89	14.39 U	6.04 U	14.39 U	7.81 U	6.93 U	143.93 U
COMP OC4-B	1	3	13.54	4.49 U	1.89 U	4.49 U	2.44 U	2.16 U	44.94 U
COMP OC4-B	2	1	16.76	5.89 U	2.47 U	5.89 U	3.20 U	2.83 U	58.90 U
COMP OC4-B	3	2	15.52	5.54 U	2.32 U	5.54 U	3.00 U	2.66 U	55.36 U
COMP OC4-B	4	2	12.87	5.95 U	2.50 U	5.95 U	3.23 U	2.87 U	59.54 U
COMP OC4-B	5	3	13.50	6.52 U	2.74 U	6.52 U	3.54 U	3.14 U	55.25 U
R-AM	1	1	16.02	6.10 U	2.56 U	6.10 U	3.31 U	2.94 U	61.00 U
R-AM	2	2	16.39	3.85 U	1.62 U	3.85 U	2.09 U	1.85 U	38.52 U
R-AM	3	1	14.33	14.87 U	6.24 U	14.87 U	8.07 U	7.15 U	148.67 U
R-AM	4	1	14.40	6.35 U	2.66 U	6.35 U	3.45 U	3.06 U	63.50 U
R-AM	5	2	14.71	7.86 U	3.30 U	7.86 U	4.26 U	3.78 U	78.57 U
R-BF	1	3	16.19	4.52 U	1.90 U	4.52 U	2.45 U	2.17 U	45.18 U
R-BF Replicate 1	2	2	13.37	28.53 U	11.97 U	28.53 U	15.48 U	13.73 U	285.37 U
R-BF Replicate 2	2	2	13.37	26.98 U	11.32 U	26.98 U	14.64 U	12.98 U	269.86 U
R-BF Replicate 3	2	2	13.37	12.76 U	5.36 U	12.76 U	6.93 U	6.14 U	127.65 U

TABLE K.15. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ dry weight)					
				Endo- sulfan sulfate	Endrin	Endrin aldehyde	Hepta- chlor	Hepta- chlor epoxide	Toxaphene
R-BF	3	1	17.11	5.54 U	2.33 U	5.54 U	3.01 U	2.67 U	55.42 U
R-BF Replicate 1	4	1	14.93	13.07 U	5.48 U	13.07 U	7.09 U	6.29 U	130.67 U
R-BF Replicate 2	4	1	14.93	13.21 U	5.54 U	13.21 U	7.17 U	6.35 U	132.06 U
R-BF Replicate 3	4	1	14.93	13.14 U	5.51 U	13.14 U	7.13 U	6.32 U	131.36 U
R-BF	5	2	14.62	3.86 U	1.62 U	3.86 U	2.10 U	1.86 U	38.64 U
R-OS	1	3	13.44	6.30 U	2.64 U	6.30 U	3.42 U	3.03 U	63.01 U
R-OS	2	2	15.31	4.14 U	1.74 U	4.14 U	2.25 U	1.99 U	41.45 U
R-OS	3	2	14.42	17.54 U	7.36 U	17.54 U	9.52 U	8.44 U	175.46 U
R-OS	4	2	12.12	4.91 U	2.06 U	4.91 U	2.67 U	2.36 U	49.11 U
R-OS	5	NA ^(b)	NA	NI ^(c)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	3.08 U	1.29 U	3.08 U	1.67 U	1.48 U	30.84 U
<i>N. caecoides</i> Background	2	3	16.67	2.60 U	1.09 U	2.60 U	1.41 U	1.25 U	26.00 U
<i>N. caecoides</i> Background	3	3	17.04	3.35 U	1.41 U	3.35 U	1.82 U	1.61 U	33.48 U
<i>N. caecoides</i> Background	4	3	16.50	3.38 U	1.42 U	3.38 U	1.84 U	1.63 U	33.85 U
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	11.66 U	4.89 U	11.66 U	6.32 U	5.61 U	116.56 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	7.53 U	3.16 U	7.53 U	4.09 U	3.63 U	75.35 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	5.40 U	2.26 U	5.40 U	2.93 U	2.60 U	53.97 U

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE K.16. Chlorinated Pesticides (alphabetical, Aldrin - Chlordane), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)					Chlordane
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC (Lindane)	
Target DL ^(a)			2.0	2.0	2.0	2.0	2.0	30
Achieved DL High			1.26	1.95	1.95	1.95	1.95	38.19
Achieved DL Low			0.14	0.22	0.22	0.22	0.22	4.31
COMP IC1-A	1	3	0.18 U ^(b)	0.07 J ^(c)	0.27 U	0.27 U	0.27 U	5.34 U
COMP IC1-A	2	1	0.40 U	0.08 J	0.62 U	0.62 U	0.62 U	12.19 U
COMP IC1-A	3	1	0.46 U	0.10 J	0.71 U	0.71 U	0.71 U	13.99 U
COMP IC1-A	4	1	0.33 U	0.50 U	0.50 U	0.50 U	0.50 U	9.89 U
COMP IC1-A	5	2	0.22 U	0.09 J	0.31 J	0.33 U	0.03 J	6.53 U
COMP IC1-B	1	3	0.18 U	0.05 J	0.15 J	0.27 U	0.27 U	5.28 U
COMP IC1-B	2	1	0.55 U	0.84 U	0.84 U	0.84 U	0.84 U	16.51 U
COMP IC1-B	3	1	0.33 U	0.51 U	0.51 U	0.51 U	0.51 U	9.94 U
COMP IC1-B	4	3	0.48 U	0.74 U	0.08 J	0.74 U	0.74 U	14.60 U
COMP IC1-B	5	2	0.27 U	0.06 J	0.41 U	0.41 U	0.41 U	8.15 U
COMP IC1-B Special	1	1	0.32 U	0.09 J	0.50 U	0.50 U	0.05 J	9.79 U
COMP IC1-B Special	2	1	0.31 U	0.11 J	0.47 U	0.47 U	0.05 J	9.31 U
COMP IC1-B Special	3	2	0.26 U	0.11 J	0.25 J	0.41 U	0.41 U	7.98 U
COMP IC1-B Special	4	3	0.20 U	0.06 J	0.31 U	0.31 U	0.31 U	6.03 U
COMP IC1-B Special	5	2	0.21 U	0.08 J	0.20 J	0.32 U	0.32 U	6.32 U
COMP IC1-C	1	3	0.25 U	0.07 J	0.81	0.39 U	0.39 U	7.57 U
COMP IC1-C	2	2	0.24 U	0.07 J	0.36 U	0.36 U	0.36 U	7.12 U
COMP IC1-C	3	3	0.39 U	0.59 U	0.59 U	0.59 U	0.59 U	11.66 U
COMP IC1-C	4	1	0.52 U	0.80 U	0.80 U	0.80 U	0.80 U	15.71 U
COMP IC1-C	5	1	0.81 U	1.25 U	1.25 U	1.25 U	1.25 U	24.63 U
COMP OC4-B	1	3	0.20 U	0.09 J	0.31 U	0.31 U	0.31 U	6.11 U
COMP OC4-B	2	1	0.33 U	0.19 J	0.50 U	0.50 U	0.05 J	9.84 U
COMP OC4-B	3	2	0.28 U	0.11 J	0.31 J	0.44 U	0.44 U	8.62 U
COMP OC4-B	4	2	0.25 U	0.11 J	0.39 U	0.39 U	0.03 J	7.63 U
COMP OC4-B	5	3	0.29 U	0.12 J	0.26 J	0.45 U	0.02 J	8.79 U
R-AM	1	1	0.32 U	0.49 U	0.49 U	0.49 U	0.49 U	9.73 U
R-AM	2	2	0.21 U	0.07 J	0.32 U	0.32 U	0.32 U	6.32 U
R-AM	3	1	0.70 U	1.07 U	1.07 U	1.07 U	1.07 U	21.05 U
R-AM	4	1	0.30 U	0.11 J	0.46 U	0.46 U	0.46 U	9.12 U
R-AM	5	2	0.38 U	0.05 J	0.59 U	0.59 U	0.59 U	11.51 U

TABLE K.16. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)					
			Aldrin	Alpha- BHC	Beta- BHC	Delta- BHC	(Lindane) Gamma- BHC	Chlordane
R-BF	1	3	0.24 U	0.13 J	0.37 U	0.37 U	0.37 U	7.32 U
R-BF Replicate 1	2	2	1.23 U	1.90 U	1.90 U	1.90 U	1.90 U	37.32 U
R-BF Replicate 2	2	2	1.16 U	1.79 U	1.79 U	1.79 U	1.79 U	35.20 U
R-BF Replicate 3	2	2	0.57 U	0.87 U	0.87 U	0.87 U	0.87 U	17.11 U
R-BF	3	1	0.31 U	0.09 J	0.48 U	0.48 U	0.06 J	9.53 U
R-BF Replicate 1	4	1	0.65 U	0.99 U	0.99 U	0.99 U	0.99 U	19.53 U
R-BF Replicate 2	4	1	0.66 U	1.01 U	1.01 U	1.01 U	1.01 U	19.94 U
R-BF Replicate 3	4	1	0.65 U	1.00 U	1.00 U	1.00 U	1.00 U	19.74 U
R-BF	5	2	0.19 U	0.10 J	0.31	0.29 U	0.29 U	5.67 U
R-OS	1	3	0.28 U	0.05 J	0.10 J	0.43 U	0.43 U	8.49 U
R-OS	2	2	0.21 U	0.08 J	0.32 U	0.32 U	0.32 U	6.36 U
R-OS	3	2	0.83 U	1.27 U	1.27 U	1.27 U	1.27 U	25.07 U
R-OS	4	2	0.20 U	0.07 J	0.20 J	0.30 U	0.30 U	5.95 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	0.14 U	0.06 J	0.59	0.22 U	0.22 U	4.31 U
<i>N. caecoides</i> Background	2	3	0.14 U	0.07 J	0.13 J	0.22 U	0.22 U	4.33 U
<i>N. caecoides</i> Background	3	3	0.19 U	0.29 U	0.29 U	0.29 U	0.29 U	5.70 U
<i>N. caecoides</i> Background	4	3	0.19 U	0.04 J	0.28 U	0.28 U	0.28 U	5.60 U
<i>N. caecoides</i> Background Replicate 1	5	3	0.63 U	0.97 U	0.97 U	0.97 U	0.97 U	19.06 U
<i>N. caecoides</i> Background Replicate 2	5	3	0.40 U	0.62 U	0.62 U	0.62 U	0.62 U	12.22 U
<i>N. caecoides</i> Background Replicate 3	5	3	0.29 U	0.45 U	0.45 U	0.45 U	0.45 U	8.74 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE K.17. Chlorinated Pesticides (alphabetical, 4,4'-DDD - Endosulfan II), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)					
			4,4'- DDD	4,4'- DDE	4,4'- DDT	Dieldrin	Endo- sulfan I	Endo- sulfan II
Target DL ^(a)			2.0	2.0	2.0	2.0	2.0	2.0
Achieved DL High			1.94	4.29	4.00	1.56	3.82	3.82
Achieved DL Low			0.22	0.48	0.45	0.18	0.43	0.43
COMP IC1-A	1	3	0.26 J ^(b)	0.18 J	0.56 U ^(c)	0.22 U	0.53 U	0.53 U
COMP IC1-A	2	1	0.34 J	0.22 J	1.28 U	0.50 U	1.22 U	1.22 U
COMP IC1-A	3	1	0.93	0.50 J	1.47 U	0.57 U	1.40 U	1.40 U
COMP IC1-A	4	1	0.43 J	0.25 J	1.04 U	0.04 J	0.99 U	0.99 U
COMP IC1-A	5	2	0.28 J	0.16 J	0.06 J	0.02 J	0.65 U	0.65 U
COMP IC1-B	1	3	0.31	0.12 J	0.55 U	0.22 U	0.53 U	0.53 U
COMP IC1-B	2	1	0.41 J	0.20 J	1.73 U	0.68 U	1.65 U	1.65 U
COMP IC1-B	3	1	0.16 J	0.17 J	1.04 U	0.41 U	0.99 U	0.99 U
COMP IC1-B	4	3	0.28 J	0.13 J	1.53 U	0.60 U	1.46 U	1.46 U
COMP IC1-B	5	2	0.23 J	0.09 J	0.85 U	0.33 U	0.81 U	0.81 U
COMP IC1-B Special	1	1	0.41 J	0.39 J	1.03 U	0.40 U	0.98 U	0.98 U
COMP IC1-B Special	2	1	0.60	0.42 J	0.11 J	0.38 U	0.93 U	0.93 U
COMP IC1-B Special	3	2	0.33 J	0.30 J	0.84 U	0.04 J	0.80 U	0.80 U
COMP IC1-B Special	4	3	0.41	0.28 J	0.63 U	0.25 U	0.60 U	0.60 U
COMP IC1-B Special	5	2	0.31 J	0.25 J	0.66 U	0.26 U	0.63 U	0.63 U
COMP IC1-C	1	3	0.19 J	0.23 J	0.79 U	0.31 U	0.76 U	0.76 U
COMP IC1-C	2	2	0.30 J	0.28 J	0.75 U	0.03 J	0.71 U	0.71 U
COMP IC1-C	3	3	0.33 J	0.27 J	1.22 U	0.48 U	1.17 U	1.17 U
COMP IC1-C	4	1	0.52 J	0.35 J	1.65 U	0.64 U	1.57 U	1.57 U
COMP IC1-C	5	1	0.45 J	0.36 J	2.58 U	1.01 U	2.46 U	2.46 U
COMP OC4-B	1	3	0.85	0.95	0.64 U	0.25 U	0.61 U	0.61 U
COMP OC4-B	2	1	1.22	1.31	1.03 U	0.40 U	0.98 U	0.98 U
COMP OC4-B	3	2	1.06	1.04	0.10 J	0.35 U	0.86 U	0.86 U
COMP OC4-B	4	2	0.75	0.78 J	0.80 U	0.06 J	0.76 U	0.76 U
COMP OC4-B	5	3	0.91	0.91 J	0.92 U	0.07 J	0.88 U	0.88 U
R-AM	1	1	1.33	0.54 J	1.02 U	0.40 U	0.97 U	0.97 U
R-AM	2	2	0.47	0.29 J	0.66 U	0.26 U	0.63 U	0.63 U
R-AM	3	1	0.65 J	0.38 J	0.33 J	0.86 U	2.11 U	2.11 U
R-AM	4	1	0.61	0.33 J	0.26 J	0.15 J	0.91 U	0.91 U
R-AM	5	2	0.38 J	0.30 J	0.38 J	0.47 U	1.15 U	1.15 U

TABLE K.17. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ wet weight)					
			4,4'- DDD	4,4'- DDE	4,4'- DDT	Dieldrin	Endo- sulfan I	Endo- sulfan II
R-BF	1	3	0.45	0.76 J	0.77 U	0.30 U	0.73 U	0.73 U
R-BF Replicate 1	2	2	0.76 J	0.54 J	3.91 U	1.53 U	3.73 U	3.73 U
R-BF Replicate 2	2	2	1.00 J	3.96 U	3.69 U	1.44 U	3.52 U	3.52 U
R-BF Replicate 3	2	2	0.70 J	1.92 U	1.79 U	0.70 U	1.71 U	1.71 U
R-BF	3	1	0.82	0.75 J	1.00 U	0.39 U	0.95 U	0.95 U
R-BF Replicate 1	4	1	0.68 J	0.64 J	2.05 U	0.80 U	1.95 U	1.95 U
R-BF Replicate 2	4	1	0.58 J	0.61 J	2.09 U	0.82 U	1.99 U	1.99 U
R-BF Replicate 3	4	1	0.66 J	0.70 J	2.07 U	0.81 U	1.97 U	1.97 U
R-BF	5	2	0.52	2.55 J	0.59 U	0.23 U	0.57 U	0.57 U
R-OS	1	3	0.18 J	0.49 J	0.89 U	0.35 U	0.85 U	0.85 U
R-OS	2	2	0.16 J	0.45 J	0.67 U	0.26 U	0.64 U	0.64 U
R-OS	3	2	0.26 J	0.47 J	2.63 U	1.03 U	2.51 U	2.51 U
R-OS	4	2	0.18 J	0.41 J	0.62 U	0.24 U	0.59 U	0.59 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	0.22 U	0.18 J	0.45 U	0.18 U	0.43 U	0.43 U
<i>N. caecoides</i> Background	2	3	0.05 J	0.23 J	0.45 U	0.18 U	0.43 U	0.43 U
<i>N. caecoides</i> Background	3	3	0.29 U	0.30 J	0.60 U	0.23 U	0.57 U	0.57 U
<i>N. caecoides</i> Background	4	3	0.28 U	0.26 J	0.59 U	0.23 U	0.56 U	0.56 U
<i>N. caecoides</i> Background Replicate 1	5	3	0.27 J	0.30 J	2.00 U	0.78 U	1.91 U	1.91 U
<i>N. caecoides</i> Background Replicate 2	5	3	0.16 J	0.27 J	1.28 U	0.50 U	1.22 U	1.22 U
<i>N. caecoides</i> Background Replicate 3	5	3	0.17 J	0.28 J	0.92 U	0.36 U	0.87 U	0.87 U

(a) DL Detection limit.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) U Undetected above given concentration.

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE K.18. Chlorinated Pesticides (alphabetical, Endosulfan sulfate - Toxaphene), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)					
			Endo-sulfan sulfate	Endrin	Endrin aldehyde	Hepta-chlor	Hepta-chlor epoxide	Toxaphene
Target DL (a)			2.0	2.0	2.0	2.0	2.0	30
Achieved DL High			3.82	1.60	3.82	2.07	1.84	38.19
Achieved DL Low			0.43	0.18	0.43	0.23	0.21	4.31
COMP IC1-A	1	3	0.53 U ^(b)	0.22 U	0.53 U	0.29 U	0.26 U	5.34 U
COMP IC1-A	2	1	1.22 U	0.51 U	1.22 U	0.66 U	0.59 U	12.19 U
COMP IC1-A	3	1	1.40 U	0.59 U	1.40 U	0.76 U	0.67 U	13.99 U
COMP IC1-A	4	1	0.99 U	0.41 U	0.99 U	0.54 U	0.48 U	9.89 U
COMP IC1-A	5	2	0.65 U	0.27 U	0.65 U	0.35 U	0.31 U	6.53 U
COMP IC1-B	1	3	0.53 U	0.22 U	0.53 U	0.29 U	0.25 U	5.28 U
COMP IC1-B	2	1	1.65 U	0.69 U	1.65 U	0.90 U	0.79 U	16.51 U
COMP IC1-B	3	1	0.99 U	0.42 U	0.99 U	0.54 U	0.48 U	9.94 U
COMP IC1-B	4	3	1.46 U	0.61 U	1.46 U	0.79 U	0.70 U	14.60 U
COMP IC1-B	5	2	0.81 U	0.34 U	0.81 U	0.44 U	0.39 U	8.15 U
COMP IC1-B Special	1	1	0.98 U	0.41 U	0.98 U	0.53 U	0.47 U	9.79 U
COMP IC1-B Special	2	1	0.93 U	0.39 U	0.93 U	0.50 U	0.45 U	9.31 U
COMP IC1-B Special	3	2	0.80 U	0.33 U	0.80 U	0.43 U	0.38 U	7.98 U
COMP IC1-B Special	4	3	0.60 U	0.25 U	0.60 U	0.33 U	0.29 U	6.03 U
COMP IC1-B Special	5	2	0.63 U	0.26 U	0.63 U	0.34 U	0.30 U	6.32 U
COMP IC1-C	1	3	0.76 U	0.32 U	0.76 U	0.41 U	0.36 U	7.57 U
COMP IC1-C	2	2	0.71 U	0.30 U	0.71 U	0.39 U	0.34 U	7.12 U
COMP IC1-C	3	3	1.17 U	0.49 U	1.17 U	0.63 U	0.56 U	11.66 U
COMP IC1-C	4	1	1.57 U	0.66 U	1.57 U	0.85 U	0.76 U	15.71 U
COMP IC1-C	5	1	2.46 U	1.03 U	2.46 U	1.34 U	1.19 U	24.63 U
COMP OC4-B	1	3	0.61 U	0.26 U	0.61 U	0.33 U	0.29 U	6.11 U
COMP OC4-B	2	1	0.98 U	0.41 U	0.98 U	0.53 U	0.47 U	9.84 U
COMP OC4-B	3	2	0.86 U	0.36 U	0.86 U	0.47 U	0.41 U	8.62 U
COMP OC4-B	4	2	0.76 U	0.32 U	0.76 U	0.41 U	0.37 U	7.63 U
COMP OC4-B	5	3	0.88 U	0.37 U	0.88 U	0.48 U	0.42 U	8.79 U

TABLE K.18. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)					
			Endo- sulfan sulfate	Endrin	Endrin aldehyde	Hepta- chlor	Hepta- chlor epoxide	Toxaphene
R-AM	1	1	0.97 U	0.41 U	0.97 U	0.53 U	0.47 U	9.73 U
R-AM	2	2	0.63 U	0.27 U	0.63 U	0.34 U	0.30 U	6.32 U
R-AM	3	1	2.11 U	0.88 U	2.11 U	1.14 U	1.01 U	21.05 U
R-AM	4	1	0.91 U	0.38 U	0.91 U	0.50 U	0.44 U	9.12 U
R-AM	5	2	1.15 U	0.48 U	1.15 U	0.62 U	0.55 U	11.51 U
R-BF	1	3	0.73 U	0.31 U	0.73 U	0.40 U	0.35 U	7.32 U
R-BF Replicate 1	2	2	3.73 U	1.57 U	3.73 U	2.02 U	1.80 U	37.32 U
R-BF Replicate 2	2	2	3.52 U	1.48 U	3.52 U	1.91 U	1.69 U	35.20 U
R-BF Replicate 3	2	2	1.71 U	0.72 U	1.71 U	0.93 U	0.82 U	17.11 U
R-BF	3	1	0.95 U	0.40 U	0.95 U	0.52 U	0.46 U	9.53 U
R-BF Replicate 1	4	1	1.95 U	0.82 U	1.95 U	1.06 U	0.94 U	19.53 U
R-BF Replicate 2	4	1	1.99 U	0.84 U	1.99 U	1.08 U	0.96 U	19.94 U
R-BF Replicate 3	4	1	1.97 U	0.83 U	1.97 U	1.07 U	0.95 U	19.74 U
R-BF	5	2	0.57 U	0.24 U	0.57 U	0.31 U	0.27 U	5.67 U
R-OS	1	3	0.85 U	0.36 U	0.85 U	0.46 U	0.41 U	8.49 U
R-OS	2	2	0.64 U	0.27 U	0.64 U	0.35 U	0.31 U	6.36 U
R-OS	3	2	2.51 U	1.05 U	2.51 U	1.36 U	1.21 U	25.07 U
R-OS	4	2	0.59 U	0.25 U	0.59 U	0.32 U	0.29 U	5.95 U
R-OS	5	NA ^(c)	NI ^(d)	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background	1	3	0.43 U	0.18 U	0.43 U	0.23 U	0.21 U	4.31 U
<i>N. caecoides</i> Background	2	3	0.43 U	0.18 U	0.43 U	0.24 U	0.21 U	4.33 U
<i>N. caecoides</i> Background	3	3	0.57 U	0.24 U	0.57 U	0.31 U	0.27 U	5.70 U
<i>N. caecoides</i> Background	4	3	0.56 U	0.23 U	0.56 U	0.30 U	0.27 U	5.60 U
<i>N. caecoides</i> Background Replicate 1	5	3	1.91 U	0.80 U	1.91 U	1.03 U	0.92 U	19.06 U
<i>N. caecoides</i> Background Replicate 2	5	3	1.22 U	0.51 U	1.22 U	0.66 U	0.59 U	12.22 U
<i>N. caecoides</i> Background Replicate 3	5	3	0.87 U	0.37 U	0.87 U	0.47 U	0.42 U	8.74 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.19. Quality Control Data for Pesticides (alphabetical, Aldrin - Chlordane), Dry Weight in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					Chlordane
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	
Method Blanks								
Blank		1	2.61 U ^(a)	4.01 U	4.01 U	4.01 U	4.01 U	78.94 U
Blank		2	2.04 U	3.13 U	3.13 U	3.13 U	3.13 U	61.53 U
Blank		3	1.59 U	2.45 U	2.45 U	2.45 U	2.45 U	48.16 U
Matrix Spikes								
COMP IC1-C	4	1	3.43 U	5.27 U	5.27 U	5.27 U	5.27 U	103.66 U
COMP IC1-C MS			92.75	96.38	115.26	97.69	96.10	NA ^(b)
Concentration Recovered			92.75	96.38	115.26	97.69	96.10	NA
Amount Spiked			149.38	157.16	149.38	149.38	149.38	NS ^(c)
Percent Recovery			62%	61%	77%	65%	64%	NA
R-OS	3	2	5.81 U	8.92 U	8.92 U	8.92 U	8.92 U	175.46 U
R-OS MS			116.35	118.13	162.39	124.99	120.93	NA
Concentration Recovered			116.35	118.13	162.39	124.99	120.93	NA
Amount Spiked			283.46	298.23	283.46	283.46	283.46	NS
Percent Recovery			41%	40%	57%	44%	43%	NA
<i>N. caecoides</i> Background	3	3	1.11 U	1.70 U	1.70 U	1.70 U	1.70 U	33.48 U
<i>N. caecoides</i> Background MS			36.22	38.74	48.74	38.33	39.34	NA
Concentration Recovered			36.22	38.74	48.74	38.33	39.34	NA
Amount Spiked			80.18	84.35	80.18	80.18	80.18	NS
Percent Recovery			45%	46%	61%	48%	49%	NA
Analytical Replicates								
R-BF Replicate 1	4	1	4.32 U	6.65 U	6.65 U	6.65 U	6.65 U	130.67 U
R-BF Replicate 2	4	1	4.37 U	6.72 U	6.72 U	6.72 U	6.72 U	132.06 U
R-BF Replicate 3	4	1	4.35 U	6.68 U	6.68 U	6.68 U	6.68 U	131.36 U
RSD			NA	NA	NA	NA	NA	NA

TABLE K.19. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
			Aldrin	Alpha- BHC	Beta- BHC	Delta- BHC	(Lindane) Gamma- BHC	Chlordane
R-BF Replicate 1	2	2	9.44 U	14.51 U	14.51 U	14.51 U	14.51 U	285.37 U
R-BF Replicate 2	2	2	8.93 U	13.72 U	13.72 U	13.72 U	13.72 U	269.86 U
R-BF Replicate 3	2	2	4.22 U	6.49 U	6.49 U	6.49 U	6.49 U	127.65 U
RSD			NA	NA	NA	NA	NA	NA
<i>N. caecoides</i> Background Replicate 1	5	3	3.86 U	5.93 U	5.93 U	5.93 U	5.93 U	116.56 U
<i>N. caecoides</i> Background Replicate 2	5	3	2.49 U	3.83 U	3.83 U	3.83 U	3.83 U	75.35 U
<i>N. caecoides</i> Background Replicate 3	5	3	1.79 U	2.75 U	2.75 U	2.75 U	2.75 U	53.97 U
RSD			NA	NA	NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NS Not spiked.

TABLE K.20. Quality Control Data for Pesticides (alphabetical, 4,4'-DDD - Endosulfan II), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ dry weight)					
			4,4'- DDD	4,4'- DDE	4,4'- DDT	Dieldrin	Endo- sulfan I	Endo- sulfan II
<u>Method Blanks</u>								
Blank		1	4.00 U ^(a)	8.88 U	8.27 U	3.23 U	7.89 U	7.89 U
Blank		2	3.12 U	6.92 U	6.45 U	2.52 U	6.15 U	6.15 U
Blank		3	2.44 U	5.42 U	5.05 U	1.97 U	4.82 U	4.82 U
<u>Matrix Spikes</u>								
COMP IC1-C	4	1	3.46 J ^(b)	2.34 J	10.86 U	4.24 U	10.37 U	10.37 U
COMP IC1-C MS	4	1	107.82	94.34	99.28	82.65	95.25	113.01
Concentration Recovered			104.36	92.00	99.28	82.65	95.25	113.01
Amount Spiked			149.38	149.38	149.38	149.38	149.38	149.38
Percent Recovery			70%	62%	66%	55%	64%	76%
R-OS	3	2	1.84 J	3.30 J	18.38 U	7.18 U	17.54 U	17.54 U
R-OS MS	3	2	169.97	139.05	175.42	124.59	126.45	171.85
Concentration Recovered			168.13	135.75	175.42	124.59	126.45	171.85
Amount Spiked			283.46	283.46	283.46	283.46	283.46	283.46
Percent Recovery			59%	48%	62%	44%	45%	61%
<i>N. caecoides</i> Background	3	3	1.70 U	1.74 J	3.51 U	1.37 U	3.35 U	3.35 U
<i>N. caecoides</i> Background MS	3	3	44.25	36.90	42.66	33.83	40.40	48.22
Concentration Recovered			44.25	35.16	42.66	33.83	40.40	48.22
Amount Spiked			80.18	80.18	80.18	80.18	80.18	80.18
Percent Recovery			55%	44%	53%	42%	50%	60%
<u>Analytical Replicates</u>								
R-BF Replicate 1	4	1	4.54 J	4.31 J	13.69 U	5.35 U	13.07 U	13.07 U
R-BF Replicate 2	4	1	3.85 J	4.04 J	13.84 U	5.41 U	13.21 U	13.21 U
R-BF Replicate 3	4	1	4.39 J	4.69 J	13.76 U	5.38 U	13.14 U	13.14 U
RSD			9%	8%	NA ^(c)	NA	NA	NA

TABLE K.20. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
			4,4'- DDD	4,4'- DDE	4,4'- DDT	Dieldrin	Endo- sulfan I	Endo- sulfan II
R-BF Replicate 1	2	2	5.84 J	4.13 J	29.50 U	11.68 U	28.53 U	28.53 U
R-BF Replicate 2	2	2	7.65 J	30.34 U	28.27 U	11.05 U	26.98 U	26.98 U
R-BF Replicate 3	2	2	5.24 J	14.35 U	13.37 U	5.23 U	12.76 U	12.76 U
RSD			20%	NA	NA	NA	NA	NA
<i>N. caecoides</i> Background Replicate 1	5	3	1.68 J	1.82 J	12.21 U	4.77 U	11.66 U	11.66 U
<i>N. caecoides</i> Background Replicate 2	5	3	0.99 J	1.64 J	7.89 U	3.09 U	7.53 U	7.53 U
<i>N. caecoides</i> Background Replicate 3	5	3	1.08 J	1.72 J	5.65 U	2.21 U	5.40 U	5.40 U
RSD			30%	5%	NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) NA Not applicable.

TABLE K.21. Quality Control Data for Pesticides (alphabetical, EndoSulfan Sulfate - Toxaphene), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)					
			Endo-Sulfan Sulfate	Endrin	Endrin aldehyde	Hepta-chlor	Hepta-chlor epoxide	Toxaphene
<u>Method Blanks</u>								
Blank		1	7.89 U(a)	3.31 U	7.89 U	4.28 U	3.80 U	78.94 U
Blank		2	6.15 U	2.58 U	6.15 U	3.34 U	2.96 U	61.53 U
Blank		3	4.82 U	2.02 U	4.82 U	2.61 U	2.32 U	48.16 U
<u>Matrix Spikes</u>								
COMP IC1-C	4	1	10.37 U	4.35 U	10.37 U	5.62 U	4.99 U	103.66 U(b)
COMP IC1-C MS			121.03	98.61	70.60	110.56	93.93	NA
Concentration Recovered			121.03	98.61	70.60	110.56	93.93	NA
Amount Spiked			149.38	152.80	149.38	149.38	149.38	NS(c)
Percent Recovery			81%	65%	47%	74%	63%	NA
R-OS	3	2	17.54 U	7.36 U	17.54 U	9.52 U	8.44 U	175.46 U
R-OS MS			177.95	148.61	66.10	161.45	127.99	NA
Concentration Recovered			177.95	148.61	66.10	161.45	127.99	NA
Amount Spiked			283.46	289.96	283.46	283.46	283.46	NS
Percent Recovery			63%	51%	23%(d)	57%	45%	NA
<i>N. caecoides</i> Background	3	3	3.35 U	1.41 U	3.35 U	1.82 U	1.61 U	33.48 U
<i>N. caecoides</i> Background MS			48.85	41.97	3.80	45.94	39.26	NA
Concentration Recovered			48.85	41.97	3.80	45.94	39.26	NA
Amount Spiked			80.18	82.02	80.18	80.18	80.18	NS
Percent Recovery			61%	51%	5%(d)	57%	49%	NA
<u>Analytical Replicates</u>								
R-BF Replicate 1	4	1	13.07 U	5.48 U	13.07 U	7.09 U	6.29 U	130.67 U
R-BF Replicate 2	4	1	13.21 U	5.54 U	13.21 U	7.17 U	6.35 U	132.06 U
R-BF Replicate 3	4	1	13.14 U	5.51 U	13.14 U	7.13 U	6.32 U	131.36 U
RSD			NA	NA	NA	NA	NA	NA
R-BF Replicate 1	2	2	28.53 U	11.97 U	28.53 U	15.48 U	13.73 U	285.37 U
R-BF Replicate 2	2	2	26.98 U	11.32 U	26.98 U	14.64 U	12.98 U	269.86 U
R-BF Replicate 3	2	2	12.76 U	5.36 U	12.76 U	6.93 U	6.14 U	127.65 U
RSD			NA	NA	NA	NA	NA	NA

TABLE K.21. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ dry weight)					
			Endo- Sulfan Sulfate	Endrin	Endrin aldehyde	Hepta- chlor	Hepta- chlor epoxide	Toxaphene
<i>N. caecoides</i> Background Replicate 1	5	3	11.66 U	4.89 U	11.66 U	6.32 U	5.61 U	116.56 U
<i>N. caecoides</i> Background Replicate 2	5	3	7.53 U	3.16 U	7.53 U	4.09 U	3.63 U	75.35 U
<i>N. caecoides</i> Background Replicate 3	5	3	5.40 U	2.26 U	5.40 U	2.93 U	2.60 U	53.97 U
RSD			NA	NA	NA	NA	NA	NA

- (a) U Undetected above given concentration.
 (b) NA Not applicable.
 (c) NS Not spiked.
 (d) Value exceeds quality control range of (40% to 120%).

TABLE K.22. Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> PCBs ($\mu\text{g}/\text{kg}$ dry weight)			
				Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
COMP IC1-A	1	3	11.50	46.41 U ^(a)	46.41 U	46.41 U	46.41 U
COMP IC1-A	2	1	16.99	71.86 U	71.86 U	71.86 U	71.86 U
COMP IC1-A	3	1	16.51	85.17 U	85.17 U	85.17 U	85.17 U
COMP IC1-A	4	1	17.12	57.74 U	57.74 U	32.40 J ^(b)	57.74 U
COMP IC1-A	5	2	13.68	47.74 U	47.74 U	24.71 J	47.74 U
COMP IC1-B	1	3	12.38	42.55 U	42.55 U	42.55 U	42.55 U
COMP IC1-B	2	1	15.62	105.65 U	105.65 U	105.65 U	105.65 U
COMP IC1-B	3	1	14.97	66.29 U	66.29 U	66.29 U	66.29 U
COMP IC1-B	4	3	13.81	105.65 U	105.65 U	105.65 U	105.65 U
COMP IC1-B	5	2	13.23	61.84 U	61.84 U	61.84 U	61.84 U
COMP IC1-B Special	1	1	16.00	60.85 U	60.85 U	73.96	60.85 U
COMP IC1-B Special	2	1	16.75	55.36 U	55.36 U	73.60	55.36 U
COMP IC1-B Special	3	2	12.98	61.76 U	61.76 U	91.69	61.76 U
COMP IC1-B Special	4	3	14.08	42.81 U	42.81 U	56.62	42.81 U
COMP IC1-B Special	5	2	12.74	49.65 U	49.65 U	74.70	49.65 U
COMP IC1-C	1	3	13.11	57.74 U	57.74 U	57.74 U	57.74 U
COMP IC1-C	2	2	15.52	45.72 U	45.72 U	39.78 J	45.72 U
COMP IC1-C	3	3	13.33	88.04 U	88.04 U	88.04 U	88.04 U
COMP IC1-C	4	1	15.14	103.66 U	103.66 U	103.66 U	103.66 U
COMP IC1-C	5	1	16.89	143.93 U	143.93 U	143.93 U	143.93 U
COMP OC4-B	1	3	13.54	44.94 U	44.94 U	162.24	44.94 U
COMP OC4-B	2	1	16.75	58.90 U	58.90 U	186.58	58.90 U
COMP OC4-B	3	2	15.52	55.36 U	55.36 U	171.95	55.36 U
COMP OC4-B	4	2	12.87	59.54 U	59.54 U	161.36	59.54 U
COMP OC4-B	5	3	13.50	65.25 U	65.25 U	174.86	65.25 U
R-AM	1	1	16.02	61.00 U	61.00 U	62.45	61.00 U
R-AM	2	2	16.39	38.52 U	38.52 U	38.76	38.52 U
R-AM	3	1	14.33	148.67 U	148.67 U	148.67 U	148.67 U
R-AM	4	1	14.40	63.50 U	63.50 U	63.50 U	63.50 U
R-AM	5	2	14.71	78.57 U	78.57 U	78.57 U	78.57 U
R-BF	1	3	16.19	45.18 U	45.18 U	83.09	45.18 U
R-BF Replicate 1	2	2	13.37	285.37 U	285.37 U	285.37 U	285.37 U
R-BF Replicate 2	2	2	13.37	269.86 U	269.86 U	269.86 U	269.86 U
R-BF Replicate 3	2	2	13.37	127.65 U	127.65 U	127.65 U	127.65 U
R-BF	3	1	17.11	55.42 U	55.42 U	76.17	55.42 U
R-BF Replicate 1	4	1	14.93	130.67 U	130.67 U	130.67 U	130.67 U
R-BF Replicate 2	4	1	14.93	132.06 U	132.06 U	132.06 U	132.06 U
R-BF Replicate 3	4	1	14.93	131.36 U	131.36 U	131.36 U	131.36 U
R-BF	5	2	14.62	38.64 U	38.64 U	67.37	38.64 U
R-OS	1	3	13.44	63.01 U	63.01 U	63.01 U	63.01 U
R-OS	2	2	15.31	41.45 U	41.45 U	41.45 U	41.45 U
R-OS	3	2	14.42	175.46 U	175.46 U	175.46 U	175.46 U
R-OS	4	2	12.12	49.11 U	49.11 U	49.11 U	49.11 U
R-OS	5	NA ^(c)	NA	NI ^(d)	NI	NI	NI
<i>N. caecoides</i> Background	1	3	13.96	30.84 U	30.84 U	30.84 U	30.84 U
<i>N. caecoides</i> Background	2	3	16.67	26.00 U	26.00 U	26.00 U	26.00 U
<i>N. caecoides</i> Background	3	3	17.04	33.48 U	33.48 U	33.48 U	33.48 U
<i>N. caecoides</i> Background	4	3	16.50	33.85 U	33.85 U	33.85 U	33.85 U

TABLE K.22. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> PCBs ($\mu\text{g/kg}$ dry weight)			
				Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>N. caecoides</i> Background Replicate 1	5	3	16.19	116.56 U	116.56 U	116.56 U	116.56 U
<i>N. caecoides</i> Background Replicate 2	5	3	16.19	75.35 U	75.35 U	75.35 U	75.35 U
<i>N. caecoides</i> Background Replicate 3	5	3	16.19	53.97 U	53.97 U	53.97 U	53.97 U

(a) U Undetected above given concentration.

(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.23. Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> PCBs ($\mu\text{g}/\text{kg}$ wet weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL (a)			20	20	20	20
Achieved DL High			38.19	38.19	38.19	38.19
Achieved DL Low			4.31	4.31	4.31	4.31
COMP IC1-A	1	3	5.34 U ^(b)	5.34 U	5.34 U	5.34 U
COMP IC1-A	2	1	12.19 U	12.19 U	12.19 U	12.19 U
COMP IC1-A	3	1	13.99 U	13.99 U	13.99 U	13.99 U
COMP IC1-A	4	1	9.89 U	9.89 U	5.55 J ^(c)	9.89 U
COMP IC1-A	5	2	6.53 U	6.53 U	3.38 J	6.53 U
COMP IC1-B	1	3	5.28 U	5.28 U	5.28 U	5.28 U
COMP IC1-B	2	1	16.51 U	16.51 U	16.51 U	16.51 U
COMP IC1-B	3	1	9.94 U	9.94 U	9.94 U	9.94 U
COMP IC1-B	4	3	14.60 U	14.60 U	14.60 U	14.60 U
COMP IC1-B	5	2	8.15 U	8.15 U	8.15 U	8.15 U
COMP IC1-B Special	1	1	9.79 U	9.79 U	11.89	9.79 U
COMP IC1-B Special	2	1	9.31 U	9.31 U	12.38	9.31 U
COMP IC1-B Special	3	2	7.98 U	7.98 U	11.85	7.98 U
COMP IC1-B Special	4	3	6.03 U	6.03 U	7.97	6.03 U
COMP IC1-B Special	5	2	6.32 U	6.32 U	9.52	6.32 U
COMP IC1-C	1	3	7.57 U	7.57 U	7.57 U	7.57 U
COMP IC1-C	2	2	7.12 U	7.12 U	6.19 J	7.12 U
COMP IC1-C	3	3	11.66 U	11.66 U	11.66 U	11.66 U
COMP IC1-C	4	1	15.71 U	15.71 U	15.71 U	15.71 U
COMP IC1-C	5	1	24.63 U	24.63 U	24.63 U	24.63 U
COMP OC4-B	1	3	6.11 U	6.11 U	22.07	6.11 U
COMP OC4-B	2	1	9.84 U	9.84 U	31.16	9.84 U
COMP OC4-B	3	2	8.62 U	8.62 U	26.77	8.62 U
COMP OC4-B	4	2	7.63 U	7.63 U	20.67	7.63 U
COMP OC4-B	5	3	8.79 U	8.79 U	23.56	8.79 U
R-AM	1	1	9.73 U	9.73 U	9.96	9.73 U
R-AM	2	2	6.32 U	6.32 U	6.36	6.32 U
R-AM	3	1	21.05 U	21.05 U	21.05 U	21.05 U
R-AM	4	1	9.12 U	9.12 U	9.12 U	9.12 U
R-AM	5	2	11.51 U	11.51 U	11.51 U	11.51 U
R-BF	1	3	7.32 U	7.32 U	13.46	7.32 U
R-BF Replicate 1	2	2	37.32 U	37.32 U	37.32 U	37.32 U
R-BF Replicate 2	2	2	35.20 U	35.20 U	35.20 U	35.20 U
R-BF Replicate 3	2	2	17.11 U	17.11 U	17.11 U	17.11 U
R-BF	3	1	9.53 U	9.53 U	13.10	9.53 U
R-BF Replicate 1	4	1	19.53 U	19.53 U	19.53 U	19.53 U
R-BF Replicate 2	4	1	19.94 U	19.94 U	19.94 U	19.94 U
R-BF Replicate 3	4	1	19.74 U	19.74 U	19.74 U	19.74 U
R-BF	5	2	5.67 U	5.67 U	9.85	5.67 U
R-OS	1	3	8.49 U	8.49 U	8.49 U	8.49 U
R-OS	2	2	6.36 U	6.36 U	6.36 U	6.36 U
R-OS	3	2	25.07 U	25.07 U	25.07 U	25.07 U
R-OS	4	2	5.95 U	5.95 U	5.95 U	5.95 U
R-OS	5	NA ^(d)	NI ^(e)	NI	NI	NI

TABLE K.23. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> PCBs ($\mu\text{g/kg}$ wet weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>N. caecoides</i> Background	1	3	4.31 U	4.31 U	4.31 U	4.31 U
<i>N. caecoides</i> Background	2	3	4.33 U	4.33 U	4.33 U	4.33 U
<i>N. caecoides</i> Background	3	3	5.70 U	5.70 U	5.70 U	5.70 U
<i>N. caecoides</i> Background	4	3	5.60 U	5.60 U	5.60 U	5.60 U
<i>N. caecoides</i> Background Replicate 1	5	3	19.06 U	19.06 U	19.06 U	19.06 U
<i>N. caecoides</i> Background Replicate 2	5	3	12.22 U	12.22 U	12.22 U	12.22 U
<i>N. caecoides</i> Background Replicate 3	5	3	8.74 U	8.74 U	8.74 U	8.74 U

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(d) NA Not applicable.

(e) NI No information; insufficient sediment to test all five replicates.

TABLE K.24. Quality Control Data for Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

			<i>N. caecoides</i> PCBs ($\mu\text{g/kg}$ dry weight)			
<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Analytical Batch</u>	<u>Aroclor 1242</u>	<u>Aroclor 1248</u>	<u>Aroclor 1254</u>	<u>Aroclor 1260</u>
<u>Method Blanks</u>						
Blank		1	78.94 U	78.94 U	78.94 U	78.94 U
Blank		2	61.53 U	61.53 U	61.53 U	61.53 U
Blank		3	48.16 U	48.16 U	48.16 U	48.16 U
<u>Matrix Spikes</u>						
COMP IC1-C	4	1	103.66 U ^(a)	103.66 U	103.66 U	103.66 U
COMP IC1-C MS	4	1	NA ^(b)	NA	1870.03	NA
Concentration Recovered			NA	NA	1870.03	NA
Amount Spiked			NS ^(c)	NS	2489.63	NS
Percent Recovery			NA	NA	75%	NA
R-OS	3	2	175.46 U	175.46 U	175.46 U	175.46 U
R-OS MS	3	2	NA	NA	3013.03	NA
Concentration Recovered			NA	NA	3013.03	NA
Amount Spiked			NS	NS	4724.41	NS
Percent Recovery			NA	NA	64%	NA
<i>N. caecoides</i> Background	3	3	33.48 U	33.48 U	33.48 U	33.48 U
<i>N. caecoides</i> Background MS	3	3	NA	NA	878.51	NA
Concentration Recovered			NA	NA	878.51	NA
Amount Spiked			NS	NS	1336.30	NS
Percent Recovery			NA	NA	66%	NA
<u>Analytical Replicates</u>						
R-BF Replicate 1	4	1	130.67 U	130.67 U	130.67 U	130.67 U
R-BF Replicate 2	4	1	132.06 U	132.06 U	132.06 U	132.06 U
R-BF Replicate 3	4	1	131.36 U	131.36 U	131.36 U	131.36 U
RSD			NA	NA	NA	NA
R-BF Replicate 1	2	2	285.37 U	285.37 U	285.37 U	285.37 U
R-BF Replicate 2	2	2	269.86 U	269.86 U	269.86 U	269.86 U
R-BF Replicate 3	2	2	127.65 U	127.65 U	127.65 U	127.65 U
RSD			NA	NA	NA	NA
<i>N. caecoides</i> Background Replicate 1	5	3	116.56 U	116.56 U	116.56 U	116.56 U
<i>N. caecoides</i> Background Replicate 2	5	3	75.35 U	75.35 U	75.35 U	75.35 U
<i>N. caecoides</i> Background Replicate 3	5	3	53.97 U	53.97 U	53.97 U	53.97 U
RSD			NA	NA	NA	NA

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NS Not spiked.

TABLE K.25. Surrogate Percent Recoveries for Polychlorinated Biphenyls (PCBS), Including Quality Control Data, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			DBOFB	CL5(112)	CL5(103)
COMP IC1-A	1	3	68	75	72
COMP IC1-A	2	1	97	59	65
COMP IC1-A	3	1	98	57	65
COMP IC1-A	4	1	107	59	64
COMP IC1-A	5	2	86	49	56
COMP IC1-B	1	3	46	62	54
COMP IC1-B	2	1	98	61	70
COMP IC1-B	3	1	101	60	73
COMP IC1-B	4	3	71	55	61
COMP IC1-B	5	2	82	53	57
COMP IC1-B Special	1	1	102	57	62
COMP IC1-B Special	2	1	111	60	71
COMP IC1-B Special	3	2	81	54	64
COMP IC1-B Special	4	3	41	62	57
COMP IC1-B Special	5	2	78	52	62
COMP IC1-C	1	3	69	64	67
COMP IC1-C	2	2	77	47	54
COMP IC1-C	3	3	68	71	59
COMP IC1-C	4	1	99	60	68
COMP IC1-C	5	1	100	60	71
COMP OC4-B	1	3	62	65	63
COMP OC4-B	2	1	97	62	70
COMP OC4-B	3	2	86	53	63
COMP OC4-B	4	2	83	50	59
COMP OC4-B	5	3	66	54	58
R-AM	1	1	107	60	75
R-AM	2	2	94	51	59
R-AM	3	1	99	60	75
R-AM	4	1	101	61	75
R-AM	5	2	80	54	63
R-BF	1	3	80	62	69
R-BF Replicate 1	2	2	68	45	50
R-BF Replicate 2	2	2	74	46	53
R-BF Replicate 3	2	2	73	47	56
R-BF	3	1	94	59	70
R-BF Replicate 1	4	1	93	62	75
R-BF Replicate 2	4	1	98	62	74
R-BF Replicate 3	4	1	92	64	77
R-BF	5	2	89	55	66
R-OS	1	3	45	70	60
R-OS	2	2	88	53	66
R-OS	3	2	85	53	63
R-OS	4	2	93	54	63
R-OS	5	NA ^(a)	NI ^(b)	NI	NI
<i>N. caecoides</i> Background	1	3	69	64	66
<i>N. caecoides</i> Background	2	3	79	61	63
<i>N. caecoides</i> Background	3	3	65	68	88
<i>N. caecoides</i> Background	4	3	83	64	67

TABLE K.25. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			DBOFB	CL5(112)	CL5(103)
<i>N. caecoides</i> Background Replicate 1	5	3	66	59	58
<i>N. caecoides</i> Background Replicate 2	5	3	80	68	70
<i>N. caecoides</i> Background Replicate 3	5	3	83	66	66
<u>Quality Control Data</u>					
<u>Method Blanks</u>					
Blank		1	83	75	73
Blank		2	87	70	91
Blank		3	62	59	66
<u>Matrix Spikes</u>					
COMP IC1-C MS	4	1	87	72	79
R-OS MS	3	2	66	58	63
<i>N. caecoides</i> Background MS	3	3	63	52	60
<u>Analytical Replicates</u>					
R-BF Replicate 1	2	2	68	45	50
R-BF Replicate 2	2	2	74	46	53
R-BF Replicate 3	2	2	73	47	56
R-BF Replicate 1	4	1	93	62	75
R-BF Replicate 2	4	1	98	62	74
R-BF Replicate 3	4	1	92	64	77
<i>N. caecoides</i> Background Replicate 1	5	3	66	59	58
<i>N. caecoides</i> Background Replicate 2	5	3	80	68	70
<i>N. caecoides</i> Background Replicate 3	5	3	83	66	66

(a) NA Not applicable.

(b) NI No information; insufficient sediment to test all five replicates.

TABLE K.26. Metals, Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL ^(a)			0.1	2.0	0.1	1.0	4.3	0.01	1	1.0	1.0	35
Achieved DL			0.064	2.0	0.246	0.422	4.3	0.045	0.848	0.073	1.0	35
COMP IC1-A	1	1	0.064 U ^(b)	25.8	0.739	0.422 U	11.4	0.078	3.21	0.309	1.00 U	163
COMP IC1-A	2	1	0.103	22.1	1.14	0.441	14.8	0.086	3.21	0.327	0.98 U	171
COMP IC1-A	3	1	0.090	20.0	0.732	0.482	14.8	0.060	2.98	0.346	1.66	164
COMP IC1-A	4	1	0.137	24.9	1.39	0.732	10.0	0.068	4.34	0.650	1.42	162
COMP IC1-A	5	1	0.084	24.0	0.935	0.422 U	15.6	0.065	3.60	0.380	1.38	174
COMP IC1-B	1	1	0.064 U	29.5	0.581	0.422 U	10.9	0.064	2.81	0.426	1.86	171
COMP IC1-B	2	1	0.067	24.1	0.813	0.429	11.4	0.063	3.13	0.696	1.10 U	162
COMP IC1-B	3	1	0.064 U	22.7	0.698	0.422 U	9.90	0.088	3.09	0.554	1.75	163
COMP IC1-B	4	1	0.067	26.4	0.978	0.533	9.70	0.082	3.39	0.599	1.10 U	170
COMP IC1-B	5	1	0.071	28.2	0.949	0.422 U	11.0	0.084	2.63	0.543	1.30	179
COMP IC1-B Special	1	1	0.065	25.1	0.994	0.500	14.4	0.056	2.81	0.606	1.00 U	181
COMP IC1-B Special	2	1	0.078	24.8	0.898	0.707	13.6	0.060	3.33	0.648	1.73	181
COMP IC1-B Special	3	1	0.091	24.6	0.965	1.03	11.6	0.061	4.09	0.751	1.21	171
COMP IC1-B Special	4	1	0.064	26.7	0.690	0.422 U	11.9	0.063	2.70	1.00	1.80	203
COMP IC1-B Special	5	1	0.064 U	23.6	0.820	0.549	9.90	0.059	2.77	0.726	0.99 U	156
COMP IC1-C	1	1	0.064 U	26.2	0.909	0.441	10.8	0.064	2.72	0.642	1.08	158
COMP IC1-C	2	1	0.064 U	28.0	0.750	0.508	11.0	0.063	3.12	0.643	1.87	187
COMP IC1-C	3	1	0.064 U	26.5	0.836	0.692	10.9	0.061	2.68	0.595	1.93	188
COMP IC1-C	4	1	0.077	37.1	1.02	0.583	11.8	0.066	2.89	0.717	1.10 U	197
COMP IC1-C	5	1	0.095	26.0	1.39	0.553	13.7	0.062	2.71	0.662	1.10 U	178
COMP OC4-B	1	1	0.064 U	24.4	0.678	0.422 U	10.5	0.059	3.54	0.482	1.00 U	169
COMP OC4-B	2	1	0.099	23.3	0.881	0.742	15.9	0.063	2.81	0.801	2.08	181
COMP OC4-B	3	1	0.064 U	28.4	0.796	0.466	12.0	0.088	2.85	0.706	2.60	193
COMP OC4-B	4	1	0.068	23.1	0.644	0.469	15.8	0.077	3.06	0.629	2.18	169
COMP OC4-B	5	1	0.064 U	28.0	0.664	0.422 U	11.1	0.084	2.35	0.519	1.26	181
R-AM	1	1	0.105	21.6	1.01	0.422 U	13.5	0.251	3.35	0.417	1.70	190
R-AM	2	1	0.108	21.5	0.644	0.422 U	10.5	0.082	2.72	0.363	2.04	168
R-AM	3	1	0.125	19.8	0.78	0.469	10.4	0.080	2.87	0.452	1.24	188
R-AM	4	1	0.147	18.1	0.636	0.555	10.9	0.073	2.53	0.658	1.00 U	178
R-AM	5	1	0.138	17.7	0.779	0.422 U	13.9	0.075	3.19	0.387	1.23	193

TABLE K.26. (contd)

Sediment			Analytical		<i>N. caecoides</i> Metals (mg/kg dry weight)							
Treatment	Replicate	Batch	Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-BF	1	1	0.077	30.5	0.990	0.422 U	11.9	0.100	0.848 U	0.872	1.10 U	167
R-BF	2	1	0.105	33.0	0.808	0.609	9.14	0.101	3.56	1.31	1.10 U	177
R-BF	3	1	0.092	29.4	1.09	0.552	12.2	0.076	0.848 U	0.985	1.40	191
R-BF	4	1	0.082	29.1	0.960	0.462	14.2	0.096	0.848 U	0.959	1.84	186
R-BF	5	1	0.128	39.1	1.07	0.679	13.0	0.099	2.57	0.942	1.10 U	176
R-OS	1	1	0.064 U	20.1	0.424	0.422 U	11.1	0.074	1.31	0.168	1.72	163
R-OS	2	1	0.071	20.5	0.772	0.422 U	10.9	0.078	2.95	0.455	1.50	171
R-OS	3	1	0.079	20.3	0.601	0.503	6.99	0.108	4.01	0.453	1.44	171
R-OS	4	1	0.077	23.3	0.682	0.422 U	12.2	0.082	2.29	0.333	2.24	192
R-OS	5	NA ^(c)	NI ^(d)	NI	NI	NI	NI	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background Replicate 1	1	1	0.138	30.2	1.15	1.14	16.4	0.078	3.51	0.538	1.53	169
<i>N. caecoides</i> Background Replicate 2	1	1	0.107	NA	1.01	1.24	NA	0.078	3.07	0.491	NA	NA
<i>N. caecoides</i> Background Replicate 3	1	1	0.138	NA	1.14	1.28	NA	0.075	3.32	0.531	NA	NA
<i>N. caecoides</i> Background	2	1	0.071	24.6	0.941	0.560	10.8	0.059	2.48	0.347	1.93	168
<i>N. caecoides</i> Background Replicate 1	3	1	0.085	23.8	0.807	0.830	15.0	0.069	2.63	0.441	1.52	164
<i>N. caecoides</i> Background Replicate 2	3	1	0.088	23.9	0.929	0.656	14.2	0.069	2.77	0.471	0.97 U	161
<i>N. caecoides</i> Background Replicate 3	3	1	0.083	23.0	0.875	0.726	14.1	0.066	2.56	0.471	1.00 U	160
<i>N. caecoides</i> Background	4	1	0.081	27.2	0.916	0.512	14.5	0.078	2.72	0.305	1.20	166
<i>N. caecoides</i> Background Replicate 1	5	1	0.086	22.9	1.16	0.424	13.2	0.067	2.78	0.512	1.56	154
<i>N. caecoides</i> Background Replicate 2	5	1	0.073	24.2	1.06	0.422 U	12.4	0.069	2.45	0.426	1.31	158
<i>N. caecoides</i> Background Replicate 3	5	1	0.069	24.0	1.02	0.516	12.6	0.069	2.66	0.423	1.53	159

(a) DL Detection limit.

(b) U Undetected above given concentration.

(c) NA Not applicable.

(d) NI No information; insufficient sediment to test all five replicates.

TABLE K.27. Metals, Wet Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Metals (mg/kg wet weight)									
				Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP IC1-A	1	1	11.50	0.007 U ^(a)	3.0	0.085	0.049 U	1.3	0.009	0.37	0.036	0.12 U	19
COMP IC1-A	2	1	16.99	0.017	3.8	0.19	0.075	2.5	0.015	0.55	0.056	0.17 U	29
COMP IC1-A	3	1	16.51	0.014	3.3	0.121	0.080	2.4	0.010	0.49	0.057	0.27	27
COMP IC1-A	4	1	17.12	0.023	4.3	0.24	0.125	1.7	0.012	0.74	0.111	0.24	28
COMP IC1-A	5	1	13.68	0.011	3.3	0.128	0.058 U	2.1	0.009	0.49	0.052	0.19	24
COMP IC1-B	1	1	12.38	0.007 U	3.7	0.072	0.052 U	1.3	0.008	0.35	0.053	0.23	21
COMP IC1-B	2	1	15.62	0.010	3.8	0.127	0.067	1.8	0.010	0.49	0.109	0.17 U	25
COMP IC1-B	3	1	14.97	0.009 U	3.4	0.104	0.063 U	1.48	0.013	0.46	0.083	0.26	24
COMP IC1-B	4	1	13.81	0.009	3.6	0.135	0.074	1.34	0.011	0.47	0.083	0.15 U	23
COMP IC1-B	5	1	13.23	0.009	3.7	0.126	0.056 U	1.5	0.011	0.35	0.072	0.17	24
COMP IC1-B Special	1	1	16.00	0.010	4.0	0.159	0.080	2.3	0.009	0.45	0.097	0.16 U	29
COMP IC1-B Special	2	1	16.75	0.013	4.2	0.150	0.118	2.3	0.010	0.56	0.109	0.29	30
COMP IC1-B Special	3	1	12.98	0.011	3.2	0.125	0.13	1.5	0.008	0.53	0.097	0.16	22
COMP IC1-B Special	4	1	14.08	0.009	3.8	0.097	0.059 U	1.7	0.009	0.38	0.14	0.25	29
COMP IC1-B Special	5	1	12.74	0.008 U	3.0	0.104	0.070	1.26	0.008	0.35	0.092	0.13 U	20
COMP IC1-C	1	1	13.11	0.008 U	3.4	0.119	0.058	1.4	0.008	0.36	0.084	0.14	21
COMP IC1-C	2	1	15.52	0.009 U	4.3	0.116	0.079	1.7	0.010	0.48	0.100	0.29	29
COMP IC1-C	3	1	13.33	0.008 U	3.5	0.111	0.092	1.5	0.008	0.36	0.079	0.26	25
COMP IC1-C	4	1	15.14	0.011	5.6	0.15	0.088	1.8	0.010	0.44	0.109	0.17 U	30
COMP IC1-C	5	1	16.89	0.016	4.4	0.23	0.093	2.3	0.010	0.46	0.112	0.19 U	30
COMP OC4-B	1	1	13.54	0.008 U	3.3	0.092	0.057 U	1.4	0.008	0.48	0.065	0.14 U	23
COMP OC4-B	2	1	16.76	0.016	3.9	0.148	0.124	2.7	0.011	0.47	0.134	0.35	30
COMP OC4-B	3	1	15.52	0.009 U	4.4	0.124	0.072	1.9	0.014	0.44	0.110	0.40	30
COMP OC4-B	4	1	12.87	0.008	3.0	0.083	0.060	2.0	0.010	0.39	0.081	0.28	22
COMP OC4-B	5	1	13.50	0.008 U	3.8	0.090	0.057 U	1.5	0.011	0.32	0.070	0.17	24
R-AM	1	1	16.02	0.016	3.5	0.16	0.068 U	2.2	0.040	0.54	0.067	0.27	30
R-AM	2	1	16.39	0.017	3.5	0.106	0.069 U	1.7	0.013	0.45	0.059	0.33	28
R-AM	3	1	14.33	0.017	2.8	0.11	0.067	1.5	0.011	0.41	0.065	0.18	27
R-AM	4	1	14.40	0.021	2.6	0.092	0.080	1.6	0.011	0.36	0.095	0.14 U	26
R-AM	5	1	14.71	0.020	2.6	0.115	0.062 U	2.0	0.011	0.47	0.057	0.18	28
R-BF	1	1	16.19	0.012	4.9	0.160	0.068 U	1.9	0.016	0.137 U	0.141	0.18 U	27
R-BF	2	1	13.37	0.014	4.4	0.108	0.081	1.22	0.014	0.48	0.18	0.15 U	24
R-BF	3	1	17.11	0.015	5.0	0.19	0.094	2.1	0.013	0.145 U	0.169	0.24	33
R-BF	4	1	14.93	0.012	4.3	0.143	0.069	2.1	0.014	0.127 U	0.143	0.27	28
R-BF	5	1	14.62	0.018	5.7	0.16	0.099	1.9	0.014	0.38	0.138	0.16 U	26

TABLE K.27. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> Metals (mg/kg wet weight)									
				Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-OS	1	1	13.44	0.008 U	2.7	0.057	0.057 U	1.5	0.010	0.18	0.023	0.23	22
R-OS	2	1	15.31	0.010	3.1	0.118	0.065 U	1.7	0.012	0.45	0.070	0.23	26
R-OS	3	1	14.42	0.011	2.9	0.087	0.073	1.01	0.016	0.58	0.065	0.21	25
R-OS	4	1	12.12	0.009	2.8	0.083	0.051 U	1.5	0.010	0.28	0.040	0.27	23
R-OS	5	NA ^(b)	NA	NI ^(c)	NI	NI	NI	NI	NI	NI	NI	NI	NI
<i>N. caecoides</i> Background Replicate 1	1	1	13.96	0.019	4.2	0.16	0.16	2.3	0.011	0.49	0.075	0.21	24
<i>N. caecoides</i> Background Replicate 2	1	1	13.96	0.014	NA	0.14	0.17	NA	0.011	0.43	0.069	NA	NA
<i>N. caecoides</i> Background Replicate 3	1	1	13.96	0.019	NA	0.16	0.18	NA	0.010	0.46	0.074	NA	NA
<i>N. caecoides</i> Background	2	1	16.67	0.011	4.1	0.157	0.093	1.8	0.010	0.41	0.058	0.32	28
<i>N. caecoides</i> Background Replicate 1	3	1	16.67	0.014	4.0	0.135	0.138	2.5	0.012	0.44	0.074	0.25	27
<i>N. caecoides</i> Background Replicate 2	3	1	16.67	0.014	4.0	0.155	0.109	2.4	0.012	0.46	0.079	0.16 U	27
<i>N. caecoides</i> Background Replicate 3	3	1	17.04	0.014	3.9	0.149	0.124	2.4	0.011	0.44	0.080	0.17 U	27
<i>N. caecoides</i> Background	4	1	16.50	0.013	4.5	0.151	0.084	2.4	0.013	0.45	0.050	0.20	27
<i>N. caecoides</i> Background Replicate 1	5	1	16.19	0.013	3.7	0.19	0.069	2.1	0.011	0.45	0.083	0.25	25
<i>N. caecoides</i> Background Replicate 2	5	1	16.19	0.011	3.9	0.17	0.068 U	2.0	0.011	0.40	0.069	0.21	26
<i>N. caecoides</i> Background Replicate 3	5	1	16.19	0.011	3.9	0.17	0.084	2.0	0.011	0.43	0.068	0.25	26

(a) U Undetected above given concentration.

(b) NA Not applicable.

(c) NI No information; insufficient sediment to test all five replicates.

TABLE K.28. Quality Control Data for Metals, Dry Weight, in Tissues of *N. caecoides*
Oakland Harbor Intensive Study

Sediment Treatment	Analytical		<i>N. caecoides</i> Metals (mg/kg dry weight)									
	Replicate	Batch	Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
<u>Method Blanks</u>												
Blank		1	0.064 U ^(a)	NM ^(b)	0.246 U	0.422 U	NM	0.0045 U	0.848 U	0.073 U	NM	NM
Blank		1	0.064 U	NM	0.246 U	0.422 U	NM	0.0045 U	0.848 U	0.073 U	NM	NM
Blank		1	0.064 U	NM	0.246 U	0.422 U	NM	0.0045 U	0.848 U	0.073 U	NM	NM
<u>Matrix Spikes</u>												
<i>N. caecoides</i> Background ^(c)	1	1	0.128	30.2	1.10	1.22	16.4	0.077	3.30	0.520	1.53	169
<i>N. caecoides</i> Background MS	1	1	1.84	NA ^(d)	2.70	4.50	NA	1.01	6.65	2.13	NA	NA
Amount Recovered			1.71	NA	1.60	3.28	NA	0.933	3.35	1.61	NA	NA
Amount Spiked			1.67	NS ^(e)	1.67	3.33	NS	0.842	3.33	1.67	NS	NS
Percent Recovery			102%	NA	96%	98%	NA	111%	101%	96%	NA	NA
<i>N. caecoides</i> Background ^(c)	3	1	0.085	23.6	0.870	0.737	14.4	0.068	2.65	0.461	1.16	162
<i>N. caecoides</i> Background MS	3	1	1.67	NA	2.41	3.83	NA	0.928	5.82	1.83	NA	NA
Amount Recovered			1.58	NA	1.54	3.09	NA	0.860	3.17	1.37	NA	NA
Amount Spiked			1.67	NS	1.67	3.33	NS	0.818	3.33	1.67	NS	NS
Percent Recovery			95%	NA	92%	93%	NA	108%	95%	82%	NA	NA
<i>N. caecoides</i> Background ^(c)	5	1	0.076	23.7	1.08	0.44	12.7	0.068	2.63	0.454	1.47	157
<i>N. caecoides</i> Background MS	5	1	1.71	NA	2.59	3.75	NA	1.01	5.92	2.03	NA	NA
Amount Recovered			1.63	NA	1.51	3.30	NA	0.942	3.29	1.58	NA	NA
Amount Spiked			1.67	NS	1.67	3.33	NS	0.835	3.33	1.67	NS	NS
Percent Recovery			98%	NA	90%	99%	NA	121%	99%	95%	NA	NA
<u>Standard Reference Material</u>												
Certified			1.68	14.0	4.15	1.43	66.3	0.0642	2.25	0.371	2.21	830
Value SRM 1566a			±0.15	±1.2	±0.38	±0.46	±4.3	±0.0067	±0.44	±0.014	±0.24	±57
1566a		1	1.64	14.6	3.99	0.793 ^(f)	63.3	0.069	1.66	0.294	1.97	833
1566a		1	1.67	14.7	4.15	1.07	65.3	0.071	2.06	0.279	1.89	834
1566a		1	1.79	15.7	4.22	0.911 ^(f)	66.7	0.077	2.21	0.326	2.17	838

TABLE K.28. (contd)

Sediment Treatment	Analytical		<i>N. caecoides</i> Metals (mg/kg dry weight)									
	Replicate	Batch	Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
<u>Analytical Replicates</u>												
<i>N. caecoides</i> Background Replicate 1	1	1	0.138	30.2	1.15	1.14	16.4	0.078	3.51	0.538	1.53	169
<i>N. caecoides</i> Background Replicate 2	1	1	0.107	NA	1.01	1.24	NA	0.078	3.07	0.491	NA	NA
<i>N. caecoides</i> Background Replicate 3	1	1	0.138	NA	1.14	1.28	NA	0.075	3.32	0.531	NA	NA
RSD			14%	NA	7%	6%	NA	2%	7%	5%	NA	NA
<i>N. caecoides</i> Background Replicate 1	3	1	0.085	23.8	0.807	0.830	15.0	0.069	2.63	0.441	1.52	164
<i>N. caecoides</i> Background Replicate 2	3	1	0.088	23.9	0.929	0.656	14.2	0.069	2.77	0.471	0.97 U	161
<i>N. caecoides</i> Background Replicate 3	3	1	0.083	23.0	0.875	0.726	14.1	0.066	2.56	0.471	1.00 U	160
RSD			3%	2%	7%	12%	3%	3%	4%	4%	NA	1%
<i>N. caecoides</i> Background Replicate 1	5	1	0.086	22.9	1.16	0.424	13.2	0.067	2.78	0.512	1.56	154
<i>N. caecoides</i> Background Replicate 2	5	1	0.073	24.2	1.06	0.422 U	12.4	0.069	2.45	0.426	1.31	158
<i>N. caecoides</i> Background Replicate 3	5	1	0.069	24.0	1.02	0.516	12.6	0.069	2.66	0.423	1.53	159
RSD			12%	3%	7%	NA	3%	2%	6%	11%	9%	2%

(a) U Undetected above given concentration.

(b) NM Not measured.

(c) Value is a mean of the replicates; in cases where a replicate was undetected, the detection limit was used in place of the mean.

(d) NA Not applicable.

(e) NS Not spiked.

(f) Value outside SRM range for certified value.

TABLE K.29. Butyltin Results, Dry and Wet Weight, in Tissues of *N. caecoides*
Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Triphenyltin (%) Internal Standard	(µg/kg wet weight)			Percent Dry Weight	(µg/kg dry weight)		
				Tri- Butyltin	Di- Butyltin	Mono- Butyltin		Tri- Butyltin	Di- Butyltin	Mono- Butyltin
Target DL (a)			NA (b)	10	10	10	NA	NA	NA	NA
Achieved DL High			NA	61.56	21.55	27.00	NA	NA	NA	NA
Achieved DL Low			NA	5.33	1.86	2.34	NA	NA	NA	NA
COMP IC1-A	1	3	49	15.18 U (c)	5.31 U	6.66 U	11.50	131.98 U	46.21 U	57.90 U
COMP IC1-A	2	1	30 (d)	18.05 U	6.32 U	7.92 U	16.99	106.11 U	37.15 U	46.54 U
COMP IC1-A	3	1	21 (d)	14.89 U	5.21 U	6.53 U	16.51	90.42 U	31.66 U	39.66 U
COMP IC1-A	4	1	7 (d)	12.98 U	4.55 U	5.69 U	17.12	75.91 U	26.58 U	33.30 U
COMP IC1-A	5	2	62	16.29 U	5.70 U	7.14 U	13.68	119.22 U	41.74 U	52.30 U
COMP IC1-B	1	3	84	17.79 U	6.23 U	7.80 U	12.38	142.75 U	49.98 U	62.62 U
COMP IC1-B	2	1	69	16.84 U	5.89 U	7.38 U	15.62	107.63 U	37.68 U	47.21 U
COMP IC1-B	3	1	15 (d)	36.57 U	12.80 U	16.04 U	14.97	243.46 U	85.23 U	106.80 U
COMP IC1-B	4	3	66	16.74 U	5.86 U	7.34 U	13.81	120.37 U	42.14 U	52.80 U
COMP IC1-B	5	2	57	14.26 U	4.99 U	6.26 U	13.23	108.40 U	37.95 U	47.55 U
COMP IC1-B Special	1	1	62	15.28 U	5.35 U	6.70 U	16.00	95.35 U	33.38 U	41.83 U
COMP IC1-B Special	2	1	43	13.62 U	4.77 U	5.97 U	16.75	81.07 U	28.38 U	35.56 U
COMP IC1-B Special	3	2	49	5.30 J (e)	5.41 U	6.78 U	12.98	40.56 J	41.41 U	51.89 U
COMP IC1-B Special	4	3	63	15.04 U	5.27 U	6.60 U	14.08	107.17 U	37.52 U	47.01 U
COMP IC1-B Special	5	2	61	15.36 U	5.38 U	6.74 U	12.74	119.98 U	42.01 U	52.63 U
COMP IC1-C	1	3	68	15.13 U	5.30 U	6.64 U	13.11	115.56 U	40.46 U	50.69 U
COMP IC1-C	2	2	81	12.55 U	4.39 U	5.50 U	15.52	80.89 U	28.32 U	35.48 U
COMP IC1-C	3	3	97	14.53 U	5.09 U	6.38 U	13.33	109.03 U	38.17 U	47.83 U
COMP IC1-C	4	1	34 (d)	5.87 J	5.81 U	7.29 U	15.14	38.91 J	38.56 U	48.32 U
COMP IC1-C	5	1	20 (d)	15.28 U	5.35 U	6.70 U	16.89	90.53 U	31.69 U	39.71 U
COMP OC4-B	1	3	65	14.81 U	5.18 U	6.50 U	13.54	109.19 U	38.23 U	47.90 U
COMP OC4-B	2	1	31 (d)	21.88 U	7.66 U	9.60 U	16.76	130.16 U	45.57 U	57.09 U
COMP OC4-B	3	2	12 (d)	17.21 U	6.02 U	7.55 U	15.52	111.62 U	39.08 U	48.96 U
COMP OC4-B	4	2	57	13.95 U	4.88 U	6.12 U	12.87	108.71 U	38.06 U	47.69 U
COMP OC4-B	5	3	69	15.12 U	5.29 U	6.63 U	13.50	111.29 U	38.96 U	48.82 U
R-AM Replicate 1	1	1	29 (d)	62.82 U	21.99 U	27.56 U	16.02	383.83 U	134.37 U	168.37 U
R-AM Replicate 2	1	1	14 (d)	53.91 U	18.87 U	23.65 U	16.02	338.87 U	118.64 U	148.65 U
R-AM Replicate 3	1	1	82	30.28 U	10.60 U	13.28 U	16.02	188.55 U	66.01 U	82.71 U
R-AM	2	2	65	16.19 U	5.67 U	7.10 U	16.39	98.86 U	34.61 U	43.36 U
R-AM	3	1	50	16.24 U	5.69 U	7.12 U	14.33	112.79 U	39.49 U	49.48 U
R-AM	4	1	55	15.09 U	5.28 U	6.62 U	14.40	104.63 U	36.63 U	45.90 U
R-AM	5	2	81	15.59 U	5.46 U	6.84 U	14.71	105.22 U	36.84 U	46.15 U

TABLE K.29. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tripenyltin (%) Internal Standard	(µg/kg wet weight)			Percent Dry Weight	(µg/kg dry weight)		
				Tri- Butyltin	Di- Butyltin	Mono- Butyltin		Tri- Butyltin	Di- Butyltin	Mono- Butyltin
R-BF	1	2	55	15.23 U	5.33 U	6.68 U	16.19	94.04 U	32.92 U	41.25 U
R-BF	2	2	66	14.79 U	5.18 U	6.49 U	13.37	110.63 U	38.73 U	48.53 U
R-BF	3	1	17 ^(d)	4.77 J	5.39 U	6.76 U	17.11	27.96 J	31.62 U	39.62 U
R-BF	4	1	54	14.98 U	5.25 U	6.57 U	14.93	99.64 U	34.88 U	43.71 U
R-BF	5	2	42	16.18 U	5.66 U	7.10 U	14.62	110.63 U	38.73 U	48.53 U
R-OS	1	3	76	16.09 U	5.63 U	7.06 U	13.44	120.56 U	42.21 U	52.89 U
R-OS	2	2	75	15.04 U	5.26 U	6.60 U	15.31	98.60 U	34.52 U	43.25 U
R-OS Replicate 1	3	2	51	49.30 U	17.26 U	21.62 U	14.42	334.36 U	117.05 U	146.67 U
R-OS Replicate 2	3	2	57	60.23 U	21.09 U	26.42 U	14.42	417.94 U	146.32 U	183.33 U
R-OS Replicate 3	3	2	69	34.55 U	12.10 U	15.16 U	14.42	237.32 U	83.08 U	104.10 U
R-OS	4	2	59 ^(f)	31.25 U	10.94 U	13.71 U	12.12	254.16 U	88.98 U	111.49 U
R-OS	5	NA	NI	NI	NI	NI	NA	NI	NI	NI
<i>N. caecoides</i> Background	1	3	91	5.32 U	1.86 U	2.33 U	13.96	38.15 U	13.36 U	16.73 U
<i>N. caecoides</i> Background Replicate 1	2	3	80	28.23 U	9.88 U	12.38 U	16.67	168.30 U	58.92 U	73.83 U
<i>N. caecoides</i> Background Replicate 2	2	3	77	18.49 U	6.47 U	8.11 U	16.67	111.62 U	39.08 U	48.96 U
<i>N. caecoides</i> Background Replicate 3	2	3	17 ^(d)	11.40 U	3.99 U	5.00 U	16.67	68.08 U	23.83 U	29.86 U
<i>N. caecoides</i> Background	3	3	77	8.26 U	2.89 U	3.62 U	17.04	48.35 U	16.93 U	21.21 U
<i>N. caecoides</i> Background	4	3	62	7.05 U	2.47 U	3.09 U	16.50	42.62 U	14.92 U	18.70 U
<i>N. caecoides</i> Background	5	3	64	7.68 U	3.14	3.37 U	16.19	47.37 U	19.36	20.78 U

(a) DL Detection limit.

(b) NA Not applicable.

(c) U Undetected above given concentration.

(d) Recovery exceeds quality control range of (40% to 120%).

(e) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).

(f) NI No information; insufficient sediment to test all five replicates.

TABLE K.30. Quality Control Data for Butyltins, Dry Weight, in Tissues of *N. caecoides*, Oakland Harbor Intensive Study

Sediment Treatment	Replicate	Analytical Batch	Tripenyltin (%) Internal Standard	(µg/kg dry weight)		
				Tri-butyltin	Di-butyltin	Mono-butyltin
Method Blanks						
Blank		1	84	114.86 U	40.21 U	50.38 U
Blank		2	64	124.14 U	43.46 U	54.46 U
Blank		3	59	80.98 U	28.35 U	35.52 U
Matrix Spikes						
COMP IC1-B	3	1	15 ^(a)	243.46 U ^(b)	85.23 U	106.80 U
COMP IC1-B MS	3	1	63	1711.32	1135.37	231.91
Concentration Recovered				1711.32	1135.37	231.91
Amount Spiked				1274.31	1226.93	1234.41
Percent Recovery				134% ^(a)	93%	19% ^(a)
R-OS	4	2	59	254.16 U	88.98 U	111.49 U
R-OS MS	4	2	58	1430.13	915.91	81.30 U
Concentration Recovered				1430.13	915.91	0.00
Amount Spiked				1255.53	1208.85	1216.22
Percent Recovery				114%	76%	0% ^(a)
<i>N. caecoides</i> Background	3	3	77	48.35 U	16.93 U	21.21 U
<i>N. caecoides</i> Background MS	3	3	53	576.86	357.33	26.22 U
Concentration Recovered				576.86	357.33	0.00
Amount Spiked				404.91	389.86	392.23
Percent Recovery				142% ^(a)	92%	0% ^(a)
Analytical Replicates						
R-AM Replicate 1	1	1	29 ^(a)	383.83 U	134.37 U	168.37 U
R-AM Replicate 2	1	1	14 ^(a)	338.87 U	118.64 U	148.65 U
R-AM Replicate 3	1	1	82	188.55 U	66.01 U	82.71 U
RSD			NA ^(c)	NA	NA	NA
R-OS Replicate 1	3	2	51	334.36 U	117.05 U	146.67 U
R-OS Replicate 2	3	2	57	417.94 U	146.32 U	183.33 U
R-OS Replicate 3	3	2	69	237.32 U	83.08 U	104.10 U
RSD			NA	NA	NA	NA
<i>N. caecoides</i> Background Replicate 1	2	3	80	168.30 U	58.92 U	73.83 U
<i>N. caecoides</i> Background Replicate 2	2	3	77	111.62 U	39.08 U	48.96 U
<i>N. caecoides</i> Background Replicate 3	2	3	17 ^(a)	68.08 U	23.83 U	29.86 U
RSD			NA	NA	NA	NA

(a) Recovery exceeds quality control range of (40% to 120%).

(b) U Undetected above given concentration.

(c) NA Not applicable.

APPENDIX L

POTENTIAL EFFECTS OF DISPOSAL OF OAKLAND HARBOR INTENSIVE STUDY
SEDIMENTS AT THE BAY FARM BORROW AREA

APPENDIX L

POTENTIAL EFFECTS OF DISPOSAL OF OAKLAND HARBOR INTENSIVE STUDY SEDIMENTS AT THE BAY FARM BORROW AREA

This appendix presents the results of statistical comparisons and a Tier III evaluation of Oakland Harbor Intensive Study sediments relative to the Bay Farm Borrow Area (R-BF) (Figure L.1). This section provides the necessary data to determine suitability of Oakland Harbor sediments for in-bay disposal at R-BF. All methods and results for sampling, physical descriptions, sediment chemistry, biological testing, and tissue chemistry are contained in Sections 2 and 3 of this report; supporting data are contained in Appendixes A through K. This appendix examines the results of the physical/chemical sediment analysis, acute toxicity, and tissue chemistry of the Oakland Harbor test treatments relative to R-BF. As stated in Section 2.5 of this report, the use of Dunnett's test for statistical comparisons of non-independent data sets increases the chance of Type II statistical errors in all comparisons, resulting in the identification of a greater number of significant differences.

L.1 SEDIMENT CHARACTERISTICS

The Bay Farm Borrow Area (R-BF) sediment consists almost entirely of silt and clay. Generally, the Oakland Harbor Intensive Study sediments were of coarser grain size than R-BF (Table L.1). Oakland Harbor test treatments were lower in TOC and oil and grease. Two Oakland Harbor test treatments, IC1-B-3 and IC1-C-1 Top 6 in., had total PAH concentrations that were greater than R-BF (2159 µg/kg dry weight) (Table L.2). The concentrations of pesticides, PCBs, metals (except Cr and Zn), and butyltins in the reference sediment R-BF were generally among the highest concentrations of any sediment treatment.

L.2 DEPOSITED SEDIMENT TOXICITY

The solid-phase tests with Oakland Harbor sediments showed no acute toxicity to *N. caecoides* or *M. nasuta* when compared to the Bay Farm reference (R-BF). The *R. abronius* 10-day test showed statistically significant differences and a >20% difference in survival in the test treatments COMP IC1-B and COMP IC1-C when compared to the reference R-BF (Table L.3).

L.3 WATER COLUMN EFFECTS

The evaluation of water column effects does not change with comparisons to different references because the reference sediment itself is not tested for water column toxicity. There was no acute toxicity to *H. costata*. T-test results showed three test treatments were acutely

FIGURE L.1. Location of Bay Farm Borrow Area (R-BF)

TABLE L.1. Conventional Sediment Measurement Results for the Oakland Harbor Intensive Study Sediment Treatments
(Grain Size, TOC, and TVS in percent dry weight; Oil and Grease and TPH in mg/kg dry weight)

Sediment Treatment	Gravel >2000 μ m	Sand 62.5- 2000 μ m	Silt 3.9- 62.5 μ m	Clay <3.9 μ m	TOC (percent)	TVS (percent)	Oil and Grease (mg/kg)	TPH (mg/kg)
COMP IC1-A	0	88	5	7	0.03	0.77	12 U(b)	12 U
IC1-A Special Chemistry(a)	2	91	4	3	0.05	0.84	12 U	12 U
IC1-A-1	0	91	4	5	0.05	0.78	23	12 U
IC1-A-2	0	92	3	5	0.10	0.63	12 U	12 U
IC1-A-3	0	94	2	4	0.03	0.54	12 U	12 U
IC1-A-4	0	93	4	3	0.06	0.34	12 U	12 U
IC1-A-5	0	87	6	7	0.20	0.61	99	58
IC1-A-6	0	93	3	4	0.05	0.53	12 U	12 U
COMP IC1-B	0	2	51	47	0.67	3.30	18 U(c)	18 U(c)
COMP IC1-B Special	14(c)	23(c)	29(c)	34(c)	0.73	1.51	170	17 U
IC1-B-1	1	3	50	41	0.65	2.55	92	36
IC1-B-2	14	11	35	40	0.66	2.07	18 U	18 U
IC1-B-3	9	30	28	33	0.58	2.07	61	17
IC1-B-4(d)	13	10	28	49	0.70	1.88	18 U	18 U
IC1-B-5	22	9	35	34	0.67	2.19	20	17 U
COMP IC1-C	0	39	31	30	0.51	2.18	16 U	16 U
IC1-C-1 Top 6 in.	0	23	42	35	0.63	2.09	52	17 U
IC1-C-1	0	3	51	46	0.67	1.90	19	17 U
IC1-C-2	0	1	51	48	0.68	1.70	22	17 U
IC1-C-3	0	93	3	4	0.06	0.35	12 U	12 U
IC1-C-4	0	21	35	44	0.94	2.54	180	76
COMP OC4-B	0	76	10	14	0.22	1.25	94	32
OC4-B-1	0	85	8	7	0.06	0.93	12 U	12 U
OC4-B-2	0	93	3	4	0.06(c)	0.47(c)	12 U(c)	12 U(c)
OC4-B-3 Special Chemistry	0	23	39	38	0.82	3.42	83	59
OC4-B-3 (-38.6 to -40.1 ft MLLW)	0	21	39	40	0.95	1.95	92	55
OC4-B-3 (-40.1 to -43.7 ft MLLW)	0	96	2	2	0.04	0.34	12 U	12 U
OC4-B-4	0	28	31	41	1.04	2.41	660	600
OC4-B-5 (-39.6 to -44.0 ft MLLW)	0	70	13	17	0.33	1.12	28	32
OC4-B-5 (-39.6 to -42.2 ft MLLW)	0	23	35	42	0.93	2.74	140	69
OC4-B-5 (-42.2 to -44.0 ft MLLW)	0	97	1	2	0.02	0.27	12 U	12 U

TABLE L.1. (contd)

Sediment Treatment	Gravel $\geq 2000 \mu\text{m}$	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay $\leq 3.9 \mu\text{m}$	TOC (percent)	TVS (percent)	Oil and Grease (mg/kg)	TPH (mg/kg)
R-BF	0	2	36	62	4.10	1.39	130	32 U

- (a) Special Chemistry sample determined in the field due to a particular sediment characteristic.
(b) U Undetected above given concentration.
(c) Mean of replicate measurements.
(d) All of the sediment from this station is represented only in COMP IC1-B Special.

OH INTENSIVE

L.5

TABLE L.2. Organics and Metals Concentrations in Oakland Harbor Intensive Study Sediment Treatments (shading indicates values greater than the Bay Farm (R-BF) reference sediment; organics in µg/kg dry weight; metals in mg/kg dry weight)

Sediment Treatment	LPAH	HPAH	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	TBT	DBT
COMP IC1-A	8	7	0.039	3.91	0.1 U(a)	231	10.4	0.026	35.0	7.4	0.12 U	29.1	0.7 U	1.2 U
IC1-A Special Chemistry(b)	9	35	0.039	3.56	0.1 U	212	32.3	0.033	46.9	6.3	0.12 U	33.8	4.8	1.2 U
IC1-A-1	6	36	0.033	3.77	0.1 U	339	10.2	0.018	62.2	6.4	0.13	36.2	0.7 U	1.2 U
IC1-A-2	7	14	0.049	4.25	0.1 U	482	14.2	0.025	39.1	6.0	0.12 U	36.2	0.7 U	1.2 U
IC1-A-3	7	14	0.030	3.11	0.1 U	310	8.8	0.018	31.8	7.7	0.14	26.2	0.7 U	1.2 U
IC1-A-4	19	33	0.026	2.13	0.1 U	249	11.6	0.018	32.9	8.8	0.12 U	24.5	1.4	1.2 U
IC1-A-5	62	348	0.118	5.07	0.119	525	14.9	0.096	44.3	10.1	0.12 U	43.7	0.7 U	1.2 U
IC1-A-6	6	13	0.034	3.78	0.1 U	420	10.4	0.024	31.1	6.6	0.12 U	27.9	0.7 U	1.2 U
COMP IC1-B	31	84	0.117	11.1	0.161	190	50.9	0.081	114	11.1	0.34	107	0.7 U	1.2 U
COMP IC1-B Special	286	1430	0.197	10.6	0.272	191	37.7	0.398	86.8	13.8	0.34	92.2	3.9	1.2 U
IC1-B-1	94	628	0.246	10.7	0.319	187	48.0	0.200	105	19.1	0.20	107	0.7 U	1.2 U
IC1-B-2	138	133	0.090	10.0	0.210	161	44.6	0.073	104	8.4	0.34	92.0	1.8	1.2 U
IC1-B-3	836	3120	0.082	10.0	0.182	216	38.1	0.091	83.2	11.0	0.20	81.6	0.7 U	1.2 U
IC1-B-4(c)	111	60	0.104	10.4	0.238	157	47.4	0.074	110	10.2	0.35	99.4	0.7 U	1.2 U
IC1-B-5	57	46	0.099	10.2	0.240	167	49.0	0.067	108	8.7	0.21	95.9	0.7 U	1.2 U
COMP IC1-C	76	477	0.127	10.2	0.153	299	31.7	0.090	81.6	10.9	0.21	83.1	1.2	1.2 U
IC1-C-1 Top 6 in.	7260	16,000	0.142	11.0	0.171	224	39.9	0.099	95.4	11.0	0.20	93.9	1.1	1.2 U
IC1-C-1	197	348	0.128	11.8	0.202	186	47.6	0.072	105	10.3	0.34	102	0.7 U	1.2 U
IC1-C-2	55	42	0.099	12.6	0.213	190	46.9	0.076	117	11.4	0.21	103	0.7 U	1.2 U
IC1-C-3	44	31	0.037	3.89	0.1 U	331	9.9	0.018	29.3	5.6	0.12 U	25.3	0.7 U	1.2 U
IC1-C-4	312	1480	0.366	13.2	0.266	233	51.5	0.294	100	30.7	0.21	131	3.9	2.0
COMP OC4-B	73	413	0.129	4.43	0.11	433	21.0	0.091	76.1	12.5	0.13	63.5	1.5	1.2 U
OC4-B-1	40	32	0.052	2.65	0.1 U	410	11.5	0.029	70.6	3.8	0.12 U	41.8	0.7 U	1.2 U
OC4-B-2(d)	37	45	0.027	3.25	0.1 U	297	10.9	0.020	53.6	5.2	0.12 U	33.3	0.7 U	1.2 U
OC4-B-3 Special Chemistry	237	1600	0.306	11.6	0.137	287	45.3	0.296	98.8	26.1	0.27	119	4.0	2.1
OC4-B-3 (-38.6 to -40.1 ft MLLW)	274	1530	0.325	10.4	0.169	213	46.6	0.303	92.9	28.4	0.21	120	4.0	2.2
OC4-B-3 (-40.1 to -43.7 ft MLLW)	70	39	0.023	1.43	0.1 U	427	9.0	0.031	58.7	7.0	0.12 U	35.6	0.7 U	1.2 U
OC4-B-4	404	1610	0.503	10.9	0.554	257	54.7	0.480	96.3	44.7	0.27	140	0.8	1.2 U
OC4-B-5 (-39.6 to -44.0 ft MLLW)	242	1020	0.150	8.35	0.121	473	25.3	0.128	76.3	13.6	0.12 U	77.7	4.9	1.4
OC4-B-5 (-39.6 to -42.2 ft MLLW)	237	1310	0.364	12.5	0.19	224	48.4	0.330	92.3	29.2	0.27	128	5.5	2.5
OC4-B-5 (-42.2 to -44.0 ft MLLW)	43	16	0.023	3.21	0.1 U	627	11.5	0.016 U	57.2	6.3	0.12 U	42.3	0.7 U	1.2 U

TABLE L.2. (contd)

Sediment Treatment	LPAH	HPAH	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	TBT	DBT
R-BF	379	1780	0.409	12.6	0.194	189	52.5	0.342	110	31.5	0.28	149	4.3	2.3

(a) U Undetected above given concentration.

(b) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(c) All of the sediment from this station is represented only in COMP IC1-B Special.

(d) Mean of replicate measurements.

toxic to *C. stigmaeus* (COMP IC1-B, COMP IC1-B Special, and COMP IC1-C). Test treatments COMP IC1-B R and COMP IC1-B Special R could not be statistically analyzed due to no variance. However, these treatments are observably different from the 0% SPP (Control R). LC50s could be calculated for two treatments (49% SPP for COMP IC1-B and 76% SPP for COMP IC1-B Special (Table L.4). A t-test analysis of the survival of *M. edulis* larvae exposed to the 100% SPP of COMP IC1-B Special and COMP OC4-B showed statistically significant differences when compared to the 0% control. The LC50 for *M. edulis* exposed to COMP IC1-B Special was 79.9%. A t-test analysis of the normal development of *M. edulis* larvae when exposed to the 100% SPP of COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and COMP OC4-B showed statistically significant differences when compared to the 0% control. The 100% SPP of COMP IC1-B, COMP IC1-B Special, and COMP IC1-C resulted in a calculable EC50 value to *M. edulis* larvae of 21.4%, 71.1%, and 87.1%, respectively.

L.4 DEPOSITED SEDIMENT BIOACCUMULATION

Complete tissue chemistry results, quality control data, and quality assurance/quality control summaries are presented in Appendix J and K. The concentrations of contaminants in *M. nasuta* and *N. caecoides* exposed to the Oakland Harbor sediment treatments were compared to the FDA action limits for contaminants in fish and shellfish. None of the FDA action limits were exceeded for any of the contaminants. The tissue concentrations in *M. nasuta* and *N. caecoides* exposed to the Oakland Harbor test treatments were statistically compared to the tissues that were exposed to the reference sediment R-BF by using the Dunnett's test.

The *M. nasuta* tissues exposed to the Oakland Harbor test treatments were statistically significantly different for one HPAH (pyrene), four pesticides (4,4'-DDD, 4,4'-DDT, dieldrin, and heptachlor), and one PCB (Aroclor-1254) (Tables L.5 through L.9). The ANOVA data for all comparisons conducted for the *M. nasuta* tissues is presented in Table L.10. Pyrene was statistically significantly different in the *M. nasuta* tissues exposed to COMP OC4-B at a magnitude of ≥ 2 times but < 5 times the concentrations found in the tissues exposed to the reference sediment R-BF. Four pesticides (4,4'-DDD, 4,4'-DDT, dieldrin, and heptachlor) were statistically significantly different in the *M. nasuta* tissues exposed to COMP OC4-B at a magnitude of < 2 times the concentrations found in the tissues exposed to the reference sediment R-BF. The PCB Aroclor-1254 was statistically significantly different in tissues exposed to COMP OC4-B and at a magnitude of ≥ 2 times but < 5 times the concentrations found in the tissues exposed to the reference sediment R-BF. There were no statistically significant differences in the concentrations of metals and butyltins in the test treatments relative to R-BF.

TABLE L.3. Comparison of Oakland Harbor Solid-Phase Acute Toxicity to the Bay Farm Borrow Area R-BF (bold type indicates mean survival statistically significantly lower than the reference based on Dunnett's test; shading indicates >10% difference between treatment and reference and for *M. nasuta* and *N. caecoides*, >20% difference for *R. abronius*)

<u>Sediment Treatment</u>	<u>Mean Percent Survival in 10-day Solid-Phase Test</u>		
	<u><i>R. abronius</i></u>	<u><i>M. nasuta</i></u>	<u><i>N. caecoides</i></u>
COMP IC1-A	91.0	99.0	94.0
COMP IC1-B	26.0	99.0	85.0
COMP IC1-B Special	76.0	97.0	81.0
COMP IC1-C	63.0	100.0	88.0
COMP OC4-B	98.0	99.0	91.0
Reference R-BF	89.0	99.0	85.0
<i>R. abronius</i> Control	95.0	NA(a)	NA
<i>M. nasuta</i> Control	NA	100.0	NA
<i>N. caecoides</i> Control	NA	NA	97.0

(a) NA Not applicable.

TABLE L.4. Suspended-Particulate-Phase Toxicity Test Results (bold type indicates mean survival in 100% SPP statistically significantly lower than control in t-test, $\alpha = 0.05$)

<u>Sediment Treatment</u>	<u>Sanddab <i>C. stigmaeus</i></u>			<u>Mysid <i>H. costata</i></u>			<u>Mussel Larvae <i>M. edulis</i></u>		
	<u>Mean Survival (%)</u>		<u>LC50 as % SPP</u>	<u>Mean Survival (%)</u>		<u>LC50 as % SPP</u>	<u>Mean Survival (%)</u>		<u>LC50 as % SPP</u>
	<u>0% SPP</u>	<u>100% SPP</u>		<u>0% SPP</u>	<u>100% SPP</u>		<u>0% SPP</u>	<u>100% SPP</u>	
COMP IC1-A	84.0	72.0	>100	96.0	96.0	>100	87.0	81.0	>100
COMP IC1-B	94.0	0.0	49.0	100.0	98.0	>100	79.0	65.0	>100
COMP IC1-B R	100.0	0.0(a)	NC(b)	NA(c)	NA	NA	NA	NA	NA
COMP IC1-B Special	92.0	18.0	76.4	100.0	98.0	>100	98.0	25.0	79.9
COMP IC1-B Special R	100.0	7.0(a)	NC	NA	NA	NA	NA	NA	NA
COMP IC1-C	90.0	56.0	>100	98.0	96.0	>100	79.0	80.0	>100
COMP IC1-C R	100.0	87.0	>100	NA	NA	NA	NA	NA	NA
COMP OC4-B	84.0	82.0	>100	100.0	98.0	>100	99.0	81.0	>100
R-BF	96.0	88.0	>100	96.0	92.0	>100	98.0	96.0	>100

(a) Statistical significance could not be determined due to no variance among replicates; the 100% SPP is observably different from the 0% SPP.

(b) NC Not calculable.

(c) NA Not applicable.

TABLE L.5. Mean Low Molecular Weight PAH Concentrations in the Tissues of *M. nasuta* that Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)			
	<u>Naphthalene</u>	<u>Fluorene</u>	<u>Phenanthrene</u>	<u>Anthracene</u>
R-BF	20.476	21.336	27.006	43.538
COMP IC1-A	---(a)	—	—	—
COMP IC1-B	—	—	—	—
COMP IC1-B Special	—	—	—	—
COMP IC1-C	—	—	—	—
COMP OC4-B	—	—	—	—

(a) — Mean value was not statistically significantly different from R-BF.

The *N. caecoides* tissues exposed to the Oakland Harbor test treatments were statistically significantly different for one HPAH (pyrene) and one metal (Ni) as shown in Tables L.11 through L.13. The ANOVA data for all comparisons conducted for the *N. caecoides* tissues are presented in Table L.14. *N. caecoides* tissues exposed to COMP OC4-B were statistically significantly different for pyrene and at a magnitude of <2 times the concentrations found in the reference treatment R-BF. Tissues exposed to all five Oakland Harbor test treatments were statistically significantly different for Ni at a magnitude of <2 times the concentrations found in the reference treatment R-BF. None of the concentrations of pesticides, PCBs, or butyltins in the test treatments were statistically significantly different from the reference treatment R-BF.

L.5 CONCLUSIONS

In this Appendix, comparisons of Oakland Harbor dredged material to the Bay Farm Borrow area reference are provided to evaluate the acceptability of this sediment for in-bay disposal. For each test treatment, sediment contaminant levels, contribution to acute toxicity, either as water column effect or deposited sediment effect, and potential for bioaccumulation are shown in Table L.15 and Figure L.2. The matrix table is a summary of sediment chemistry, acute toxicity, and bioaccumulation potential for the test treatments relative to the reference R-BF. For the bioaccumulation potential, the matrix shows the number of contaminants in *M. nasuta* and *N. caecoides* that were elevated above a range of magnitudes (two-, five-, ten-fold) and where similar classes of contaminants were accumulated by both species. This summary is intended to assist USACE, EPA, and other resource agencies in evaluating the potential effects of in-bay disposal of dredged material from Oakland Harbor.

TABLE L.6. Mean High Molecular Weight PAH Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)								
	Fluor- anthene	Benzo(a)- anthracene	Pyrene	Chrysene	Benzo(b)- fluor- anthene	Benzo(k)- fluor anthene	Benzo(a)- pyrene	Indeno- (1,2,3-c,d) pyrene	Benzo(g,h,i) perylene
R-BF	100.48	58.16 B(a)	81.45	33.89	103.78	59.74	40.13	44.30	51.93
COMP IC1-A	—(b)	—	—	—	—	—	—	—	—
COMP IC1-B	—	—	—	—	—	—	—	—	—
COMP IC1-B Special	—	—	—	—	—	—	—	—	—
COMP IC1-C	—	—	—	—	—	—	—	—	—
COMP OC4-B	—	—	167.94	—	—	—	—	—	—

(a) B Analyte detected in blank at >5 times the MDL.

(b) — Mean value was not statistically significantly different from R-BF.

TABLE L.7. Mean Pesticide and PCB Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)					
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Heptachlor	Aroclor-1254
R-BF	6.98	10.16	7.47	4.31	0.97 U(a)	74.23 UE(b)
COMP IC1-A	---(c)	—	—	—	—	—
COMP IC1-B	—	—	—	—	—	—
COMP IC1-B Special	—	—	—	—	—	—
COMP IC1-C	—	—	—	—	—	—
COMP OC4-B	13.67	—	13.45	6.77	1.34	208.42 E (d)

(a) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

(b) UE Value is mean of replicates that were undetected or estimated.

(c) — Mean value was not statistically significantly different from R-BF.

(d) E Value is an estimate; most similar Aroclor pattern is 1254.

TABLE L.8. Mean Metals Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in mg/kg dry weight)									
	<u>Ag</u>	<u>As</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Hg</u>	<u>Ni</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>
R-BF	0.284	27.1	0.351	3.23	14.2	0.135	6.01	2.246	2.21	93.7
COMP IC1-A	---(a)	—	—	—	—	—	—	—	—	—
COMP IC1-B	—	—	—	—	—	—	—	—	—	—
COMP IC1-B Special	—	—	—	—	—	—	—	—	—	—
COMP IC1-C	—	—	—	—	—	—	—	—	—	—
COMP OC4-B	—	—	—	—	—	—	—	—	—	—

(a) — Mean value was not statistically significantly different from R-BF.

TABLE L.9. Mean Butyltins Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	<u>(concentrations in $\mu\text{g/kg}$ dry weight)</u>	
	<u>Tributyltin</u>	<u>Dibutyltin</u>
R-BF	26.49	29.81 U(a)
COMP IC1-A	---(b)	---
COMP IC1-B	---	---
COMP IC1-B Special	---	---
COMP IC1-C	---	---
COMP OC4-B	---	---

(a) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

(b) --- Mean value was not statistically significantly different from R-BF.

TABLE L.10. ANOVA Results for Chemical Parameters in Tissues of *M. nasuta* Compared to the Bay Farm Borrow Area

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
PAHs						
Naphthalene	0.016	0.359	5	24	0.218	0.9513
Fluorene	0.001	0.391	1	8	0.027	0.8742
Phenanthrene	0.337	0.294	5	24	5.494	0.0016
Anthracene	0.375	0.354	3	16	5.644	0.0078
Fluoranthene	4.857	0.254	5	24	91.712	0.0001
Benzo(a)anthracene	0.355	0.137	5	24	12.392	0.0001
Pyrene	12.521	0.394	3	16	169.322	0.0001
Chrysene	7.375	0.736	4	20	50.112	0.0001
Benzo(b)fluoranthene	21.490	16.219	5	24	6.360	0.0007
Benzo(k)fluoranthene	0.139	0.070	3	16	10.547	0.0005
Benzo(a)pyrene	2.991	3.107	5	24	4.622	0.0043
Indeno(1,2,3-c,d)pyrene	0.184	0.971	2	12	1.137	0.3530
Benzo(g,h,i)perylene	0.186	0.052	1	8	28.422	0.0007
Chlorinated Pesticides						
4,4'-DDD	5.831	4.631	5	24	6.044	0.0009
4,4'-DDE	16.182	17.610	4	20	4.595	0.0086
4,4'-DDT	4.754	3.452	3	16	7.344	0.0026
Dieldrin	0.793	1.252	1	8	5.068	0.0545
Heptachlor	0.201	0.370	1	8	4.338	0.0708
Polychlorinated Biphenyls						
Aroclor-1254	4.583	4.109	1	8	8.923	0.0174
Metals						
Silver	0.325	4.560	5	24	0.342	0.8823
Arsenic	0.067	0.473	5	24	0.676	0.6456
Cadmium	0.821	3.465	5	24	1.137	0.3680
Chromium	0.136	1.655	5	24	0.395	0.8471
Copper	0.064	0.890	5	24	0.347	0.8789
Mercury	0.746	0.319	5	24	11.228	0.0001
Nickel	0.641	0.742	5	24	4.149	0.0074
Lead	2.216	0.880	5	24	12.092	0.0001
Selenium	0.284	1.212	5	24	1.125	0.3737
Zinc	0.135	0.457	5	24	1.423	0.2520
Organotins						
Tributyltin	3.803	1.276	5	24	14.306	0.0001
Dibutyltin	0.053	1.387	1	8	0.303	0.5971
Monobutyltin	2.489	4.865	5	24	2.456	0.0622

TABLE L.11. Mean High Molecular Weight PAH Concentrations in the Tissues of *N. caecoides* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)				
	<u>Fluor-anthene</u>	<u>Pyrene</u>	<u>Chrysene</u>	<u>Benzo(b) fluor-anthene</u>	<u>Benzo(k) fluor-anthene</u>
R-BF	11.90 UJ(a)	21.34	10.52 J(b)	28.19 UJ	17.04 UJ
COMP IC1-A	---(c)	---	---	---	---
COMP IC1-B	---	---	---	---	---
COMP IC1-B Special	---	---	---	---	---
COMP IC1-C	---	---	---	---	---
COMP OC4-B	---	35.29	---	---	---

(a) UJ Analyte was either undetected or detected below method detection limit in all replicates; value is mean of detected values and dry weight detection limits.

(b) J Analyte detected below method detection limits (MDL), but above instrument detection limit (IDL).

(c) --- Mean value was not statistically significantly different from R-BF.

TABLE L.12. Mean Pesticide and PCB Concentrations in the Tissues of *N. caecoides* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)			
	<u>4,4'-DDD</u>	<u>4,4'-DDE</u>	<u>4,4'-DDT</u>	<u>Aroclor-1254</u>
R-BF	4.32	6.68 UJ(a)	10.44 U(b)	117.12
COMP IC1-A	---(c)	---	---	---
COMP IC1-B	---	---	---	---
COMP IC1-B Special	---	---	---	---
COMP IC1-C	---	---	---	---
COMP OC4-B	---	---	---	---

(a) UJ Analyte was either undetected or detected below method detection limit in all replicates; value is mean of detected values and dry weight detection limits.

(b) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

(c) --- Mean value was not statistically significantly different from R-BF.

TABLE L.13. Mean Metals Concentrations in the Tissues of *N. caecoides* That Were Statistically Significantly Different from the Bay Farm Borrow Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-BF; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-BF mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in mg/kg dry weight)									
	<u>Ag</u>	<u>As</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Hg</u>	<u>Ni</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>
R-BF	0.097	32.2	0.98	0.545	12.1	0.094	1.74	1.014	1.31	179
COMP IC1-A	---(a)	—	—	—	—	—	3.47	—	—	—
COMP IC1-B	—	—	—	—	—	—	3.01	—	—	—
COMP IC1-B Special	—	—	—	—	—	—	3.14	—	—	—
COMP IC1-C	—	—	—	—	—	—	2.82	—	—	—
COMP OC4-B	—	—	—	—	—	—	2.92	—	—	—

(a) — Mean value was not statistically significantly different from R-BF.

TABLE L.14. ANOVA Results for Chemical Parameters in Tissues of *N. caecoides* Compared to the Bay Farm Borrow Area

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
PAHs						
Naphthalene	1.142	7.386	5	24	0.742	0.5994
Acenaphthene	0.009	14.363	1	8	0.005	0.9464
Fluorene	0.001	26.041	1	8	1.608 x 10 ⁻⁴	0.9902
Phenanthrene	0.536	1.744	5	24	1.476	0.2343
Anthracene	1.971	36.062	2	12	0.328	0.7267
Fluoranthene	9.920	13.842	5	24	3.440	0.0175
Pyrene	24.559	2.037	5	24	57.875	0.0001
Chrysene	20.455	9.114	5	24	10.772	0.0001
Benzo(b)fluoranthene	6.893	57.655	5	24	0.574	0.7193
Benzo(k)fluoranthene	6.331	52.118	5	24	0.583	0.7127
Chlorinated Pesticides						
Alpha-BHC	0.092	22.440	2	12	0.025	0.9757
Beta-BHC	0.071	2.985	1	8	0.190	0.6745
Gamma-BHC	0.514	8.069	1	8	0.510	0.4955
4,4'-DDD	5.086	2.219	5	24	11.002	0.0001
4,4'-DDE	0.105	1.492	1	8	0.561	0.4754
4,4'-DDT	2.264	16.220	3	16	0.744	0.5412
Dieldrin	4.638	25.193	4	20	0.921	0.4715
Polychlorinated Biphenyls						
Aroclor-1254	2.225	2.149	3	16	5.521	0.0085
Metals						
Silver	0.588	0.851	5	24	3.313	0.0205
Arsenic	0.320	0.287	5	24	5.350	0.0019
Cadmium	0.368	0.939	5	24	1.883	0.1348
Chromium	0.307	1.227	5	24	1.203	0.3378
Copper	0.153	0.562	5	24	1.304	0.2952
Mercury	0.625	0.378	5	24	7.936	0.0002
Nickel	2.582	2.347	5	24	5.281	0.0021
Lead	2.477	0.930	5	24	12.792	0.0001
Selenium	0.324	2.032	5	24	0.765	0.5840
Zinc	0.030	0.099	5	24	1.435	0.2477

TABLE L.15 Summary of Statistically Significant Acute Toxicity and Bioaccumulation for Oakland Harbor Sediment Treatments Relative to the Reference Sediment R-BF

Sediment Treatment	Acute Toxicity	<i>M. nasuta</i> Bioaccumulation					<i>N. caecoides</i> Bioaccumulation				
		PAH	pesticides	PCB	Metals	TBT	PAH	pesticides	PCB	Metals	TBT
COMP IC1-A	---(a)	---	---	---	---	---	---	---	---	Ni	---
COMP IC1-B	R(b),C(c)	---	---	---	---	---	---	---	---	Ni	---
COMP IC1-B R	---	NA(d)	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IC1-B Special	C, B(e)	---	---	---	---	---	---	---	---	Ni	---
COMP IC1-B Special R	---	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IC1-C	R,C	---	---	---	---	---	---	---	---	Ni	---
COMP IC1-C R	---	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP OC4-B	B	HPAH	DDD,DDT,Diel, Hep	1254	---	---	HPAH	---	---	Ni	---

(a) No statistically significant acute toxicity or bioaccumulation.

(b) R Acutely toxic to *R. abronius* in the 10-day solid-phase test.

(c) C Statistically significantly different to *C. stigmaeus* in the 96-h SPP test.

(d) NA Not Applicable

(e) B Statistically significantly different to *M. edulis* in the 72-h SPP test.

Sediment Treatments	Sediment Chemistry		Toxicity		Significant Bioaccumulation						Bioaccumulation $\geq 2 < 5$ times						Bioaccumulation $\geq 5 < 10$ times						Bioaccumulation ≥ 10 times								
	sediment LPAH > R-BF	sediment HPAH > R-BF	# of sediment Pesticide and PCB > R-BF	# of sediment Metals > R-BF	# of sediment Butyltins > R-BF	species associated with SPP toxicity	species with solid-phase acute toxicity	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds
COMP IC1-A				1								1																			
COMP IC1-B				3		C	R																								
COMP IC1-B Special				4		C,B																									
COMP IC1-C				1		R																									
COMP OC4-B				1				1	1	4	1	1	1																		

✓ Total LPAH or HPAH with detected values above the reference R-BF

C Calculable LC50 values in the *C. stigmaeus*

B Calculable LC50 values in the *M. edulis*

R Acute Toxicity in the *R. abronius* 10-day test

N Acute Toxicity in the *N. caecoides* 10-day test

☒ Number of Compounds Bioaccumulating in *M. nasuta* Tissues

☒ Number of Compounds Bioaccumulating in *N. caecoides* Tissues

FIGURE L.2. Matrix of Sediment Chemistry, Significant Acute Toxicity, and Bioaccumulation for Oakland Harbor Sediment Relative to the Deep Off-Shelf Reference R-BF

APPENDIX M

POTENTIAL EFFECTS OF DISPOSAL OF OAKLAND HARBOR INTENSIVE STUDY
SEDIMENTS AT THE ALCATRAZ ENVIRONS REFERENCE AREA

APPENDIX M

POTENTIAL EFFECTS OF DISPOSAL OF OAKLAND HARBOR INTENSIVE STUDY SEDIMENTS AT THE ALCATRAZ ENVIRONS REFERENCE AREA

This appendix presents the results of statistical comparisons and a Tier III evaluation of Oakland Harbor Intensive Study sediments relative to the Alcatraz Environs reference area (R-AM) (Figure M.1). This section provides the necessary data to determine suitability of Oakland Harbor sediments for in-bay disposal at R-AM. All methods and results for sampling, physical descriptions, sediment chemistry, biological testing, and tissue chemistry are contained in Sections 2 and 3 of this report; supporting data are contained in Appendixes A through K. This appendix examines the results of the physical/chemical sediment analysis, acute toxicity, and tissue chemistry of the Oakland Harbor test treatments relative to R-AM. As stated in Section 2.5 of this report, the use of Dunnett's test for statistical comparisons of non-independent data sets increases the chance of Type II statistical errors in all comparisons, resulting in the identification of a greater number of significant differences.

M.1 SEDIMENT CHARACTERISTICS

The Alcatraz Environs reference sediment (R-AM) consists almost entirely of sand. Fifteen of the 31 Oakland Harbor test treatments were generally composed of coarse grain size (>50% sand and gravel), similar to R-AM (Table M.1). The concentrations of TOC, TVS, oil and grease, TPH, pesticides, PCBs, metals (except As and Pb), and butyltins in the reference sediment R-AM were generally either undetected above the method detection limit or among the lowest of all the Oakland Harbor test treatments measured. The concentrations of PAHs in the reference sediment R-AM was the second highest behind the test treatment IC1-C-1 Top 6" (total LPAH in R-AM was 1372 µg/kg dry weight; total HPAH in R-AM was 3757 µg/kg dry weight) (Table M.2).

M.2 DEPOSITED SEDIMENT TOXICITY

The solid-phase tests with Oakland Harbor sediments showed no acute toxicity to *N. caecoides* or *M. nasuta* when compared to the Alcatraz Environs reference (R-AM). The *R. abronius* 10-day test showed statistically significant differences and a >20% difference in survival in the test treatments COMP IC1-B, COMP IC1-B Special, and COMP IC1-C when compared to the reference R-AM (Table M.3).

FIGURE M.1. Location of Alcatraz Environs Reference Area (R-AM)

TABLE M.1. Conventional Sediment Measurement Results for the Oakland Harbor Intensive Study Sediment Treatments
(Grain Size, TOC, and TVS in percent dry weight; Oil and Grease and TPH in mg/kg dry weight)

Sediment Treatment	Gravel >2000µm	Sand 62.5- 2000 µm	Silt 3.9- 62.5 µm	Clay <3.9 µm	TOC (percent)	TVS (percent)	Oil and Grease (mg/kg)	TPH (mg/kg)
COMP IC1-A	0	88	5	7	0.03	0.77	12 U ^(b)	12 U.
IC1-A Special Chemistry ^(a)	2	91	4	3	0.05	0.84	12 U	12 U
IC1-A-1	0	91	4	5	0.05	0.78	23	12 U
IC1-A-2	0	92	3	5	0.10	0.63	12 U	12 U
IC1-A-3	0	94	2	4	0.03	0.54	12 U	12 U
IC1-A-4	0	93	4	3	0.06	0.34	12 U	12 U
IC1-A-5	0	87	6	7	0.20	0.61	99	58
IC1-A-6	0	93	3	4	0.05	0.53	12 U	12 U
COMP IC1-B	0	2	51	47	0.67	3.30	18 U ^(c)	18 U ^(c)
COMP IC1-B Special	14 ^(c)	23 ^(c)	29 ^(c)	34 ^(c)	0.73	1.51	170	17 U
IC1-B-1	1	8	50	41	0.65	2.55	92	36
IC1-B-2	14	11	35	40	0.66	2.07	18 U	18 U
IC1-B-3	9	30	28	33	0.58	2.07	61	17
IC1-B-4 ^(d)	13	10	28	49	0.70	1.88	18 U	18 U
IC1-B-5	22	9	35	34	0.67	2.19	20	17 U
COMP IC1-C	0	39	31	30	0.51	2.18	16 U	16 U
IC1-C-1 Top 6 in.	0	23	42	35	0.63	2.09	52	17 U
IC1-C-1	0	3	51	46	0.67	1.90	19	17 U
IC1-C-2	0	1	51	48	0.68	1.70	22	17 U
IC1-C-3	0	93	3	4	0.06	0.35	12 U	12 U
IC1-C-4	0	21	35	44	0.94	2.54	180	76
COMP OC4-B	0	76	10	14	0.22	1.25	94	32
OC4-B-1	0	85	8	7	0.06	0.93	12 U	12 U
OC4-B-2	0	93	3	4	0.06 ^(c)	0.47 ^(c)	12 U ^(c)	12 U ^(c)
OC4-B-3 Special Chemistry	0	23	39	38	0.82	3.42	83	59
OC4-B-3 (-38.6 to -40.1 ft MLLW)	0	21	39	40	0.95	1.95	92	55
OC4-B-3 (-40.1 to -43.7 ft MLLW)	0	96	2	2	0.04	0.34	12 U	12 U
OC4-B-4	0	28	31	41	1.04	2.41	660	600
OC4-B-5 (-39.6 to -44.0 ft MLLW)	0	70	13	17	0.33	1.12	28	32
OC4-B-5 (-39.6 to -42.2 ft MLLW)	0	23	35	42	0.93	2.74	140	69
OC4-B-5 (-42.2 to -44.0 ft MLLW)	0	97	1	2	0.02	0.27	12 U	12 U

TABLE M.1. (contd)

Sediment Treatment	Gravel >2000µm	Sand 62.5- 2000 µm	Silt 3.9- 62.5 µm	Clay ≤3.9 µm	TOC (percent)	TVS (percent)	Oil and Grease (mg/kg)	TPH (mg/kg)
R-AM	3	94	1	2	0.78	0.24	41	12 U

- (a) Special Chemistry sample determined in the field due to a particular sediment characteristic.
(b) U Undetected above given concentration.
(c) Mean of replicate measurements.
(d) All of the sediment from this station is represented only in COMP IC1-B Special.

TABLE M.2. Organics and Metals Concentrations in Oakland Harbor Intensive Study Sediment Treatments (shading indicates values greater than the Alcatraz Environs (R-AM) reference sediment; organics in µg/kg dry weight; metals in mg/kg dry weight)

Sediment Treatment	LPAH	HPAH	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	TBT	DBT
COMP IC1-A	8	7	0.039	3.91	0.1 U(a)	231	10.4	0.026	35.0	7.4	0.12 U	29.1	0.7 U	1.2 U
IC1-A Special Chemistry(b)	9	35	0.039	3.56	0.1 U	212	32.3	0.033	46.9	6.3	0.12 U	33.8	4.8	1.2 U
IC1-A-1	6	36	0.033	3.77	0.1 U	339	10.2	0.018	62.2	6.4	0.13	36.2	0.7 U	1.2 U
IC1-A-2	7	14	0.049	4.25	0.1 U	482	14.2	0.025	39.1	6.0	0.12 U	36.2	0.7 U	1.2 U
IC1-A-3	7	14	0.030	3.11	0.1 U	310	8.8	0.018	31.8	7.7	0.14	26.2	0.7 U	1.2 U
IC1-A-4	19	33	0.026	2.13	0.1 U	249	11.6	0.018	32.9	8.8	0.12 U	24.5	1.4	1.2 U
IC1-A-5	62	348	0.118	5.07	0.119	525	14.9	0.096	44.3	10.1	0.12 U	43.7	0.7 U	1.2 U
IC1-A-6	6	13	0.034	3.78	0.1 U	420	10.4	0.024	31.1	6.6	0.12 U	27.9	0.7 U	1.2 U
COMP IC1-B	31	84	0.117	11.1	0.161	190	50.9	0.081	114	11.1	0.34	107	0.7 U	1.2 U
COMP IC1-B Special	286	1430	0.197	10.6	0.272	191	37.7	0.398	86.8	13.8	0.34	92.2	3.9	1.2 U
IC1-B-1	94	628	0.246	10.7	0.319	187	48.0	0.200	105	19.1	0.20	107	0.7 U	1.2 U
IC1-B-2	138	133	0.090	10.0	0.210	161	44.6	0.073	104	8.4	0.34	92.0	1.8	1.2 U
IC1-B-3	836	3120	0.082	10.0	0.182	216	38.1	0.091	83.2	11.0	0.20	81.6	0.7 U	1.2 U
IC1-B-4(c)	111	60	0.104	10.4	0.238	157	47.4	0.074	110	10.2	0.35	99.4	0.7 U	1.2 U
IC1-B-5	57	46	0.099	10.2	0.240	167	49.0	0.067	108	8.7	0.21	95.9	0.7 U	1.2 U
COMP IC1-C	76	477	0.127	10.2	0.153	299	31.7	0.090	81.6	10.9	0.21	83.1	1.2	1.2 U
IC1-C-1 Top 6"	7260	16,000	0.142	11.0	0.171	224	39.9	0.099	95.4	11.0	0.20	93.9	1.1	1.2 U
IC1-C-1	197	348	0.128	11.8	0.202	186	47.6	0.072	105	10.3	0.34	102	0.7 U	1.2 U
IC1-C-2	55	42	0.099	12.6	0.213	190	46.9	0.076	117	11.4	0.21	103	0.7 U	1.2 U
IC1-C-3	44	31	0.037	3.89	0.1 U	331	9.9	0.018	29.3	5.6	0.12 U	25.3	0.7 U	1.2 U
IC1-C-4	312	1480	0.366	13.2	0.266	233	51.5	0.294	100	30.7	0.21	131	3.9	2.0
COMP OC4-B	73	413	0.129	4.43	0.11	433	21.0	0.091	76.1	12.5	0.13	63.5	1.5	1.2 U
OC4-B-1	40	32	0.052	2.65	0.1 U	410	11.5	0.029	70.6	3.8	0.12 U	41.8	0.7 U	1.2 U
OC4-B-2(d)	37	45	0.027	3.25	0.1 U	297	10.9	0.020	53.6	5.2	0.12 U	33.3	0.7 U	1.2 U
OC4-B-3 Special Chemistry	237	1600	0.306	11.6	0.137	287	45.3	0.296	98.8	26.1	0.27	119	4.0	2.1
OC4-B-3 (-38.6 to -40.1 ft MLLW)	274	1530	0.325	10.4	0.169	213	46.6	0.303	92.9	28.4	0.21	120	4.0	2.2
OC4-B-3 (-40.1 to -43.7 ft MLLW)	70	39	0.023	1.43	0.1 U	427	9.0	0.031	58.7	7.0	0.12 U	35.6	0.7 U	1.2 U
OC4-B-4	404	1610	0.603	10.9	0.554	257	54.7	0.480	96.3	44.7	0.27	140	0.8	1.2 U
OC4-B-5 (-39.6 to -44.0 ft MLLW)	242	1020	0.150	8.35	0.121	473	25.3	0.128	76.3	13.6	0.12 U	77.7	4.9	1.4
OC4-B-5 (-39.6 to -42.2 ft MLLW)	237	1310	0.364	12.5	0.19	224	48.4	0.330	92.3	29.2	0.27	128	5.5	2.5
OC4-B-5 (-42.2 to -44.0 ft MLLW)	43	16	0.023	3.21	0.1 U	627	11.5	0.016 U	57.2	6.3	0.12 U	42.3	0.7 U	1.2 U

TABLE M.2. (contd)

Sediment Treatment	LPAH	HPAH	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	TBT	DBT
R-AM ^(d)	1372	3757	0.042	9.1	0.1 U	190	11.5	0.036	42.3	15.2	0.12 U	36.8	0.8	1.2 U

(a) U Undetected above given concentration.

(b) Special Chemistry sample determined in the field due to a particular sediment characteristic.

(c) All of the sediment from this station is represented only in COMP IC1-B Special.

(d) Mean of replicate measurements.

TABLE M.3. Comparison of Oakland Harbor Solid-Phase Acute Toxicity to the Alcatraz Environs Reference Area R-AM (bold type indicates mean survival statistically significantly lower than the reference based on Dunnett's test; shading indicates >10% difference between treatment and reference and for *M. nasuta* and *N. caecoides*, >20% difference for *R. abronius*)

<u>Sediment Treatment</u>	<u>Mean Percent Survival in 10-day Solid-Phase Test</u>		
	<u><i>R. abronius</i></u>	<u><i>M. nasuta</i></u>	<u><i>N. caecoides</i></u>
COMP IC1-A	91.0	99.0	94.0
COMP IC1-B	26.0	99.0	85.0
COMP IC1-B Special	76.0	97.0	81.0
COMP IC1-C	63.0	100.0	88.0
COMP OC4-B	98.0	99.0	91.0
Reference R-AM	96.0	96.0	92.0
<i>R. abronius</i> Control	95.0	NA(a)	NA
<i>M. nasuta</i> Control	NA	100.0	NA
<i>N. caecoides</i> Control	NA	NA	97.0

(a) NA Not applicable.

M.3 WATER COLUMN EFFECTS

The evaluation of water column effects does not change with comparisons to different references because the reference sediment itself is not tested for water column toxicity. There was no acute toxicity to *H. costata*. T-test results showed three test treatments were acutely toxic to *C. stigmaeus* (COMP IC1-B, COMP IC1-B Special, and COMP IC1-C). Test treatments COMP IC1-B R and COMP IC1-B Special R could not be statistically analyzed due to no variance. However, these treatments are observably different from the 0% SPP (Control R). LC50s could be calculated for two treatments (49% SPP for COMP IC1-B and 76% SPP for COMP IC1-B Special (Table M.4). A t-test analysis of the survival of *M. edulis* larvae exposed to the 100% SPP of COMP IC1-B Special and COMP OC4-B showed statistically significant differences when compared to the 0% control. The LC50 for *M. edulis* exposed to COMP IC1-B Special was 79.9%. A t-test analysis of the normal development of *M. edulis* larvae when exposed to the 100% SPP of COMP IC1-B, COMP IC1-B Special, COMP IC1-C, and COMP OC4-B showed statistically significant differences when compared to the 0% control. The 100% SPP of COMP IC1-B, COMP IC1-B Special, and COMP IC1-C resulted in a calculable EC50 value to *M. edulis* larvae of 21.4%, 71.1%, and 87.1%, respectively.

TABLE M.4. Suspended-Particulate-Phase Toxicity Test Results (bold type indicates mean survival in 100% SPP statistically significantly lower than control in t-test, $\alpha = 0.05$)

Sediment Treatment	<u>Sanddab <i>C. stigmaeus</i></u>			<u>Mysid <i>H. costata</i></u>			<u>Mussel Larvae <i>M. edulis</i></u>		
	<u>Mean Survival (%)</u>		LC50 as % SPP	<u>Mean Survival (%)</u>		LC50 as % SPP	<u>Mean Survival (%)</u>		LC50 as % SPP
	0% SPP	100% SPP		0% SPP	100% SPP		0% SPP	100% SPP	
COMP IC1-A	84.0	72.0	>100	96.0	96.0	>100	87.0	81.0	>100
COMP IC1-B	94.0	0.0	49.0	100.0	98.0	>100	79.0	65.0	>100
COMP IC1-B R	100.0	0.0(a)	NC(b)	NA(c)	NA	NA	NA	NA	NA
COMP IC1-B Special	92.0	18.0	76.4	100.0	98.0	>100	98.0	25.0	79.9
COMP IC1-B Special R	100.0	7.0(a)	NC	NA	NA	NA	NA	NA	NA
COMP IC1-C	90.0	56.0	>100	98.0	96.0	>100	79.0	80.0	>100
COMP IC1-C R	100.0	87.0	>100	NA	NA	NA	NA	NA	NA
COMP OC4-B	84.0	82.0	>100	100.0	98.0	>100	99.0	81.0	>100
R-AM	96.0	82.0	>100	98.0	98.0	>100	96.0	93.0	>100

(a) Statistical significance could not be determined due to no variance among replicates; the 100% SPP is observably different from the 0% SPP.

(b) NC Not calculable.

(c) NA Not applicable.

M.4 DEPOSITED SEDIMENT BIOACCUMULATION

Complete tissue chemistry results, quality control data, and quality assurance/quality control summaries are presented in Appendix J and K. The concentrations of contaminants in *M. nasuta* and *N. caecoides* exposed to the Oakland Harbor sediment treatments were compared to the FDA action limits for contaminants in fish and shellfish. None of the FDA action limits was exceeded for any of the contaminants. The tissue concentrations in *M. nasuta* and *N. caecoides* exposed to the Oakland Harbor test treatments were statistically compared to the tissues that were exposed to the reference sediment R-AM by using the Dunnett's test.

The *M. nasuta* tissues exposed to the Oakland Harbor test treatments were statistically significantly different for four pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin), one PCB (Aroclor-1254), three metals (Cd, Cr, and Ni), and tributyltin as shown in Tables M.5 through M.9. The ANOVA data for all comparisons conducted for the *M. nasuta* tissues are presented in Table M.10. Three of the four pesticides were statistically significantly different in the *M. nasuta* tissues exposed to COMP OC4-B at a magnitude of ≥ 2 times but < 5 times the concentrations found in the tissues exposed to the reference treatment R-AM. The PCB Aroclor-1254 was statistically significantly different in tissues exposed to COMP OC4-B and at a magnitude of ≥ 2 times but < 5 times the concentrations found in the tissues exposed to the reference treatment R-AM. Concentrations of Cd in *M. nasuta* tissues exposed to COMP IC1-B Special were statistically significantly different and at a magnitude of < 2 times the reference treatment R-AM. Tissues exposed to all five Oakland Harbor test treatments were statistically significantly different for Cr at

TABLE M.5. Mean Low Molecular Weight PAH Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)			
	<u>Naphthalene</u>	<u>Fluorene</u>	<u>Phenanthrene</u>	<u>Anthracene</u>
R-AM	22.30	28.410	65.942	66.286
COMP IC1-A	---(a)	—	—	—
COMP IC1-B	—	—	—	—
COMP IC1-B Special	—	—	—	—
COMP IC1-C	—	—	—	—
COMP OC4-B	—	—	—	—

(a) — Mean value was not statistically significantly different from R-AM.

magnitudes of ≥ 2 times but <5 times the reference treatment R-AM. *M. nasuta* tissues exposed to COMP IC1-B was statistically significantly different for Ni at a magnitude of ≥ 2 times but <5 times the tissues exposed to the reference sediment R-AM. Tributyltin was statistically significantly different in tissues exposed to COMP OC4-B and at a magnitude of <2 times the concentrations found in the tissues exposed to the reference treatment R-AM. None of the concentrations of PAHs in the test treatments were statistically significantly different from the reference treatment R-AM.

The *N. caecoides* tissues exposed to the Oakland Harbor test treatments were statistically significantly different for the pesticide 4,4'-DDE, PCB Aroclor-1254, and the metals As and Pb as shown in Tables M.11 through M.13. The ANOVA data for all comparisons conducted for the *N. caecoides* tissues are presented in Table M.14. *N. caecoides* tissues exposed to COMP OC4-B was statistically significantly different for 4,4'-DDE and Aroclor-1254 and at a magnitude of ≥ 2 times but <5 times the concentrations found in the reference treatment R-AM. Tissues exposed to all five Oakland Harbor test treatments were statistically significantly different for As at a magnitude of <2 times the concentrations found in the reference treatment R-AM. Tissues exposed to three of the five Oakland Harbor test treatments (COMP IC1-B Special, COMP IC1-C, and COMP OC4-B) were statistically significantly different for Pb at a magnitude of <2 times the concentrations found in the reference treatment R-AM. None of the concentrations of PAHs or butyltins in the test treatments was statistically significantly different from the reference treatment R-AM.

TABLE M.6. Mean High Molecular Weight PAH Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)								
	Fluor- anthene	Benzo(a)- anthracene	Pyrene	Chrysene	Benzo(b)- fluor- anthene	Benzo(k)- fluor anthene	Benzo(a)- pyrene	Indeno- (1,2,3-c,d) pyrene	Benzo(g,h,i) perylene
R-AM	261.12	117.89 B ^(a)	393.58	145.20	155.67	78.71	112.38	56.26	58.19
COMP IC1-A	---(b)	—	—	—	—	—	—	—	—
COMP IC1-B	—	—	—	—	—	—	—	—	—
COMP IC1-B Special	—	—	—	—	—	—	—	—	—
COMP IC1-C	—	—	—	—	—	—	—	—	—
COMP OC4-B	—	—	—	—	—	—	—	—	—

(a) B Analyte detected in blank at >5 times the MDL.

(b) — Mean value was not statistically significantly different from R-AM.

TABLE M.7. Mean Pesticide and PCB Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)					
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Heptachlor	Aroclor-1254
R-AM	6.14	6.24	7.78	2.95	1.17	48.39 UE(a)
COMP IC1-A	---(b)	—	—	—	—	—
COMP IC1-B	—	—	—	—	—	—
COMP IC1-B Special	—	—	—	—	—	—
COMP IC1-C	—	—	—	—	—	—
COMP OC4-B	13.67	16.80	13.45	6.77	—	208.42 E (c)

(a) UE Value is mean of replicates that were undetected or estimated.

(b) — Mean value was not statistically significantly different from R-AM.

(c) E Value is an estimate; most similar Aroclor pattern is 1254.

M.5 CONCLUSIONS

In this Appendix, comparisons of Oakland Harbor dredged material to the Alcatraz Environs reference area are provided to evaluate the acceptability of this sediment for in-bay disposal. For each test treatment, sediment contaminant levels, contribution to acute toxicity, either as water column effect or deposited sediment effect, and potential for bioaccumulation are shown in Table M.15 and Figure M.2. The matrix table is a summary of sediment chemistry, acute toxicity, and bioaccumulation potential for the test treatments relative to the reference R-AM. For the bioaccumulation potential, the matrix shows the number of contaminants in *M. nasuta* and *N. caecoides* that were elevated above a range of magnitudes (two-, five-, ten-fold) and where similar classes of contaminants were accumulated by both species. This summary is intended to assist USACE, EPA, and other resource agencies in evaluating the potential effects of in-bay disposal of dredged material from Oakland Harbor.

TABLE M.8. Mean Metals Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in mg/kg dry weight)									
	<u>Ag</u>	<u>As</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Hg</u>	<u>Ni</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>
R-AM	0.205	27.1	0.256	1.25	11.6	0.109	3.37	1.252	1.78	109.8
COMP IC1-A	---(a)	—	—	2.95	—	—	5.10	—	—	—
COMP IC1-B	—	—	—	2.68	—	—	7.06	—	—	—
COMP IC1-B Special	—	—	0.462	2.78	—	—	6.25	—	—	—
COMP IC1-C	—	—	—	2.61	—	—	4.91	—	—	—
COMP OC4-B	—	—	—	3.01	—	—	4.66	—	—	—

(a) — Mean value was not statistically significantly different from R-AM.

TABLE M.9. Mean Butyltins Concentrations in the Tissues of *M. nasuta* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	<u>(concentrations in $\mu\text{g/kg}$ dry weight)</u>	
	<u>Tributyltin</u>	<u>Dibutyltin</u>
R-AM	21.14	31.80 U(a)
COMP IC1-A	---(b)	---
COMP IC1-B	---	---
COMP IC1-B Special	---	---
COMP IC1-C	---	---
COMP OC4-B	27.14	---

(a) U Analyte was undetected in all replicates; value is mean of dry weight detection limits.

(b) — Mean value was not statistically significantly different from R-AM.

TABLE M.10: ANOVA Results for Chemical Parameters in Tissues of *M. nasuta* Compared to the Alcatraz Environs Reference Area

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
PAHs						
Naphthalene	0.023	0.484	5	24	0.224	0.9487
Fluorene	0.120	0.829	1	8	1.158	0.3133
Phenanthrene	3.619	2.202	5	24	7.887	0.0002
Anthracene	1.358	0.859	3	16	8.439	0.0014
Fluoranthene	12.482	2.326	5	24	25.735	0.0001
Benzo(a)anthracene	2.704	1.253	5	24	10.356	0.0001
Pyrene	25.075	2.174	3	16	61.514	0.0001
Chrysene	22.331	3.734	4	20	29.901	0.0001
Benzo(b)fluoranthene	24.819	16.787	5	24	7.097	0.0003
Benzo(k)fluoranthene	0.523	0.347	3	16	8.041	0.0017
Benzo(a)pyrene	9.161	4.792	5	24	9.176	0.0001
Indeno(1,2,3-c,d)pyrene	0.621	1.347	2	12	2.765	0.1029
Benzo(g,h,i)perylene	0.280	0.597	1	8	3.749	0.0888
Chlorinated Pesticides						
4,4'-DDD	5.808	4.170	5	24	6.687	0.0005
4,4'-DDE	15.480	18.347	4	20	4.219	0.0123
4,4'-DDT	4.846	2.421	3	16	10.677	0.0004
Dieldrin	2.099	0.769	1	8	21.832	0.0016
Heptachlor	0.038	0.576	1	8	0.534	0.4856
Polychlorinated Biphenyls						
Aroclor-1254	9.389	3.691	1	8	20.351	0.0020
Metals						
Silver	0.502	3.503	5	24	0.688	0.6375
Arsenic	0.067	0.468	5	24	0.691	0.6354
Cadmium	1.033	2.329	5	24	2.130	0.0965
Chromium	2.574	1.408	5	24	8.773	0.0001
Copper	0.123	0.788	5	24	0.747	0.5963
Mercury	0.200	0.284	5	24	3.386	0.0187
Nickel	1.622	0.678	5	24	11.488	0.0001
Lead	0.514	0.771	5	24	3.199	0.0236
Selenium	0.083	1.093	5	24	0.363	0.8689
Zinc	0.229	0.619	5	24	1.778	0.1556
Organotins						
Tributyltin	3.398	1.295	5	24	12.592	0.0001
Dibutyltin	0.110	1.388	1	8	0.632	0.4494
Monobutyltin	2.471	4.876	5	24	2.432	0.0642

TABLE M.11. Mean High Molecular Weight PAH Concentrations in the Tissues of *N. caecoides* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)				
	<u>Fluor-anthene</u>	<u>Pyrene</u>	<u>Chrysene</u>	<u>Benzo(b) fluor-anthene</u>	<u>Benzo(k) fluor-anthene</u>
R-AM	23.67	103.41	25.31	22.03 UJ(a)	13.77 UJ
COMP IC1-A	---(b)	—	—	—	—
COMP IC1-B	—	—	—	—	—
COMP IC1-B Special	—	—	—	—	—
COMP IC1-C	—	—	—	—	—
COMP OC4-B	—	—	—	—	—

(a) UJ Analyte was either undetected or detected below method detection limit in all replicates; value is mean of detected values and dry weight detection limits.

(b) — Mean value was not statistically significantly different from R-AM.

TABLE M.12. Mean Pesticide and PCB Concentrations in the Tissues of *N. caecoides* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

<u>Sediment Treatment</u>	(concentrations in $\mu\text{g/kg}$ dry weight)			
	<u>4,4'-DDD</u>	<u>4,4'-DDE</u>	<u>4,4'-DDT</u>	<u>Aroclor-1254</u>
R-AM	4.54	2.43 J(a)	3.43 UJ(b)	78.39
COMP IC1-A	---(c)	—	—	—
COMP IC1-B	—	—	—	—
COMP IC1-B Special	—	—	—	—
COMP IC1-C	—	—	—	—
COMP OC4-B	—	6.87	—	171.40

(a) J Analyte detected below method detection limits (MDL), but above instrument detection limit (IDL).

(b) UJ Analyte was either undetected or detected below method detection limit in all replicates; value is mean of detected values and dry weight detection limits.

(c) — Mean value was not statistically significantly different from R-AM.

TABLE M.13. Mean Metals Concentrations in the Tissues of *N. caecoides* That Were Statistically Significantly Different from the Alcatraz Environs Reference Area, Oakland Harbor Intensive Study (where appropriate, plain type indicates statistical significance above R-AM; bold type indicates $\geq$ two < fivefold magnification of treatment mean compared to R-AM mean; shading indicates $\geq$ five < tenfold magnification; shaded double-lined box indicates $\geq$ tenfold magnification)

Sediment Treatment	(concentrations in mg/kg dry weight)									
	<u>Ag</u>	<u>As</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Hg</u>	<u>Ni</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>
R-AM	0.125	19.7	0.77	0.458	11.8	0.112	2.93	0.455	1.44	183
COMP IC1-A	---(a)	23.4	—	—	—	—	—	—	—	—
COMP IC1-B	—	26.2	—	—	—	—	—	—	—	—
COMP IC1-B Special	—	25.0	—	—	—	—	—	0.746	—	—
COMP IC1-C	—	28.8	—	—	—	—	—	0.652	—	—
COMP OC4-B	—	25.4	—	—	—	—	—	0.627	—	—

(a) — Mean value was not statistically significantly different from R-AM.

TABLE M.14. ANOVA Results for Chemical Parameters in Tissues of *N. caecoides* Compared to the Alcatraz Environs Reference Area

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
PAHs						
Naphthalene	1.601	6.290	5	24	1.222	0.3295
Acenaphthene	0.052	11.034	1	8	0.038	0.8508
Fluorene	0.009	20.871	1	8	0.003	0.9548
Phenanthrene	7.694	1.820	5	24	20.295	0.0001
Anthracene	1.959	29.646	2	12	0.397	0.6811
Fluoranthene	20.157	13.300	5	24	7.274	0.0003
Pyrene	46.728	2.717	5	24	82.548	0.0001
Chrysene	34.736	9.079	5	24	18.365	0.0001
Benzo(b)fluoranthene	5.763	62.135	5	24	0.445	0.8125
Benzo(k)fluoranthene	0.844	62.690	5	24	0.065	0.9968
Chlorinated Pesticides						
Alpha-BHC	0.800	20.956	2	12	0.229	0.7986
Beta-BHC	0.207	1.745	1	8	0.948	0.3587
Gamma-BHC	0.048	1.802	1	8	0.212	0.6577
4,4'-DDD	5.073	2.699	5	24	9.023	0.0001
4,4'-DDE	2.805	0.280	1	8	80.116	0.0001
4,4'-DDT	0.163	14.892	3	16	0.058	0.9808
Dieldrin	3.004	24.661	4	20	0.609	0.6608
Polychlorinated Biphenyls						
Aroclor-1254	2.646	2.098	3	16	6.727	0.0038
Metals						
Silver	1.413	0.773	5	24	8.773	0.0001
Arsenic	0.394	0.262	5	24	7.215	0.0003
Cadmium	0.351	1.023	5	24	1.647	0.1859
Chromium	0.360	1.132	5	24	1.525	0.2194
Copper	0.155	0.534	5	24	1.394	0.2618
Mercury	0.745	1.437	5	24	2.491	0.0594
Nickel	0.126	0.406	5	24	1.488	0.2307
Lead	1.472	1.051	5	24	6.725	0.0005
Selenium	0.292	2.148	5	24	0.652	0.6628
Zinc	0.037	0.101	5	24	1.730	0.1661

TABLE M.15 Summary of Statistically Significant Acute Toxicity and Bioaccumulation for Oakland Harbor Sediment Treatments Relative to the Reference Sediment R-AM

Sediment Treatment	Acute Toxicity	<i>M. nasuta</i> Bioaccumulation					<i>N. caecoides</i> Bioaccumulation				
		PAH	pesticides	PCB	Metals	TBT	PAH	pesticides	PCB	Metals	TBT
COMP IC1-A	---(a)	---	---	---	Cr, Ni	---	---	---	---	As	---
COMP IC1-B	R ^(b) , C ^(c)	---	---	---	Cr, Ni	---	---	---	---	As	---
COMP IC1-B R	---	NA ^(d)	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IC1-B Special	R, C, B ^(e)	---	---	---	Cd, Cr, Ni	---	---	---	---	As, Pb	---
COMP IC1-B Special R	---	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IC1-C	R, C	---	---	---	Cr, Ni	---	---	---	---	As, Pb	---
COMP IC1-C R	---	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP OC4-B	B	---	DDD, DDE, DDT, Dield	1254	Cr, Ni	TBT	---	DDE	1254	As, Pb	---

(a) No statistically significant acute toxicity or bioaccumulation.

(b) R Acutely toxic to *R. abronius* in the 10-day solid-phase test.

(c) C Statistically significantly different to *C. stigmaeus* in the 96-h SPP test.

(d) NA Not Applicable.

(e) B Statistically significantly different to *M. edulis* in the 72-h SPP test.

Sediment Chemistry	Toxicity		Significant Bioaccumulation						Bioaccumulation $\geq 2 < 5$ times						Bioaccumulation $\geq 5 < 10$ times						Bioaccumulation ≥ 10 times										
	sediment LPAH > R-AM	sediment HPAH > R-AM	# of sediment Pesticide and PCB > R-AM	# of sediment Metals > R-AM	# of sediment Butyltins > R-AM	species associated with SPP toxicity	species with solid-phase acute toxicity	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds	# of LPAH compounds	# of HPAH compounds	# of Pesticide compounds	# of PCB compounds	# of Metals compounds	# of Butyltin compounds
sediment LPAH > R-AM																															
sediment HPAH > R-AM																															
# of sediment Pesticide and PCB > R-AM																															
# of sediment Metals > R-AM																															
# of sediment Butyltins > R-AM																															
COMP IC1-A			1																												
COMP IC1-B			1	8		C	R																								
COMP IC1-B Special			3	9	1	C, B	R																								
COMP IC1-C			2	9	1		R																								
COMP OC4-B			3	8	1																										

✓ Total LPAH or HPAH with detected values above the reference R-AM

C Calculable LC50 values in the *C. stigmatæus*

B Calculable LC50 values in the *M. edulis*

R Acute Toxicity in the *R. abronius* 10-day test

N Acute Toxicity in the *N. caecoides* 10-day test

☒ Number of Compounds Bioaccumulating in *M. nasuta* Tissues

☒ Number of Compounds Bioaccumulating in *N. caecoides* Tissues

FIGURE M.2. Matrix of Sediment Chemistry, Significant Acute Toxicity, and Bioaccumulation for Oakland Harbor Sediment Relative to the Deep Off-Shelf Reference R-AM

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