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Ecological Evaluation of Proposed Dredged Material from Richmond Harbor

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**Battelle/Marine Sciences Laboratory
Sequim, Washington**

October 1992

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SUMMARY

Navigational channels in Richmond Harbor, California, are no longer wide or deep enough to accommodate large, deep draft vessels. Because this is a major West Coast port, dredging is proposed in four areas to deepen the channel to -38 ft MLLW and to provide a turning area between Potrero Reach and the Inner Harbor Channel. The Water Resources Development Act of 1989 (Public Law 99-662) authorized the U.S. Army Corps of Engineers (USACE), San Francisco District, to deepen and widen the navigational channels associated with Richmond Harbor. During the summer of 1991, Battelle/Marine Sciences Laboratory (MSL) was contracted by USACE to conduct sampling and testing of sediments proposed for dredging following the guidelines established in Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (Public Law 92-532). This Public Law mandates that potentially harmful effects of dredged material be evaluated by chemical characterization, toxicity testing, and bioaccumulation testing.

The MSL collected sediment cores to a depth of -40 ft MLLW (-38 ft + 2 ft overdepth) from 28 (12-in. core) and 30 (4-in. core) stations in Richmond Harbor representing the areas proposed for dredging. The sediment cores were allocated to six composite samples referred to as sediment treatments, which were then subjected to physical, chemical, toxicological, and bioaccumulation testing. Physical and chemical parameters included grain size, total organic carbon (TOC), total volatile solids (TVS), oil and grease, total petroleum hydrocarbons (TPH), polynuclear aromatic hydrocarbons (PAH), chlorinated pesticides, polychlorinated biphenyls (PCBs), priority pollutant metals, and butyltins. The results from the test treatments were compared to results from five reference treatments representative of potential in-bay and off-shore disposal sites.

The results from physical and chemical analyses show that the majority of sediments were fine-grained, representative of silt and clay (Younger Bay Mud). The sediments with the higher proportion of fine grains also exhibited higher levels for the remaining conventional parameters. Reference treatment R-AC demonstrated the highest levels of PAHs. Four of the test treatments showed higher PAH levels when compared to the remaining reference treatments. Three pesticides, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, were detected in 3 test treatments at levels above all 5 reference treatments, and one PCB, aroclor 1254, was also detected in 20 of the Richmond Harbor sediment treatments at levels above all 5 reference treatments. Five test treatments consistently produced the highest levels for 5 of the 10 metals analyzed in this

study (silver, arsenic, lead, zinc, and mercury). Three test treatments had the highest levels of tributyltin or dibutyltin concentrations compared to any of the reference treatments.

Solid-phase acute toxicity tests were conducted using the bentnose clam *Macoma nasuta*, the polychaete *Nephtys caecoides*, and the amphipod *Rhepoxynius abronius* to evaluate sediment toxicity. Toxicity tests designed to evaluate the suspended-particulate-phase were conducted using the mysid *Holmesimysis sculpta*, the speckled sanddab *Citharichthys stigmaeus*, and larvae of the mussel *Mytilus edulis*. Acute toxicity was noted in *Rhepoxynius abronius* for one test treatment when compared to either R-AM or R-BF. Three test treatments produced acute toxicity in *N. caecoides* when compared to R-PF, and two test treatments were acutely toxic when compared to R-OS.

Bioaccumulation potential was evaluated by exposing the *M. nasuta* and *N. caecoides* to solid-phase treatments for 28 days and then measuring the contaminants of concern present in their tissues. Bioaccumulation testing showed variable results depending on the reference treatment used for comparison. Four notable observations were found when comparing the levels of parameters in tissues of *M. nasuta* and *N. caecoides* in test treatments to reference treatments. First, elevated levels of PAH observed in *M. nasuta* and *N. caecoides* consisted mainly of the HPAH compounds fluoranthene, pyrene, and chrysene. Second, elevated levels of pesticides and PCBs were attributed to DDD, DDE, and aroclor 1254. Third, elevated levels of metals were limited to lead and arsenic. Finally, butyltins were not elevated in any test organism tissues relative to the reference treatments. The results generated from this study can be used by USACE to help make decisions regarding acceptable disposal options for the sediments from Richmond Harbor.

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1.0 INTRODUCTION

Richmond Harbor, a major West Coast port for shipping and petroleum refining, lies on the eastern shoreline of central San Francisco Bay near San Francisco, California (Figure 1.1). The currently authorized navigational depth of Richmond Harbor is -35 ft mean lower low water (MLLW). Because this depth will no longer accommodate large, deep draft vessels, a federal program is under way to widen channels and deepen the harbor to -38 ft MLLW. The proposed dredging areas are the four major reaches of Richmond Harbor: the entrance channel, Potrero Reach, Inner Harbor Channel, and the Santa Fe Channel (Figure 1.2). Between the Potrero Reach and Inner Harbor Channel, a turning area is being considered that will allow ships to negotiate the turn into and out of the Inner Harbor Channel area. This deepening and widening program will remove an estimated 1.5 million cubic yards of dredged material.

The Water Resources Development Act of 1986 (Public Law 99-662) authorized the U.S. Army Corps of Engineers (USACE), San Francisco District, to be responsible for dredging and/or disposal of Richmond Harbor sediments. Aquatic disposal (both in San Francisco Bay and ocean sites) is a preferred disposal option for suitable Richmond Harbor sediments. To gain authorization for aquatic disposal, the deepening program must evaluate sediment in accordance with Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), Public Law 92-532. To gain authorization for in-bay disposal, "The Corps must make determinations on the potential effects of dredged material into waters of the United States on the physical, chemical, and biological components of the aquatic environment in accordance with 40 CFR 230.11. Therefore, aquatic disposal should be divided into in-bay (Section 404 of the Clean Water Act) and ocean (Section 103 of the MPRSA). This law stipulates that the proposed disposal of dredged material into open water will not result in potential environmental impacts. To comply with Section 103 and Section 404, the potentially harmful effects of the dredged material must be evaluated through chemical characterization, toxicity testing, and bioaccumulation testing prior to any dredging or disposal of material.

The USACE requested that Battelle/Marine Sciences Laboratory^(a) (MSL)^(a) collect sediments and conduct chemical and biological evaluations under the guidelines established in

(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. Richmond Harbor Study Area

FIGURE 1.2. Richmond Harbor Sampling Stations

Section 103. In 1989, the MSL conducted a detailed program to chemically characterize sediments proposed for dredging from Richmond Harbor. A total of 55 sediment treatments were subjected to characterization and testing. These sediment treatments were taken from sites in the entrance channel, Potrero Reach, the proposed turning circle, the Inner Harbor Channel, and the Santa Fe Channel. The data from this sediment characterization is contained in *Environmental Evaluations for Deepening of Richmond Harbor and Santa Fe Channels, Task 4: Chemistry Program* (Brown et al. 1990).

The sediment characterization data contained in Brown et al. (1990) were used to plan the additional chemical and biological evaluations of Richmond Harbor sediments that are the subject of this report. Chemical characteristics were used to group sampling stations in the entrance channel, Potrero Reach, Inner Harbor Channel, and the proposed turning circle into representative composite samples for biological testing. The USACE excluded Santa Fe Channel sediments from further aquatic testing based on the levels of 4,4'-DDT (130 to 470 µg/kg dry weight) as well as the presence of other chlorinated pesticides in sediment (4,4'-DDE, 4,4'-DDD, and dieldrin). The northernmost part of the Inner Harbor Channel, where the Santa Fe Channel enters it, was also excluded from further aquatic testing because the levels of pesticides at these sites appeared to be influenced by Santa Fe Channel sediments.

In June 1991, the MSL collected sediment cores (to a depth of -38 ft MLLW + 2 ft overdepth) from 28 (12-in. core) and 30 (4-in. core) stations in Richmond Harbor. Sediment from each of the 28 stations were combined into six composites (COMPs), subjected to physical/chemical evaluation, and subjected to toxicological and bioaccumulation testing. Individual core samples from each of the 30 stations were described geologically. Samples from two additional stations located in the Potrero Turning Circle were also taken for geologic description and chemical characterization (Figure 1.2). In addition to the dredged material samples, sediment from five reference stations and three control stations was collected with a pipe dredge or a van Veen grab and tested concurrently with the Richmond Harbor sediments. The reference stations allowed the biological responses and contaminant levels of a proposed dredged sediment sample to be compared to those of a potential disposal area that is "...substantially free of contaminants and which...reflects conditions that would exist in the vicinity of the disposal site had no dredged-material disposal ever occurred...." The control sediments (native to the area) allowed validation of test results through evaluation of the health and normal response of the test organisms.

After field collection, sediments were shipped to the MSL to begin chemical analysis and toxicological testing. All testing done by the MSL followed the protocols in the 1991 Implementation Manual *Evaluation of Dredged Material Proposed for Ocean Disposal* (USACE/EPA 1991) published jointly by USACE and the U.S. Environmental Protection Agency (EPA), hereinafter referred to as the 1991 Implementation Manual. Chemical parameters included measurements of EPA priority pollutant metals, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides, butyltins, and conventional parameters. The six COMPs were evaluated in solid-phase, bioaccumulation, and suspended-particulate-phase (SPP) tests. Three species of marine organisms (the juvenile sanddab *Citharichthys stigmaeus*, the mysid *Holmesimysis sculpta* and larvae of the mussel *Mytilus edulis*) were used in SPP tests to evaluate water column effects of dredged material disposal. Three species of marine organisms (the polychaete *Nephtys caecoides*, the bentnose clam *Macoma nasuta*, and the amphipod *Rhepoxynius abronius*) were exposed to solid-phase testing. The 28-day exposure of *M. nasuta* and *N. caecoides* to the solid phase of the dredged material was used to measure the bioaccumulation potential of sediment-bound contaminants. The tissues of these organisms were removed and measured for the same parameters as the sediments, with the exception of the conventional parameters. The toxicity and bioaccumulation results from test sediments were statistically compared to the reference sediments.

This report is intended to provide information required to address potential ecological effects from the proposed disposal of Richmond Harbor sediments in the ocean. This report is divided into five sections. Section 1.0 is the introduction containing a brief overview of the Richmond Harbor project. 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 Method of Geologic Description
- Appendix B Geologic 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-M Bioaccumulation Results

2.0 MATERIALS AND METHODS

2.1 SEDIMENT AND TEST ORGANISM COLLECTION

Sediment core samples were collected from 28 stations (12-in. core) and 30 stations (4-in. core) in Richmond Harbor using vibratory-hammer core samplers designed by MSL and Manson Construction (Figure 2.1). The sediment samples were collected to -40 ft MLLW (38 ft plus 2 ft overdepth). Specific locations of sediment sampling stations are shown in Figure 1.2. The 12-in. core sampler was used to collect the large volume of sediment needed for biological testing while minimizing contamination caused by excessive sample handling. The 4-in. core sampler was used to collect sediment needed for geologic descriptions and chemical characterizations at each station. In addition to the test sediment samples, reference and control sediment samples were collected to provide a comparison for sediment chemistry and biological testing. Five reference area sediment samples were collected using a pipe dredge sampler; three control samples were collected using either an MSL-designed sand dredge, modified Van Veen grab sampler, or shovel and bucket. Six species of marine organisms were required for biological testing; three of the species (*N. caecoides*, *C. stigmaeus*, and *H. sculpta*) were collected from the northern California coast, and the remaining three species (*M. nasuta*, *R. abronius*, and *M. edulis*) were collected from Puget Sound in Washington State.

Navigation support for locating stations in Richmond 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 also provided MLLW corrected water depths at each station by measuring the actual depth with a recording fathometer (Raytheon DE719-E), measuring the distance to the water surface elevation from a known elevation above sea level, and calculated the difference between the water surface elevation and 0 ft MLLW to provide for actual tidal heights.

2.1.1 Richmond Harbor Core Samples

All stations were sampled to -40 ft MLLW using the 12-in. and 4-in. vibratory-hammer core samplers. The 12-in. core samples were taken at 28 stations and combined to form six COMPs (COMPs I through VI) (Figure 2.2). The 4-in. core samples were collected from 30 stations and used for geologic description and sediment chemistry. The six COMPs were submitted for chemical analyses and used for biological testing. The 4-in. cores were collected and stored in noncontaminating Lexan polycarbonate tubes that maintained the stratigraphic

12-in. Coring Device

4-in. Coring Device

Vibratory-hammer Core

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

FIGURE 2.2. Richmond Harbor Composite Map

integrity of these sediments, which allowed a geologist to characterize the types of sediments composing each station.

Both the 12-in. and 4-in. core samplers were deployed from the Manson Construction derrick barge *Vasa*. The coring apparatus was attached to an electric vibratory hammer and suspended by a crane on the derrick barge. When the coring apparatus was positioned directly above the sampling station, the core was lowered through the water to the sediment surface. For harder-packed sediments, the vibratory hammer was engaged and driven through the sediment to project depth as indicated by the water surface level relative to calibrations (ft) on the outside of the core barrel. For soft sediment, the weight of the coring apparatus caused penetration through the sediment without vibration; if harder material was encountered, the vibratory hammer was engaged to project depth. The coring apparatus was then extracted from the sediment, detached from the vibratory hammer, and lowered onto the barge deck.

As each 12-in. core was placed horizontally on deck, 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 achieved, the sediment was marked at -40 ft MLLW. If the required core length was not achieved, the sediment in the core barrel was removed and the core sampler rinsed with seawater to prepare for a second coring attempt.

Once the core segments were measured, the appropriate amount of sediment for chemical and biological analyses was transferred from the core barrel to an epoxy-coated container using a stainless-steel spade. Each sample container was labeled with the project name, station or composite designation, contributing station(s), total vertical segment of contributing core in feet, 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 -40 ft MLLW using the 4-in. core sampler. One core was collected per site. The core barrel was lined with a 3.125-in. (inner diameter) clear, steam-cleaned Lexan core liner. When each core was brought on board, the liner was pulled from the barrel and the sediment was measured from the mudline downward to determine if appropriate depth (-40 ft MLLW) was reached. If the core achieved 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. If the required core length was not achieved, the sediment in the core

barrel was emptied and the core sampler rinsed with seawater to prepare for a second coring attempt. Each core label included an arrow pointing to the top of the core, the station designation, core section indicator (e.g., Section 1 of 2 and Section 2 of 2), length interval from the mudline (e.g., 0 to 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 for each station. These included the 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. An inventory form was maintained daily as the core samples were placed onto the refrigerated truck for shipment to MSL. When sampling was completed, the inventory form was confirmed and recorded on the MSL chain-of-custody forms. The custody forms (three carbon copies) were signed by the field leader who kept one copy and sealed the others with the core samples.

2.1.2 Reference and Control Samples

Sediment samples from the five reference stations were collected with 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, variable fix and range radar systems, and visible ranges. The vessel's electronic navigation systems were verified at known fixed locations, such as the Golden Gate channel pilot buoy. 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, was collected with a modified Van Veen grab sampler (0.1 m²) deployed from an MSL research vessel. West Beach sediment and the amphipod *R. abronius*, were collected with a small, MSL-designed anchor-dredge sampler. 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 control sediment was collected with a shovel by Brezina and Associates concurrently with the test organism *N. caecoides*. The Dillon Beach sediment was shipped overnight to the MSL, where it

was stored at $4^{\circ}\pm 2^{\circ}\text{C}$. 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 Richmond Harbor toxicity tests:

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

All the organisms were wild-captured individuals collected either by a commercial supplier or by the MSL. Amphipods (*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 and were delivered to a holding tank at the MSL at the end of the collection day. *M. nasuta* were collected from intertidal zones in Discovery Bay near Gardiner, Washington, by a commercial supplier using a shovel, sieve, and bucket. Until shipment, the clams were kept cool by placing them in large containers filled with sediment and seawater from the collection site.

Brezina and Associates (Dillon Beach, California) supplied *N. caecoides*, *C. stigmaeus*, and *H. sculpta* individuals for toxicity testing. *N. caecoides* were collected from mud flats in Tomales Bay, California, using a shovel, bucket, and sieve and then placed into clean coolers containing sediment and seawater from the collection site. 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. After capture, the net was held close to the work boat so that a small dip net could be used to transfer the organisms into double plastic bags containing oxygen-saturated seawater. *H. sculpta* were collected by Brezina and Associates in Monterey Bay, California. They were captured 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. After collection, the containers were supersaturated with oxygen (22 ppm) and shipped overnight to MSL.

2.2 SEDIMENT SAMPLE PREPARATION

Sediment used for biological testing was prepared within a 14-day holding period. During that period, the core samples were received at the MSL and inventoried against the chain-of-custody form, processed for solid-phase and SPP testing, and biological tests initiated. 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 went through stringent cleaning procedures to avoid contaminating sediment samples. Glassware, including test containers, aquaria, and sediment transfer equipment, was 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 also 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 a mild soap solution and thoroughly rinsed with tap water followed by deionized water.

Equipment used to determine water quality parameters, such as pH, dissolved oxygen, temperature, and refractometers were calibrated according to the manufacturer's specifications and internal MSL procedures.

2.2.2 Geologic Description of Cores

A geologic characterization of each Richmond Harbor sampling station was conducted by an MSL geologist on the 4-in. Lexan-lined core. The Lexan core tube maintains the strati-

graphic integrity of the sediment. All core sections from one station were removed from storage and the Lexan tube 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 entire core from mudline to bottom, recording data on a core data log. The geologic characterization protocol (Appendix A) was consistent with American Society for Testing Materials (ASTM) Method D2488-84 (ASTM 1984).

2.2.3 Preparation of Solid-Phase Samples

Sediment samples prepared for solid-phase testing and used for chemical and biological evaluation were collected with the 12-in. vibratory-hammer core (test sediment representing dredged material), a sand dredge sampler at the reference sites (existing environment of a disposal site without dredged material), and an amphipod dredge or shovel for the control sediment (environment of a benthic test organism).

Test sediment collected with the 12-in. vibratory-hammer core was used for biological testing and came from stations that were combined to yield six COMPs. The location of the 28 Richmond Harbor sampling stations and the determination of the stations designated to each composite were established prior to field sampling. Individual stations comprising a composite with a specific volume of sediment were placed in the appropriate pre-labeled bucket. The pre-labeled buckets with COMPs I through VI were then sent back to the MSL for processing.

Test sediment collected with the 4-in. vibratory-hammer core were analyzed separately for 30 individual sampling stations. These samples were collected in Lexan cores that were capped, labeled, and divided into smaller sections for shipment to MSL. At MSL, the cores were split in a longitudinal direction and placed on an epoxy-coated table for geologic description.

The procedure for homogenizing the 4-in. cores and the six COMPs created from the 12-in cores varied according to sediment type. Compacted clay sediments were separated into smaller pieces with a stainless-steel grater and then mixed either with stainless-steel spoons or a mixer coated with a special epoxy paint. Silt, soft clay, and sandy sediments were mixed with stainless-steel spoons in stainless-steel bowls until uniform consistency and color were visible throughout the sediment. Minimal amounts of 0.45- μ m-filtered seawater were added as needed to achieve a homogeneous consistency. Once a sediment sample 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 clean, labeled containers appropriate for

the parameters to be measured. Solid-phase sediment treatments not used immediately for solid-phase testing or SPP preparation were returned to the labeled, epoxy-coated metal buckets and stored at 4°C.

The reference and control sediments were maintained at 4°C until sieved. To perform the sieving process, sediments were placed onto stacked screens, with mesh diameters of 0.5 to 1.0 mm, set on top of a sieving stand. This sieving stand was designed to empty directly into a 55 gal, pre-cleaned aquarium containing approximately 15 gal of filtered seawater. A Simms Geyser submersible pump was placed in the aquarium to recirculate the water. Organisms collected during the sieving process were discarded because they could influence the results of the test. Small debris such as shells or wood chips were placed into the collection aquarium to preserve the physical nature of the sediment. The sieved sediment was then allowed to settle overnight at 4°C. After settling, the overlying water was siphoned off and the sediment was transferred to an epoxy-coated mixer that was operated for 5 to 10 min or until a homogenous sediment mixture was achieved. At the end of the mixing period, the sediment was transferred to the 55-gal aquarium and 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 between samples.

2.2.4 Preparation of Suspended-Particulate Phase

The SPP of sediment COMPs was used to evaluate water column effects of suspended-particulate-phase materials for open water dredged material disposal. The SPP is the liquid that remains after intermixing 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 dredged material disposal operations.

The first step of SPP preparation was to create 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 increments. Seawater was added to the 200-mL mark and homogenized sediment was 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 containing 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 fitting lids, which were then placed in a centrifuge and spun for 10 to 15 min at approximately 1750 rpm. The 10-min centrifugation was allowed by the 1991 Implementation Manual and 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 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

Solid-phase, SPP, toxicity, and bioaccumulation tests were performed on each composite at the MSL in Sequim, Washington. These tests were designed to assess distinct ecological effects of proposed aquatic disposal of dredged material from the Richmond Harbor Project.

The solid-phase tests were used to assess the acute toxicity and bioaccumulation potential of dredged material after settling at an aquatic disposal site. Three species of marine organisms were exposed to the sediment from the Richmond Harbor sampling stations, reference area sediment, and control sediment. Two acute toxicity tests were conducted: 1) a 10-day solid-phase flow-through acute toxicity test using the polychaete *N. caecoides*, 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 28-day test was to assess the potential for bioaccumulation of contaminants from the sediment into the tissues of the organisms. The test 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 were used to assess the potential effects of discharging dredged material through the water column during disposal operations. The SPP tests evaluate 1) effects caused by the physical presence of suspended particles, 2) toxicity of chemical contaminants associated with the particles, or 3) the chemical contaminants after they have dissolved into the water column. Three marine species were used in these tests: mysids (*H. sculpta*), 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 four replicates of each of the four SPP concentrations: 0% (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 included a controlled-temperature environment, flow-through seawater supply, lighting control, and air supply.

2.3.1 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 bioaccumulation test using *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. Sediment was then added to a depth of 3 cm by measuring the required amount (3870 mL) into a glass container and pouring the sediment into the aquaria. The sediment was washed with seawater to distribute the sediment evenly over the bottom of the aquaria. 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 settled and the flow-through system was adjusted and calibrated to deliver 125 ± 10 mL/min of seawater flow to each aquarium. The system operated overnight before the organisms were added.

To initiate the test, 25 *M. nasuta* and 40 *N. caecoides* were collected from the holding tanks and placed in each aquarium. The label on each test aquaria included initiation time/date and the initials of the person 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 Appendixes D through I). The water quality parameters and ranges established for the tests were

Dissolved Oxygen	≥ 4.0 mg/L
pH	ambient ± 0.5 units
Salinity	ambient $\pm 2.0\%$
Temperature	$15.0^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$
Flow Rates	125 ± 10 mL/min.

FIGURE 2.3. Flow-Through Aquarium for *M. nasuta*, *N. caecoides*

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

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 and the number of dead versus live of each species was determined. Death was determined by observing whether the *N. caecoides* reacted to gentle probing; if there was no movement, the organism was considered dead. Death in the *M. nasuta* was determined by observations; those which were unresponsive and those with gaping shells were considered dead. The mortality data were recorded on the termination forms and at least 10% of the mortality counts were confirmed by a second observer.

2.3.2 10-Day Solid-Phase Static Test with *R. abronius*

The amphipods were held 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-qt Mason jars (Figure 2.4) 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 slowly filled with 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.

Tests were initiated by adding 20 *R. abronius* to each test container. 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 being transferred into the 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 floating on the surface were gently pushed below the water surface with a pipette tip and observations were made as to whether they burrowed below the sediment or returned to the surface.

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 test. Acceptable ranges for water quality parameters during the experiment were

Dissolved Oxygen	≥ 4.0 mg/L
pH	ambient ± 0.5 units
Salinity	ambient $\pm 2.0\%$
Temperature	15°C $\pm 2.0^\circ$ C.

FIGURE 2.4. Static Amphipod Testing Jars

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 versus dead organisms was determined (if necessary, they were 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 organism. The reference toxicant test was conducted in the same manner as the solid-phase test. *R. abronius* were exposed to a seawater control plus four concentrations of cadmium chloride (0.5, 1.0, 2.0, and 4.0 mg/L as Cd). There were three replicates of each treatment.

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 40 *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 (void the digestive tract) 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 was 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 for 48 h following the 28-day exposure. The surviving *N. caecoides* from each test aquarium were placed in another flow-through 10-gal aquarium with approximately 2 in. of clean sediment in the bottom. This sediment layer is necessary for *N. caecoides* because they require sediment to surround their tissues in order 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 in pre-cleaned 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 Static Test with *C. stigmaeus*

The test chambers for the SPP test using *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.

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 netted from the holding tanks and added to each test container. The test population for each concentration was 40 individuals (160 individuals per SPP treatment). Initiation time and date were documented on test containers and data record 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	≥ 4.0 mg/L
pH	ambient ± 0.5 units
Salinity	ambient ± 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. Dead organisms were removed and preserved in Davidson's fixative for potential histopathological analysis.

Before termination of the test at 96 h, water quality parameters were measured in all replicates. At 96 h, the number of live versus dead organisms was determined for each test container. As a quality control check, a second observer confirmed at least 10% of the mortality counts. Additionally, *C. stigmaeus* from SPP treatments exhibiting a toxicological effect (either through mortality or behavioral abnormalities) were also preserved for potential histopathological analysis.

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

Prior to testing, *H. sculpta* were held for at least 48 h in flow-through aquaria maintained at test temperature (15°C). *H. sculpta* 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. sculpta* test were 2-L glass baking dishes 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, 1 gal jars to make 0%, 10%, 50%, and 100% SPP concentrations for the *H. sculpta* test. A total of 3000 mL was prepared for each dilution to achieve the test volume of 1000 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, each container was gently aerated and water quality was measured in all replicates of each sediment treatment. *H. sculpta* 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 40 individuals per concentration (160 individuals per treatment). The test initiation time and date were documented on data forms. After test initiation, water quality parameters were measured daily in one replicate of each sediment treatment. Acceptable water quality parameters for this test were

Dissolved Oxygen	≥ 4.0 mg/L
pH	ambient ± 0.5 units
Salinity	ambient $\pm 2.0\%$
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. sculpta*. During the 96-h exposure, *H. sculpta*

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 versus dead animals was determined for 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. sculpta* were exposed to a seawater control plus four concentrations of zinc chloride (0.25, 0.50, 1.0, and 2.0 mg/L as Zn). There were three replicates of each treatment.

2.3.6 48-h Suspended-Particulate-Phase Static Test with Larval *M. edulis*

Prior to testing, adult *M. edulis* were held in flow-through holding tanks at ambient temperature. The test chambers for the bivalve larvae test were 1-qt Mason jars in which dilutions of SPP for the bivalve test (0%, 10%, 50%, and 100%) were directly prepared. The dilution water consisted of offshore Strait of Juan de Fuca seawater filtered at 20 μ m. This offshore water was collected to reduce the risk of using nearshore water that 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 750 mL. Test chambers containing SPP were placed in random positions on a water table and aerated. Once the containers had reached test temperature (16°C $\pm$ 2°C), initial water quality parameters were measured in all replicates.

Adult *M. edulis* were induced to spawn by placing individuals in seawater that was quickly warmed to 20°C. Broodstock mussels were maintained in 20°C seawater for 45 min during which time DO levels were monitored. If no spawning occurred within 1 h, adult mussels were removed from the water and allowed to air dry for approximately 15 min and then returned to the 20°C seawater.

Most adults spawned within an hour and 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 passed through 35- μ m mesh to remove debris. The sperm pool 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- μ m mesh to remove debris and retained on a 20- μ m screen to rinse away excess sperm. The eggs were rinsed from the 20- μ m 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 percent fertilization and the amount of embryo stock to add to each test container.

To initiate the test, an appropriate amount of bivalve embryo stock solution was pipetted into each test container to yield a density of 25 embryos/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 record forms. 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	ambient ± 2.0 ‰
Temperature	16.0°C ± 2.0 °C.

The bivalve test was terminated after 48 to 72 h, when development of D-shaped larvae predominated in control containers. Final water quality measurements were recorded for all replicates. Each chamber was then 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 (1, 4, 16, and 64 µg/L as Cu) with two replicates per treatment.

2.4 SEDIMENT AND TISSUE CHEMISTRY PROCEDURES

Richmond Harbor sediment treatments were analyzed for conventional and chemical parameters. Conventional parameters included grain size, total organic carbon (TOC), total volatile solids (TVS), oil and grease, total petroleum hydrocarbons (TPH), and percent solids. Chemical analyses included PAHs, chlorinated pesticides, PCBs, metals, and butyltins. Table 2.1 shows the analytical parameters measured for the Richmond Harbor sediment treatments. *N. caecoides* and *M. nasuta* were analyzed for the same set of PAHs, chlorinated pesticides, PCBs, metals, and butyltins as shown 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) and matrix spike duplicate (MSD) analyses, standard reference materials (SRMs), and analytical replicates. The MS, MSD, and SRMs were used as measurements of analytical accuracy. The analytical replicates, MS, and MSD were used to evaluate analytical precision. Accuracy is defined in terms of bias (how close the measurement is to the true value) and precision (how variable the measurements are when repeated).

2.4.1 Conventional Sediment Measurements

Conventional sediment measurements consist of grain size, TOC, TVSs, oil and grease, TPHs, and percent solids. The procedures for each of these analyses are discussed in the following paragraphs.

Grain size analysis was conducted by Soil Technology, Inc., 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

TABLE 2.1. Analytical Chemistry Requirements for Richmond Harbor Sediment Treatments

Parameters	Detection Limits^(a) (mg/kg dry wt)	Number of Samples	Range of Recovery (%)	Relative Precision (%)
<u>Sediment Conventionals</u>				
TOC	0.1%	57	NA ^(b)	10
Oil and Grease	20	57	50 - 150	20
TPH	20	57	50 - 150	20
Grain Size	NA	57	NA	NA
Total Volatile Solids	0.1%	57	NA	10
<u>Metals</u>				
Ag	1.0	57	75 - 125	20
As	1.0	57	NA	20
Cd	0.1	57	75 - 125	20
Cr	1.0	57	NA	20
Cu	1.0	57	NA	20
Hg	0.02	57	75 - 125	20
Ni	1.0	57	NA	20
Pb	1.0	57	NA	20
Se	0.5	57	75 - 125	20
Zn	1.0	57	NA	20
<u>Organic Compounds</u>				
Butyltins	0.01	57	40 - 120	30
PCBs ^(c)	0.02	57	40 - 120	30
PAHs ^(d)	0.02	57	40 - 120	30
Pesticides ^(e)	0.002	57	40 - 120	30

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

(b) NA 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.

TABLE 2.2. Analytical Chemistry Requirements for Richmond Harbor Tissue Samples

Parameters	Detection Limits ^(a) (mg/kg dry wt)	Number of Samples	Range of Recovery (%)	Relative Precision (%)
<u>Metals</u>				
Ag	1.0	145	75 - 125	20
As	1.0	145	NA ^(b)	20
Cd	0.1	145	75 - 125	20
Cr	1.0	145	75 - 125	20
Cu	1.0	145	NA	20
Hg	0.02	145	75 - 125	20
Ni	1.0	145	75 - 125	20
Pb	1.0	145	NA	20
Se	0.5	145	75 - 125	20
Zn	1.0	145	NA	20
<u>Organic Compounds</u>				
Butyltins	0.01	145	40 - 120	30
PCBs ^(c)	0.02	150	40 - 120	30
PAHs ^(d)	0.02	150	40 - 120	30
Pesticides ^(e)	0.002	150	40 - 120	30

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

(b) NA 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.

ASTM D421 (ASTM 1978) 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- 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

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
0.9	10	NA
0.4883	11	NA

(a) NA Not applicable.

63.5-μm (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 the final 63.5-μm sieve was added to the previous fines in the 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°±2°C to a constant weight. Triplicate analysis of three 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 TOC was performed by Global Geochem in Canoga Park, California. Total organic carbon is the amount of non-volatile, 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 (PSEP 1986; SW846 Method 9060, EPA 1986) and reported as percent of dry weight. Quality control measures included three method blanks and one triplicate analysis per batch (three batches).

Total oil and grease and TPH analyses were performed by Twin City Testing in St. Paul, Minnesota. 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 and extracted with Freon. For total oil and grease, sample extracts were scanned from 4000 to 600 cm^{-1} on an IR and the peak height measured at 2930 cm^{-1} . This wavelength represents the $-\text{CH}_2$ configurations of hydrocarbons and was the standard used to determine oil and grease. For TPHs, silica gel was added to the extract to remove the more polar animal- and vegetable-based oils. The extract was then shaken, allowed to settle, 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 included one blank, an MS and MSD, and one analytical triplicate per batch. Three batches were performed for the oil and grease and TPH.

Analysis of TVSs 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. The TVS is used as an estimate for the amount of organic matter in the total solids. Operationally, TVS is defined by the combustion temperature and does not always represent the organic content of a sample; more volatile organic material may be lost during drying, and inorganic material may be lost during combustion. To perform TVS analysis, the MSL followed 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 three sets of triplicate analysis.

Sediment treatments used for determination of percent solids were prepared in one of two ways. (Each laboratory performs a percent solids analysis to determine a sample dry

weight; different laboratories may use one of the two methods.) Pre-weighed wet samples are either freeze-dried over a period of 4 days or dried in an oven at 110°C for at least 8 h, and cooled in a desiccator. The ratio of dry weight to wet weight is multiplied by 100 to determine the percent solids.

2.4.2. Semivolatile Organic Compounds

Analyses for 16 PAHs in the Richmond Harbor sediment treatments and tissues were performed by the MSL in Sequim, Washington. The semivolatile organic compounds were analyzed in Richmond Harbor sediments (EPA Method 9270). These compounds were extracted using a slightly modified NOAA Status and Trends Method (NOAA 1985). The modification involved multiple extractions on an ambient roller using methylene chloride as the extraction solvent. A portion of the sediment extract was then analyzed by gas chromatography/mass spectroscopy in the Selective Ion Mode (GC/MS SIM) following EPA SW-846 Method 8270 (1986). 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 and one MS/MSD per batch. An MS and MSD solution consisting of all 16 PAH compounds was added to each sample (sediment and tissue) to assess the accuracy and precision of the measurement. The SRM was used to assess the accuracy of the measurement. This SRM was National Institute of Science and Technology (NIST) SRM 1941. The SRM for the tissues was the NIST 1974.

2.4.3 Chlorinated Pesticides and Polychlorinated Biphenyls

The PCB and pesticide analyses for Richmond Harbor sediment and tissue samples were performed by the MSL in Sequim, Washington. Chlorinated pesticides and PCBs in sediments and tissues were quantified by gas chromatography/electron capture detection (GC/ECD) following EPA SW-846 Method 8080 (1986).

Chlorinated pesticides and PCBs were extracted simultaneously with the PAH compounds using the ambient roller technique as described for PAHs (NOAA 1985). The procedure involved a multiple methylene chloride extraction. 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 10 g of 2% deactivated alumina and 20 g of 2% deactivated silica following standard MSL procedures. Most samples required an additional cleanup treatment using high performance liquid chromatography (HPLC) to remove other interferences. Analyti-

cal quantification was performed using GC/ECD analysis. Tetrachlorometaxylene (TCMX) and Octachloronaphthalene (OCN) were added to each sample before extraction to assess extraction efficiency.

Quality control measures included a method blank with each batch. An MS solution consisting of either a subset of pesticides or one aroclor was also added to the appropriate samples before extraction. The MS/MSD analyses and blanks were conducted with each batch to assess accuracy and precision of the measurement.

2.4.4 Metals

Sediment and tissue metals analyses were performed by the Pacific Northwest Laboratory (PNL) in Richland, Washington, and the MSL in Sequim, Washington. In addition, tissue samples were analyzed for selected metals using inductively coupled plasma mass spectrometry (ICP/MS) by Skidaway Institute of Oceanography in Savannah, Georgia. 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). Sediment samples, *M. nasuta* tissue, and *N. caecoides* tissue were analyzed using a combination of four different methods: 1) energy-diffusive x-ray fluorescence (XRF), following the method of Sanders (1987); 2) Zeeman graphite-furnace atomic absorption spectroscopy (GFAA), following EPA SW-846 Method 7000 (1986) and the method of Bloom and Crecelius (1984); 3) cold-vapor atomic absorption spectroscopy (CVAA) according to EPA SW-846 Method 7471 (1986) and the method of Bloom and Crecelius (1983); and 4) ICP/MS. 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 and 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- to 0.5-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), MS and MSD, 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 NIST, and BEST-1 and PACS-1, obtained from the National Research

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

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

Council of Canada (NRCC). The tissue SRMs included an oyster tissue, 1566a, obtained from NRCC.

2.4.5. Butyltins

Butyltins in sediment and *M. nasuta* tissue were analyzed at the MSL in Sequim, Washington, and butyltins in *N. caecoides* samples were analyzed at Battelle Ocean Sciences 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. For sediment, triphenyltin was added before extraction as a surrogate compound to assess extraction efficiency. For tissues, tripropyltin was added before extraction as a surrogate compound to assess extraction efficiency. The mono, di-, tri-, and tetrabutyltin 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 di-, tri- and tetra-butyltin species as tin. The recently certified reference material for butyltins, NRCC SRM PACS-1, was analyzed with Richmond Harbor sediment. Selected sediment and tissue samples were spiked with di- and tributyltins prior to extraction to assess the accuracy of the procedure. Method blanks, one set of MS/MSD and one set of triplicates were analyzed with each batch of samples extracted.

2.5 DATA ANALYSIS AND INTERPRETATION

Several statistical analyses were conducted to determine the magnitude and significance of toxicity and bioaccumulation in test treatments relative to reference treatments. Each statistical test is based on a completely random design that allows unbiased comparison between treatments. The 1991 Implementation Manual recommends Dunnett's Test for comparing test treatments to a single reference treatment. However, the Richmond Harbor experiments were conducted with multiple reference treatments because a single reference most representative of a potential disposal site had not been selected. In this case, Dunn's Test, a modification of Tukey's Honestly Significant Difference (HSD) Test (Dunn 1961), is appropriate for multiple reference comparisons and it was used to compare the test treatments to all the reference treatments. The alpha level was expanded to 0.1 for both bioaccumulation and toxicity comparisons in order to increase the comparison-wise error rate, which decreases confidence limits around the means and enhances the likelihood of detecting significant differences between treatments. This implies that the test is statistically less conservative, meaning that it is more likely to detect a significant difference than comparisons at $\alpha = 0.05$. Comparisons conducted at $\alpha = 0.05$ are less sensitive to differences in means, resulting in fewer significant differences. Test design and specific statistical analysis procedures are discussed in the following sections.

Concentrations of contaminants of concern in the tissues of *M. nasuta* and *N. caecoides* were also compared to the Food and Drug Administration (FDA) action levels for poisonous and deleterious substances in fish and shellfish for human food. "These action limits are the levels above which the FDA can take legal action, and are based on human health as well as economic considerations" (USACE/EPA 1991). Procedures for evaluating levels are outlined in the 1991 Implementation Manual.

2.5.1 Randomization

All solid phase and SPP toxicity tests were designed as completely random tests. Organisms were randomly allocated to treatments, and treatments were randomly positioned on water tables. To determine the randomization, a random number table was generated for each toxicity test using the discrete uniform random number generator in the Lotus 123 spreadsheet software. For the SPP tests, *C. stigmaeus* and *H. sculpta* individuals and *M. edulis* larvae were randomly allocated to SPP replicates for all concentrations. Special care was taken with *C. stigmaeus* individuals 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 toxicity of all sediment treatments was compared by analysis of variance (ANOVA) tests on the arcsine square-root of the proportion of organisms surviving the test. The arcsine square-root transformation stabilizes the within-class variances to meet the assumptions of the ANOVA. All treatments were compared using Dunn's Test with an experiment-wise error rate of $\alpha = 0.10$. Dunn's Test is similar to Tukey's HSD Test, which had been used for previous projects, but Dunn's modification accommodates larger numbers of treatments and unbalanced replicates. Both Dunn's and Tukey's HSD Tests are multiple-range comparisons that provide information about how each sediment treatment compares to all other treatments. These statistical methods allow comparison of a test treatment to more than one reference treatment when all are tested concurrently. Toxicity of the treatment was considered significant if it was statistically different from one or more reference treatments and if the survival in the treatment was $\geq 10\%$ lower than the reference treatment for the test organism (20% lower than reference for *R. abronius*).

2.5.3 Statistical Analysis of SPP Tests

Two statistical tests are presented in the 1991 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% (70% *M. edulis* test) 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 1991 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-Kärber method (Hamilton 1977). The Spearman-Kärber 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 where 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 all of the replicate samples in a 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.

Treatments where contaminants of concern were detected were compared to all reference treatments using ANOVA and Dunn's Test for comparison of all means. Analytical detection limit values were used for replicates where the compound was not detected. If all replicates of a test treatment were flagged with U (analyte was not present above the level of associated value) or J [analyte detected below method detection limits (MDL), but above instrument detection limit (IDL)] qualifications by the analytical laboratory, the treatment was not analyzed. Significant bioaccumulation of a contaminant was determined by the statistical grouping yielded by Dunn's Test at $\alpha = 0.10$.

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

The QA/QC procedures followed for these studies were consistent with the 1991 Implementation Manual and the EPA protocols (PSEP 1986). The procedures followed were documented by PNL's Quality Engineering Division as 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. The PNL Laboratory Record Books (LRB) were assigned to each portion of the study and served as records of day-to-day activities during the research. All entries in the LRBs were signed, dated, and reviewed by the project manager. The following discussion summarizes QA/QC procedures followed for the three main portions of this study: sediment sampling, tracking, and storage; sediment and tissue chemistry; and toxicological testing (all QA/QC evaluations are contained in Appendixes C, J, and K).

2.6.1 Sediment Sampling, Tracking, and Storage

To locate the sampling points within the harbor the vessel's navigation systems required an accuracy of ± 10 ft. All core liners were made of noncontaminating lexan and were steam cleaned before use. The sample stations were labeled with the appropriate locations, date, time

collected, and core sections. After collection, all samples were kept at ~4°C in a refrigerated storage container. The detailed sampling information was recorded daily on core logs.

To ensure the integrity of samples from the time of collection through sample analysis, sample custody procedures were followed. 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 this study was stored in glass containers, 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 for a period not exceeding 2 months (PSEP 1986; EPA/USACE 1991). Samples for metals were freeze-dried upon receipt at the laboratory and held for a period not exceeding 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 EPA certified precleaned glass jars with Teflon-lined lids, and held up to 2 months prior to analysis. Tissue samples for metals analyses were stored in precleaned plastic jars and 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 by the PNL Quality Engineering Division as a QA Plan. 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 10% of the samples (where applicable) with appropriate compounds to assess accuracy

- analysis of 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 QA Plan 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 MS of known concentrations and SRMs that have been certified for the presence of specific parameters. The MS were analyzed for metals and organic parameters and are generally made up of a subset of the analytes of interest. Percent recoveries were calculated based on the differences between the amount spiked and the amount recovered in the sample. Metal spikes were analyzed at a frequency of 5% and organic compound spikes were generally analyzed at 5%. In sediment, SRMs were analyzed for metals and organic compounds; in tissues, SRMs were analyzed for metals only.

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.

Measurements of precision were obtained through replicate analysis of selected sediment treatments. Analysis of replicates shows the precision and repeatability of the results. The measurements of precision are the industrial statistic (I-stat) and relative percent difference (RPD) for duplicate analyses, and the relative standard deviation (RSD) for triplicate analyses. The I-stat 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. Copies of data generated by offsite analytical facilities are maintained at the MSL.

2.6.3 Toxicological Testing Quality Control Procedures

Appropriate procedures for organism care were maintained from collection through testing. 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 1991 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 testing.

Native control sediments were included in all bioassays to validate the test through organism survival. Reference toxicant tests were also included to measure the relative sensitivity of the test organisms. Reference toxicant tests are frequently conducted at MSL and results from these tests were used in comparison to previous studies.

During testing, 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 14 h of light per day. Salinity was allowed to vary $\pm 2.0\text{‰}$, and pH was allowed to vary ± 0.5 units within each test container during the testing period. These limits and values are consistent with those outlined in the 1991 Implementation Manual. Water quality instruments were calibrated according to the manufacturer's specification or PNL protocols.

All data generated on spreadsheets for use in this report received a 100% data validation by technically qualified staff members. Manipulation of data within the spreadsheets was rechecked with hand calculations. These calculations were documented directly on the spreadsheet to assure data traceability. In addition, the report received a technical review, editorial review, and QA/QC review.

3.0 RESULTS

This section presents the results from sediment sampling, geologic descriptions, sediment chemistry, toxicological testing, and tissue chemistry. Complete appendixes containing all data generated in support of the Richmond Harbor Program are included in this report.

3.1 SEDIMENT SAMPLING RESULTS

Richmond Harbor sediment was collected from June 17 through June 20, 1991. Reference sediment was collected on June 17 and 18, 1991. All sediment samples were collected following the procedures described in Section 2.1.

The 12-in. core samples were collected from 28 stations in Richmond Harbor to a project depth of -40 ft MLLW (Figure 1.2). Based on Brown et al. (1990), sediment obtained from stations presumed to be similar were combined to form six sediment composites that were thoroughly mixed in the laboratory, subsampled for chemistry, and used in biological and bioaccumulation testing (Figure 3.1). Because these stations were similar, composites eliminated the need to perform biological testing at individual stations. Table 3.1 provides field sampling information for the 12-in. core samples including station designation and location, collection data, core length, contribution to composites (gal), and composite number. Approximately 4 to 10 gal of sediment from individual stations was combined with sediment from other stations to form the six COMPs. The amount of sediment contributed from each station was dependent on the length of core collected. COMPs I, II, V, and VI were composited as planned; however, COMPs III and IV provided some noteworthy exceptions that require explanation.

Originally, COMPs III and IV were to be made from the appropriate sections of cores taken from the Potrero Reach turning circle and stations TC-1 through TC-5. COMP III was to comprise the upper sections of the 12-in. cores from stations TC-1 through TC-5 and COMP IV was to comprise the lower sections of those same 12-in. cores; the division between the two was to be based on grain-size characteristics. When the core sample from Station TC-5 was examined in the field, however, the upper section appeared different from the other turning circle stations. Consequently this section was kept separate and given the designation TC-5 Upper Comp. Because of this, COMP III actually comprises the upper sections of the 12-in. cores from stations TC-1 through TC-4. Figure 3.2 shows TC-1 through TC-5 and their respective contributions to COMPs III and IV.

FIGURE 3.1. Richmond Harbor Composite Stations

Table 3.1. Information for 12-in. Core Sampling and Compositing, Richmond Harbor Program

Station	Replicate	Date Collected	California State Plane Coordinates (Zone III)		Mudline Depth (-ft MLLW)	Ft Core Required to -40 ft	Ft Core Collected	Volume of contribution (gal)	Composite	Comments
			East (X)	North (Y)						
C-1	1	06-17-91	1449390.19	520987.69	36.4	3.6	7.0	4.5	I	
C-3	1	06-17-91	1450547.70	519752.43	36.0	4.0	6.0	5.0	I	
C-5	1	06-17-91	1452379.27	518120.72	36.4	3.6	3.6	4.0	I	
C-6	1	06-17-91	1453053.81	517926.81	36.3	3.7	6.0	4.2	I	
C-6	1	06-17-91	1454896.38	517590.35	36.4	3.6	5.7	5.0	I	
C-10	1	06-17-91	1456429.14	517239.72	36.0	4.0	4.0	5.0	I	
C-29	1	06-18-91	1463334.18	518492.92	35.0	5.0	9.5	7.0	VI	
C-32	1	06-18-91	1463210.48	519097.77	35.3	4.7	9.0	6.0-7.0	VI	
C-36	1	06-18-91	1463135.69	520210.61	36.1	3.9	9.0	6.0	VI	
C-38	1	06-18-91	1463113.00	520633.36	36.1	3.9	7.0	6.0	VI	
C-37	1	06-18-91	1462458.57	520383.62	36.1	3.9	10.0	6.0	V	
C-35	1	06-18-91	1462806.17	520008.19	36.2	3.8	8.0	6.0	V	
C-33	1	06-18-91	1462559.19	519573.36	35.0	5.0	9.0	7.0	V	
C-30	1	06-18-91	1462643.87	518940.33	35.3	4.7	7.0	7.0	V	
C-26	1	06-18-91	1462783.48	517802.54	36.1	3.9	7.5	6.0	V	
C-24	1	06-18-91	1462668.10	517210.83	36.0	4.0	7.0	6.0	V	
C-25	1	06-18-91	1463471.95	517427.14	35.0	5.0	5.0	7.0	VI	
C-23	1	06-18-91	1463292.49	516419.86	32.8	7.2	12.0	10.0	II	
C-11	1	06-19-91	1457316.48	517260.14	37.3	2.7	6.5	7.0	II	
C-16	1	06-19-91	1459062.57	516947.11	36.2	3.8	4.0	7.0	II	
C-18	1	06-19-91	1460733.61	516591.21	36.1	3.9	7.0	7.0	II	Penetrated to 48 ft to retain sediment; collected sediment from -36.1 to -40.0 ft MLLW.
C-19	1	06-19-91	1461734.38	516529.59	35.9	4.1	6.6	7.0	II	
C-20	1	06-19-91	1462470.03	516699.50	36.2	3.8	3.8	7.0	II	
TC-5	1	06-19-91	1463563.33	518188.03	21.9	18.1	18.0	30.0	Upper Comp	Taken from mudline to -36.5 ft MLLW
TC-5	1	06-19-91	1463563.33	518188.03	21.9	18.1	18.0	10.0	IV	Taken from -36.3 to -40.0 ft MLLW
TC-1	1	06-19-91	1463670.76	518668.25	11.3	28.7	30.0	10.0	IV	Taken from -21.3 to -40.0 ft MLLW
TC-1	1	06-19-91	1463670.76	518668.25	11.3	28.7	30.0	10.0	III	Taken from -11.3 to -21.3 ft MLLW
TC-2	1	06-20-91	1463762.30	517300.30	11.5	28.5	38.0	10.0	III	Taken from -11.5 to -14.5 ft MLLW
TC-2	1	06-20-91	1463762.30	517300.30	11.5	28.5	38.0	15.0	IV	Taken from -14.5 to -40.0 ft MLLW
TC-4	1	06-20-91	1463681.45	517852.69	6.2	33.8	34.5	10.0	III	Taken from -6.2 to -23.2 ft MLLW
TC-4	1	06-20-91	1463681.45	517852.69	6.2	33.8	34.5	10.0	IV	Taken from -23.2 to -40 ft MLLW
TC-3	1	06-20-91	1463728.93	517605.20	8.5	31.5	37.5	10.0	III	Taken from -8.5 to -24.0 ft MLLW
TC-3	1	06-20-91	1463728.93	517605.20	8.5	31.5	37.5	10.0	IV	Taken from -24.0 to -40.0 ft MLLW

FIGURE 3.2. Compositing Scheme for TC-1 Through TC-5, Richmond Harbor Program

The 4-in. core samples were also collected from the 28 stations in Richmond Harbor with 2 additional stations in the Potrero Reach maneuvering area (Table 3.2). All cores from each station were geologically described and chemically evaluated to document sediment type and chemical contaminant levels at each station. The additional two stations, TC-6 and TC-7, were sampled exclusively with the 4-in. core sampler because biological testing was not required. Examination of the 4-in. core in the laboratory also revealed Station TC-5 had a small section that appeared to have different grain-size characteristics from the remaining core. This portion, referred to as TC-5 Special, was subjected to separate chemical analysis independent from TC-5.

Reference sediment was collected from three in-bay areas and two offshore areas. The three in-bay reference areas had multiple sampling sites. The Alcatraz Island environs (R-AM) consisted of eight sites evenly spaced at 0.5-nautical mile (nm) intervals around Alcatraz Island (Figure 3.3), four sites within the boundaries of the Alcatraz Island disposal site (R-AC) (Figure 3.3), and four sites within the Bay Farm Borrow Area (R-BF) (Figure 3.4).

Sediment collected from individual sites within a reference area was composited to produce a homogeneous sample. The two offshore reference areas were the deep, off-shelf reference area (R-OS) and the Point Reyes Fine reference area (R-PF) (Figure 3.5). These reference composites consisted of three replicate samples collected and combined to obtain the required volume of sediment needed for testing. Complete reference sediment sampling information is provided in Table 3.3.

Control sediment for use in solid-phase toxicity tests was 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 2.1.3. Sequim Bay control sediment (C-SB) was used as an experimental control in all toxicity tests as well as the native control for *M. nasuta*. West Beach control sediment (C-WB) was the native sediment for the amphipod *R. abronius*. Native sediment for *N. caecoides* (C-NE) and *C. stigmaeus* (C-SD) was collected from Tomales Bay, California.

3.2 GEOLOGIC DESCRIPTIONS

The following sections provide a description of the geology of the Richmond Harbor sediment based on the characterization of 30 sediment cores collected June 17 through 20, 1991. Twenty-three short core samples (< 7 ft) were collected from the Richmond Harbor

Table 3.2. Information for 4-in. Core Sampling, Richmond Harbor Program

Station	Replicate	Date Collected	California State Plane Coordinates (Zone III)		Mudline Depth (-ft MLLW)	FI Core Required to -40 ft MLLW	FI Core Collected
			East (X)	North (Y)			
C-1	1	08-17-91	1449390.19	520987.69	36.4	3.6	4.5
C-3	1	08-17-91	1450547.70	519752.43	36.0	4.0	4.0
C-5	1	06-17-91	1452379.27	518120.72	36.4	3.6	3.6
C-6	1	08-17-91	1453053.81	517926.81	38.3	3.7	4.7
C-8	1	08-17-91	1454896.38	517590.35	38.4	3.6	8.0
C-10	1	06-17-91	1456429.14	517239.72	38.0	4.0	4.7
C-29	1	06-18-91	1463334.18	518492.92	35.0	5.0	7.0
C-32	1	06-18-91	1463210.48	519097.77	35.3	4.7	7.5
C-36	1	06-18-91	1483135.89	520210.61	36.1	3.9	8.5
C-38	1	06-18-91	1463113.00	520633.36	38.1	3.9	6.9
C-37	1	06-18-91	1462458.57	520383.62	38.1	3.9	6.7
C-35	1	06-18-91	1462806.17	520008.19	36.2	3.8	6.5
C-33	1	06-18-91	1462559.19	519573.36	35.0	5.0	6.0
C-30	1	06-18-91	1462643.87	518940.33	35.3	4.7	6.0
C-26	1	06-18-91	1462783.48	517802.54	36.1	3.9	4.5
C-24	1	08-18-91	1462888.10	517210.83	36.0	4.0	4.6
C-25	1	06-18-91	1463471.95	517427.14	35.0	5.0	6.0
C-23	1	08-18-91	1463292.49	516419.86	32.8	7.2	7.2
C-11	1	08-19-91	1457318.48	517260.14	37.3	2.7	2.7
C-16	1	06-19-91	1459062.57	516947.11	36.2	3.8	4.5
C-18	1	06-19-91	1460733.61	516591.21	36.1	3.9	4.5
C-19	1	06-19-91	1461734.38	516529.59	35.9	4.1	6.0
C-20	1	06-19-91	1462470.03	516699.50	36.2	3.8	7.0
TC-5	1	06-19-91	1463563.33	518188.03	21.9	18.1	15.0
TC-7	1	06-19-91	1483615.40	516336.91	11.0	29.0	35.0
TC-6	1	06-19-91	1463754.99	516496.57	6.0	34.0	39.0
TC-1	1	06-19-91	1463870.76	516868.25	11.3	28.7	25.0
TC-2	1	06-20-91	1463762.30	517300.30	11.5	28.5	21.5
TC-4	1	06-20-91	1463681.45	517852.69	6.2	33.8	32.5
TC-3	1	06-20-91	1463728.93	517605.20	8.5	31.5	26.0

FIGURE 3.3. Locations of R-AC and R-AM Reference Sampling Stations, Richmond Harbor Program

FIGURE 3.4. Locations of R-BF Reference Sampling Stations, Richmond Harbor Program

channel, and seven long core samples (15 to 39 ft) were collected from the proposed turning basin (Potrero Reach). Sample station locations are presented in Figure 1.2. The core samples were geologically described according to ASTM Procedure D2488-84: "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." The following sediment characteristics were logged: dry strength of silt/clay, 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, 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 sediment cores is given in Appendix A. Detailed cores logs collected during Richmond Harbor sampling are provided in Appendix B.

FIGURE 3.5. Location of R-PF Reference Sampling Station, Richmond Harbor Program

TABLE 3.3. Information for Reference Sediment Sampling, Richmond Harbor Program

<u>Station</u>	<u>Replicate</u>	<u>Date Sampled</u>	<u>Time</u>	<u>Coordinates</u>		<u>Depth (-ft MLLW)</u>
				<u>Latitude(N)</u>	<u>Longitude (W)</u>	
<u>Alcatraz-Environs</u>						
R-AM-A	1	06-17-91	1240	37°49.81	122°25.86	54
R-AM-B	1	06-17-91	1300	37°49.72	122°25.43	64
R-AM-B	2	06-17-91	1310	37°49.73	123°25.48	50
R-AM-B	3	06-17-91	1330	37°49.72	122°25.38	77
R-AM-C	1	06-17-91	1355	37°49.87	122°25.07	70
R-AM-F	1	06-17-91	1415	37°49.13	122°24.29	84
R-AM-F	1	06-17-91	1440	37°49.35	122°24.84	82
R-AM-I	1	06-17-91	1503	37°48.98	122°24.73	78
R-AM-H	1	06-17-91	1529	37°48.89	122°25.50	48
R-AM-G	1	06-17-91	1542	37°48.83	122°26.13	72
R-AM-D	1	06-17-91	1615	37°49.35	122°25.95	71
<u>Alcatraz-Disposal</u>						
R-AC-1	1	06-17-91	1640	37°49.27	122°25.33	54
R-AC-3	1	06-17-91	1700	37°49.12	122°25.30	80
R-AC-6	1	06-17-91	1715	37°49.18	122°25.10	76
R-AC-8	1	06-17-91	1730	37°49.14	122°25.09	68
<u>Bay Farm</u>						
R-BF-2	1	06-17-91	1845	37°44.23	122°17.11	31
R-BF-3	1	06-17-91	1905	37°44.48	122°16.76	34
R-BF-4	1	06-17-91	1925	37°44.67	122°16.97	30
R-BF-5	1	06-17-91	1945	37°44.57	122°16.19	33
<u>Point Reyes</u>						
R-PF	1	06-18-91	1105	37°54.05	122°57.00	222
R-PF	2	06-18-91	1123	37°54.05	122°57.01	222
R-PF	3	06-18-91	1140	37°54.02	122°57.01	223
<u>Deep Offshore Site</u>						
R-OS	1	06-18-91	1550	37°25.03	123°14.84	4200 test
R-OS	2	06-18-91	1700	37°24.87	123°14.96	4192
R-OS	3	06-18-91	1820	37°24.98	123°14.90	4200

FIGURE 3.6. Location of C-SB Control Station, Richmond Harbor Program

FIGURE 3.7. Location of C-WB Control Station, Richmond Harbor Program

FIGURE 3.8. Location of C-NE Control Station, Richmond Harbor Program

Two geologic units have been identified in the Richmond Harbor Program area: Older Bay Mud (OBM) and Younger Bay Mud (YBM) (USACE 1975a). The firm to hard OBM sediments include both estuarine and terrestrial deposits; the soft, dark YBM sediments are marine deposits.

The OBM and YBM are distinguished from each other on the basis of consistency and color. The OBM sediments are firm to hard in consistency and are various shades of red, brown, yellow, or gray; whereas the YBM sediments are generally very soft in consistency and dark gray to black in color. The OBM and YBM are described in detail below.

3.2.1 Older Bay Mud

The OBM unit consists of a wide range of deposits ranging from loose pebbly sands to stiff, cohesive silty clays. The OBM unit was probably deposited during the last glacial period when sea level resided as much as 335 ft below its present level (USACE 1975b, 1979). Some of the unit may have been deposited during previous glacial and interglacial periods.

The terrestrial sediments of the OBM unit are various shades of red, yellow, and brown; implying deposition in oxidizing environments such as rivers, streams, and deltas. The presence of deeply penetrating root traces also suggests deposition in a terrestrial environment. The marine portions of the OBM unit consist of fine-grained deposits that are olive and gray in color, indicating a low energy, chemically reducing environment.

The high degree of compaction and consolidation of the OBM implies that this unit is much older than the overlying YBM unit. The highly oxidized and weathered nature of the OBM, in combination with the presence of root traces, calcium-carbonate, and iron oxide nodules, suggest the OBM unit locally underwent subaerial alteration where portions of the bay lay above sea level.

In the Richmond Harbor Program area, the OBM is composed primarily of estuarine deposits of clay to silty or sandy clay with occasional lenses and thin beds of sand. The OBM sediments are firm to hard in consistency and brown or gray in color and have no odor. Traces of organic matter were observed in 10 cores. Four to 6 ft of silty sand was encountered at -32 ft MLLW in cores from the turning basin stations TC-1 through TC-4. The sand unit was green to brown in color, contained rounded and angular pebbles, and exhibited stratification and graded bedding. Nodules of calcium carbonate were observed in samples from stations C-29, C-32, C-35, C-36, C-38, and TC-3, which are all located within the Inner Harbor Channel. Nodules of

iron oxide were observed in samples from stations C-18, C-19, C-25, C-37, TC-1, TC-2, and TC-4, which are located in the Potrero Reach (and the proposed turning basin). These iron oxide areas appear to have experienced post-depositional subaerial alteration.

3.2.2 Younger Bay Mud (YBM)

The YBM forms a continuous blanket across the harbor bottom, except where it has been removed by dredging. The YBM was deposited as sea level rose following the last ice age, which ended approximately 12,000 years ago (Barry 1983). The YBM unit is also present above sea level inland from the present bay (USACE 1975a), suggesting that either sea level was higher at times in the past or recent uplift (i.e., tectonic) of the land surface has occurred.

The YBM unit consists mostly of very soft to soft silty clays and clayey silts with minor amounts of organic matter, fine sand, and shell fragments (USACE 1975a). The YBM sediments are dark gray to black in color. The dark color and odor of hydrogen sulfide are consistent with deposition in chemically reducing conditions. Shells and shell fragments were commonly observed in YBM sediments, and a concentrated layer of oyster shells was identified at stations TC-3 and TC-4 at approximately -20 ft MLLW. A layer of silty to gravelly sand was identified at stations C-6 and C-10 at approximately -40 ft MLLW. The sand layer contains shells and was laminated or cross-laminated at Station TC-6, consistent with deposition in a deltaic environment. The thickness and extent of the sand layer is unknown.

The USACE (1975a) subdivided the YBM 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 overlying sediments. The primary unit identified at the Richmond Harbor area is the Soft Bay Mud member; however, the Semi-Consolidated Bay Mud member was tentatively identified at stations TC-2 and TC-3.

Geologic cross sections representing the composite areas shown in Figure 3.9 are constructed from sediment sample core logs that depict the distribution of the OBM and YBM in the Richmond Harbor Program area. Figure 3.10 shows an east/west cross section representing the geology of the entrance channel. As seen in the figure, the OBM was not encountered west of Station C-16. Figures 3.11 and 3.12 show north/south cross sections representing the Inner Harbor Channel. In contrast to the entrance channel, Inner Harbor Channel cross sections consisted primarily of OBM. The OBM was encountered at approximately -39 to -40 ft MLLW; the overlying YBM was generally less than 5 ft thick, which may have accumulated since the channel was last dredged. The YBM increases dramatically in the turning circle portion of

FIGURE 3.9. Geologic Cross Section Map of the Richmond Harbor Area

3.17

FIGURE 3.10. Cross Section A-A', Richmond Harbor Program

FIGURE 3.11. Cross Section B-B', Richmond Harbor Program

FIGURE 3.12. Cross Section C-C', Richmond Harbor Program

the channel where dredging has not occurred. Figure 3.13 shows a north/south cross section representing the turning circle. Here, the YBM was the dominant unit, shown by the fact that OBM was not encountered at stations C-23, C-24, TC-6, or TC-7. The cross section shows the YBM has a thickness of approximately 40 ft, which may represent a filled paleochannel downcut into the OBM unit. Figure 3.14 shows a cross section roughly perpendicular to the opening of the Inner Harbor Channel. Stations in this cross section consisted primarily of YBM down to -40 ft MLLW. The contact of OBM and YBM in this cross section is irregular.

3.3 SEDIMENT CHEMISTRY

Forty-three individual sediment samples, 6 COMPs, 5 references, and 3 controls, were composited into 57 sediment treatments that were analyzed for physical and chemical parameters. Table 3.4 indicates how each sediment treatment was evaluated through sediment chemistry, solid-phase testing, bioaccumulation, and SPP testing. The chemical parameters included grain size, TOC, TVS, oil and grease, TPH, PAH, pesticides, PCBs, metals, and butyltins. Sediment chemistry results are reported in dry weight and complete chemistry results and quality control information are presented in Appendix C. The acceptable QA/QC criteria for sediments are listed in Table 2.1 and the summaries are in Appendix C.

3.3.1 Conventional Sediment Measurements

Conventional sediment measurements include grain size, TOC, TVS, oil and grease, and TPH. Grain size, TOC, and TVS are expressed as a percent of the sample dry weight. Oil and grease and TPH concentrations are expressed as mg/kg dry weight. A summary of sediment conventional measurements is shown in Table 3.5.

Richmond Harbor grain size results are presented in Table 3.5 and Figure 3.15. The majority of stations contained fine-grained sediments with $\geq 50\%$ belonging to the silt and clay fractions. The grain size distribution of sediment in COMPs I, II, III, V, and VI represented a mixture of OBM and YBM in their respective stations. COMP IV on the other hand, primarily represented the deeper OBM unit and contained equal amounts of sand, silt, and clay. An exception in COMP IV was Station TC-2 and was predominantly silt and clay (the sand layer began at 36 ft). The specific length and placement of the sand layer is depicted in the core logs in Appendix B.

Individual stations TC-6 and TC-7 represented core lengths of 39 and 35 ft, respectively. Each core was divided into four sections based on grain size characteristics. Sections (1), (2),

FIGURE 3.13. Cross Section D-D', Richmond Harbor Program

FIGURE 3.14. Cross Section E-E' Across the Richmond Harbor Inner Channel, Richmond Harbor Program

Table 3.4. Summary of Sediment Treatments for Testing, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mudline (-ft MLLW)</u>	<u>Description</u>	<u>Sediment Chemistry</u>	<u>Solid-Phase Testing</u>	<u>SPP Testing</u>
COMP I	NA(a)	Mudline to -40 ft MLLW from 12-in. core sections of C-1, C-3, C-5, C-6, C-8, C-10	YES	YES	YES
C-1	36.4	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-3	36.0	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-5	36.4	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-6	36.3	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-8	36.4	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-10	36.0	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
COMP II	NA	Mudline to -40 ft MLLW from 12-in. core sections of C-11, C-16, C-18, C-19, C-20, C-23	YES	YES	YES
C-11	37.3	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-16	36.2	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-18	36.1	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-19	35.9	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-20	36.2	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-23	32.8	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
COMP III	NA	Taken from upper 12-in. core sections of TC-1, TC-2, TC-3, TC-4	YES	YES	YES
TC-1 Upper	11.3	Mudline to -21.3 ft MLLW from 4-in. core	YES	NO	NO
TC-2 Upper	11.5	Mudline to -15.3 ft MLLW from 4-in. core	YES	NO	NO
TC-3 Upper	8.5	Mudline to -24.3 ft MLLW from 4-in. core	YES	NO	NO
TC-4 Upper	6.2	Mudline to -17.0 ft MLLW from 4-in. core	YES	NO	NO
TC-5 Upper Comp	NA	Upper Comp taken from Mudline to -36.5 ft MLLW of a 12-in. core	YES	YES	YES
TC-5 Upper	21.9	Mudline to -34.0 ft MLLW from 4-in. core	YES	NO	NO
TC-5 Special Sample	NA	Sample taken from -30.2 ft to 32.7 ft MLLW of a 4-in. core	YES	NO	NO

TABLE 3.4. (contd)

Sediment Treatment	Mudline (-ft MLLW)	Description	Sediment Chemistry	Solid-Phase Testing	SPP Testing
COMP IV	NA	Taken from lower 12-in. core sections of TC-1, TC-2, TC-3, TC-4, TC-5	YES	YES	YES
TC-1 Lower	11.3	21.3 ft to -36.5 ft MLLW from 4-in. core	YES	NO	NO
TC-2 Lower	11.5	15.3 ft to -32.1 ft MLLW from 4-in. core	YES	NO	NO
TC-3 Lower	8.5	24.3 to -34.3 ft MLLW from 4-in. core	YES	NO	NO
TC-4 Lower	6.2	17.0 to -38.8 ft MLLW from 4-in. core	YES	NO	NO
TC-5 Lower	21.9	36.5 ft to -39.6 ft MLLW from 4-in. core	YES	NO	NO
COMP V	NA	Mudline to -40 ft MLLW from 12-in. cores from C-24, C-26, C-30, C-33, C-35, C-37	YES	YES	YES
C-24	36.0	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-26	36.1	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-30	35.3	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-33	35.0	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-35	36.2	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-37	36.1	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
COMP VI	NA	Mudline to -40 ft MLLW from 12-in. cores from C-25, C-29, C-32, C-36, C-38	YES	YES	YES
C-25	35.0	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-29	35.0	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-32	35.3	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-36	36.1	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
C-38	36.1	Mudline to -40 ft MLLW from 4-in. core	YES	NO	NO
TC-6 (1)	6.0	Mudline to -9.0 ft MLLW from 4-in. core	YES	NO	NO
TC-6 (2)	9.0	Mudline to -32.0 ft MLLW from 4-in. core	YES	NO	NO
TC-6 (3)	32.0	Mudline to -33.5 ft MLLW from 4-in. core	YES	NO	NO
TC-6 (4)	33.5	Mudline to -40.0 ft MLLW from 4-in. core	YES	NO	NO

TABLE 3.4 (contd)

Sediment Treatment	Mudline (-ft MLLW)	Description	Sediment Chemistry	Solid-phase Testing	SPP Testing
TC-7 (1)	11.0	Mudline to -21.0 ft MLLW from 4-in. core	YES	NO	NO
TC-7 (2)	21.0	Mudline to -33.0 ft MLLW from 4-in. core	YES	NO	NO
TC-7 (3)	33.0	Mudline to -34.7 ft MLLW from 4-in. core	YES	NO	NO
TC-7 (4)	34.7	Mudline to -40.0 ft MLLW from 4-in. core	YES	NO	NO
R-AC	NA	Alcatraz Disposal Site Reference	YES	YES	NO
R-AM	NA	Alcatraz Island Environs Reference	YES	YES	NO
R-BF	NA	Bay Farm Borrow Area Reference	YES	YES	NO
R-OS	NA	Deep Off-Shelf Reference	YES	YES	NO
R-PF	NA	Point Reyes Fine Reference	YES	YES	NO
C-SB	NA	Sequim Bay Control	YES	YES	NO
C-WB	NA	<i>R. abronius</i> Native Control (West Beach)	YES	YES	NO
C-NE	NA	<i>N. caecoides</i> Native Control (Tomales Bay)	YES	YES	NO

(a) NA Not applicable.

TABLE 3.5. Conventional Sediment Measurement Results (grain size, TOC, and TVS in percent dry weight; Oil and Grease and TPH in mg/kg dry weight)

Sediment Treatment	Gravel ≥2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay ≤3.9 μm	TOC	TVS	Oil and Grease	TPH
COMP I	0	9	45	46	0.99	6.10	63.22	41.39
C-1	0	23	42	35	0.80	4.75	91.26	68.41
C-3	0	12	44	44	0.93	5.52	89.17	65.03
C-5	0	5	51	44	1.01	5.68	144.92	92.66
C-6	0	4	46	50	1.09	6.12	108.89	88.21
C-8	0	1	41	58	1.18	6.55	132.45	104.76
C-10	0	4	45	51	1.08	5.90	151.75	115.92
COMP II	0	8	44	48	0.73	5.49	118.30	91.00
C-11	0	1	41	58	1.14	6.46	99.86	76.06
C-16	0	25	34	41	0.59	3.98	93.04	74.71
C-18	3	13	39	45	0.81	4.73	124.58	95.91
C-19	0	20	49	31	0.28	3.38	42.91	27.30
C-20	7	28	29	36	0.67	4.66	103.58	78.82
C-23	0	3	45	52	0.74	4.54	65.91	46.08
COMP III	2	11	54	33	0.68	3.65	44.06	26.74
TC-1 Upper	0	3	57	40	0.79	3.96	90.29	34.60
TC-2 Upper	0	8	49	43	0.90	5.19	132.78	79.16
TC-3 Upper	0	6	65	29	0.59	3.03	37.83	19.54
TC-4 Upper	5	12	57	26	0.54	2.37	73.52	16.77
TC-5 Upper Comp	0	10	43	47	0.91	5.00	311.19	281.16
TC-5 Upper Rep 1	0	8	45	47	0.93	5.14	297.24	256.11
TC-5 Upper Rep 2	0	8	44	48	0.94	5.09	230.74	189.60
TC-5 Upper Rep 3	0	8	43	49	0.96	5.09	418.34	350.10
TC-5 Special Sample	0	5	45	50	1.07	5.65	18.83	10.99

TABLE 3.5. (contd)

Sediment Treatment	Gravel ≥2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay ≤3.9 μm	TOC	TVS	Oil and Grease	TPH
COMP IV	3	26	43	28	0.39	3.32	19.06	10.50
TC-1 Lower	7	21	39	33	0.43	3.00	9.80	5.67
TC-1 Lower Dup	NM(a)	NM	NM	NM	0.42	NM	NM	NM
TC-2 Lower	3	9	47	41	0.60	3.45	24.30	13.27
TC-3 Lower	12	48	22	18	0.26	2.07	13.03	8.58
TC-3 Lower Dup	NM	NM	NM	NM	0.28	NM	NM	NM
TC-4 Lower	3	30	40	27	0.25	2.22	14.14	8.10
TC-5 Lower	3	30	39	28	0.41	2.50	24.65	7.79
COMP V	1	2	34	63	1.08	6.38	186.23	141.25
C-24	0	2	39	59	0.79	4.96	76.55	54.99
C-26	1	6	37	56	1.01	5.93	138.15	107.13
C-30	0	3	38	59	1.06	6.26	218.95	174.70
C-30 Dup	NM	NM	NM	NM	1.06	NM	NM	NM
C-33	0	3	37	60	0.92	6.06	100.39	83.05
C-35	0	5	41	54	0.84	5.52	151.47	119.79
C-37	0	16	41	43	0.60	4.77	263.31	150.44
COMP VI	0	3	36	61	1.03	6.52	252.06	185.70
C-25	0	16	41	43	0.49	4.06	76.89	63.25
C-29	0	6	51	43	0.57	4.61	91.93	72.97
C-29 Dup	NM	NM	NM	NM	0.59	NM	NM	NM
C-32	0	2	54	44	0.60	4.74	167.80	140.78
C-32 Dup	NM	NM	NM	NM	0.60	NM	NM	NM
C-36	0	5	40	55	0.89	5.62	223.76	180.06
C-38	1	6	45	48	0.59	4.65	118.09	101.70
TC-6 (1)	2	11	50	37	0.79	4.48	37.60	25.13
TC-6 (2)	0	3	61	36	0.71	3.56	27.74	14.43
TC-6 (3)	1	77	11	11	0.15	1.53	5.64	2.63
TC-6 (4)	0	10	45	45	0.56	3.50	15.57	9.01

TABLE 3.5. (contd)

Sediment Treatment	Gravel ≥2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay ≤3.9 μm	TOC	TVS	Oil and Grease	TPH
TC-7 (1)	0	3	60	37	0.81	3.63	27.50	24.48
TC-7 (2)	0	2	59	39	0.72	3.62	62.33	20.42
TC-7 (3)	0	67	18	15	0.23	1.68	6.50	5.68
TC-7 (4)	0	14	45	41	0.54	3.33	16.87	15.21
R-AC	0	65	17	18	0.38	2.95	59.07	27.81
R-AM Rep 1	0	95	2	3	0.06	0.98	12.97	6.79
R-AM Rep 2	0	95	2	3	0.06	1.02	11.92	6.77
R-AM Rep 3	0	95	2	3	0.06	0.98	9.99	5.77
R-BF Rep 1	0	12	35	53	1.00	6.28	73.70	50.64
R-BF Rep 2	0	12	34	54	1.04	6.09	101.51	73.76
R-BF Rep 3	0	12	34	54	0.96	5.86	134.35	126.51
R-OS Rep 1	0	16	62	22	1.39	5.74	39.26	17.09
R-OS Rep 2	NM	NM	NM	NM	1.49	NM	NM	NM
R-PF	0	57	37	6	0.41	2.08	37.61	3.72
C-SB	0	9	60	31	2.15	7.81	172.93	47.89
C-WB Rep 1	0	99	0	1	0.06	0.69	30.75	6.96
C-WB Rep 2	NM	NM	NM	NM	0.06	NM	NM	NM
C-NE	0	98	1	1	0.06	0.87	13.58	4.90

(a) NA Not measured.

FIGURE 3.15. Grain Size Distribution in Sediment Treatments

and (4) at both stations were categorized as silt and/or clay, while section (3) consisted of a layer of sand and mollusk shells.

The reference treatments were primarily sand ($\geq 57\%$) with the exception of R-BF, which was 12% sand and 88% silt and clay, and R-OS, which was 16% sand and 84% silt and clay. Control treatments C-NE and C-WB were $\geq 98\%$ sand, while C-SB was 9% sand and 91% silt and clay material.

The QA/QC requirements were met for grain size analysis and are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix C.

The QA/QC requirements were met for TOC analysis and are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix C.

3.30

FIGURE 3.17. Linear Regression of TOC and Fine-Grained Sediment

FIGURE 3.18. Concentrations of TVS in Sediment Treatments

FIGURE 3.19. Linear Regression of TVS and Fine-Grained Sediment

A positive correlation is also observed for TVS and TOC in Figure 3.20. Generally, as the percentage of TOC increased, so did the percentage of TVS. Two exceptions, R-OS and C-SB, had higher amounts of TVS than predicted by the TOC content.

The QA/QC requirements were met for TVS and are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix C.

Oil and grease and TPH concentrations are shown in Figures 3.21 and 3.22. Oil and grease concentrations in the test treatments ranged from 5.64 mg/kg at TC-6(3) to 418.34 mg/kg at TC-5 Upper Rep 3. The concentrations of oil and grease in the reference and control treatments ranged from 9.99 mg/kg at R-AM Rep 3 to 172.93 mg/kg at C-SB. The concentrations of TPH in the test treatments ranged from 2.63 mg/kg at TC-6(3) to 350.10 mg/kg at TC-5 Upper Rep. 3. In the reference and control treatments, TPH ranged from 3.72 mg/kg at R-PF to 126.51 mg/kg at R-BF Rep 3. Test treatment TC-6(3) had the lowest oil and grease and TPH levels, possibly attributed to its coarse grain size (sand) in contrast to the other sediment treatments. Treatments with the highest concentrations of oil and grease also had the highest concentrations of TPH (Figure 3.23). The exception to this correlation is C-SB, which contains a high TOC value and substantially more oil and grease relative to TPH, suggesting that the TOC is not petroleum based.

FIGURE 3.20. Linear Regression of TOC and TVS

FIGURE 3.21. Concentrations of Oil and Grease in Sediment Treatments

FIGURE 3.22. Concentrations of TPH in Sediment Treatments

FIGURE 3.23. Linear Regression of TPH and Oil and Grease

The QA/QC requirements were met for oil and grease and TPH with the exception of some MS/MSD results. Overall analytical performance was acceptable and those data are appropriate for use in analysis. A detailed QA/QC summary is presented in Appendix C.

3.3.2 Polynuclear Aromatic Hydrocarbons

Sixteen PAH compounds were analyzed in Richmond Harbor sediment treatments. The results and quality control data are reported in two groups based on molecular weight. The low molecular weight compounds (LPAH) are naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The high molecular weight compounds (HPAH) are chrysene, fluoranthene, pyrene, benzo(a)anthracene, benzo(b)- and benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

The results of LPAH and HPAH are shown in Figure 3.24. Concentrations of LPAHs ranged from 10.9 to 810.27 $\mu\text{g/kg}$ dry weight, while concentrations of HPAHs ranged from 0 to 5696.86 $\mu\text{g/kg}$ dry weight. Complete results of PAH analysis, quality control data, and a quality control summary are contained in Appendix C, Tables 1 through 6. HPAHs comprised a greater fraction of total PAH in 46 out of the 57 sediment treatments. The 11 sediment treatments where LPAHs were higher included the COMP IV treatments, TC-3 Lower, TC-6 and TC-7, and control treatments C-WB and C-NE. Most of the higher LPAH treatments contained >10% coarser grain size fractions and were representative of the deeper cores. Figure 3.25 is a linear regression comparing the LPAHs to the total HPAHs. Reference treatment R-AC had a substantially higher contribution of HPAH than expected.

The QA/QC requirements were met for PAH with the exception of a few MS/MSD and surrogate recoveries. The overall QA/QC results are acceptable for use in analysis, though the estimates of pyrene concentrations may be high for selected stations. A detailed QA/QC summary is presented in Appendix C.

3.3.3 Chlorinated Pesticides and Polychlorinated Biphenyls

Three pesticides were detected in sediment treatments from Richmond Harbor as shown in Figures 3.26, 3.27, and 3.28. These three compounds were found at the highest concentrations in test treatments C-38 (4,4'-DDD), C-36 (4,4'-DDE), and COMP VI (4,4'-DDT). (Note that sediment treatments C-38 and C-36 are two of the stations comprising COMP VI.) Reference treatment R-BF had the highest 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT levels of any reference treatment, with values of 8.0 $\mu\text{g/kg}$, 1.6 $\mu\text{g/kg}$, and 7.3 $\mu\text{g/kg}$, respectively. Aroclor 1254 was

FIGURE 3.24. Concentrations of Total PAH in Sediment Treatments (Reference treatment R-AC had a concentration of 6304.43 µg/kg, which is above the vertical axis of the figure.)

the only detected PCB in the Richmond Harbor sediment treatments (Figure 3.29). Detected concentrations ranged from 6.0 µg/kg at R-AC to 64 µg/kg at TC-7(4). The two test treatments with the highest levels of pesticides and PCBs had predominantly fine-grained sediments with relatively high TOC, oil and grease, and TPH.

The QA/QC requirements were met for the majority of PCB and pesticides analyzed, indicating these data are acceptable for use in analysis, though the levels reported for the pesticides Endrin, 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE may be overestimated. A detailed QA/QC summary is presented in Appendix C.

FIGURE 3.25. Linear Regression of LPAH and HPAH

FIGURE 3.26. Concentrations of 4,4'-DDD in Sediment Treatments

FIGURE 3.27. Concentrations of 4,4'-DDE in Sediment Treatments

FIGURE 3.28. Concentrations of 4,4'-DDT in Sediment Treatments

FIGURE 3.29. Concentrations of Aroclor 1254 in Sediment Treatments

3.3.4 Metals

Ten metals were measured in sediments from Richmond Harbor. These are reported in mg/kg (ppm) dry weight. Complete results, quality control data, and a quality control summary are contained in Appendix C, Tables 14 and 15. Figures 3.30 through 3.38 provide a comparison of metals concentrations in test treatments and reference treatments. Comparison with metals concentrations in typical shale soil is also provided because these metals are ubiquitous in the natural environment. The metals concentrations in shale soil are reported by Krauskopf (1967).

Concentrations of silver (Ag) in the reference treatments ranged from 0.033 mg/kg at R-AM to 0.501 mg/kg at R-OS. Concentrations in the test treatments ranged from 0.078 mg/kg in TC-6(3) to 1.299 mg/kg in TC-5 Special Sample. A 40-fold difference was observed between the reference treatment (R-AM) and the test treatment (TC-5 Special Sample). Six test treatments had values higher than R-OS (Figure 3.30). Three test treatments, two reference treatments, and two control treatments had Ag values below that of typical shale soil (0.1 mg/kg dry weight) (Krauskopf 1967).

Concentrations of chromium (Cr) in the reference treatments ranged from 172 mg/kg at R-OS to 438 mg/kg at R-AC. Concentrations of Cr in test treatments ranged from 156 mg/kg at C-19 to 320 mg/kg at TC-1 Lower (Figure 3.33). A twofold difference was observed between the reference treatment (R-OS) and the test treatment (TC-1 Lower). All test, reference, and control treatments were above the shale soil Cr concentration of 100 mg/kg (Krauskopf 1967).

FIGURE 3.31. Concentrations of Arsenic in Sediment Treatments

FIGURE 3.32. Concentrations of Cadmium in Sediment Treatments (Reference treatment R-PF had a concentration of 2.297 mg/kg, which is above the vertical axis of the figure.)

Mercury (Hg) concentrations in test treatments ranged from 0.052 mg/kg at TC-7(1) to 1.431 mg/kg at TC-5 Special Sample (Figure 3.35). Twelve test treatments exceeded the highest reference treatment, which was R-BF (0.427 mg/kg). Fourteen Richmond Harbor test treatments and one reference treatment exceeded the shale soil Hg value of 0.4 mg/kg (Krauskopf 1967).

3.42

Selenium (Se) was detected in 12 test treatments with concentrations ranging from 0.82 mg/kg at C-26 to 1.44 mg/kg at TC-5 Upper Comp. Selenium was undetected in all of the references except R-OS, which had a value of 2.57 mg/kg, the highest Se value of any treatment. All of the sediment treatments with detected values of Se were above the typical shale soil value of 0.6 mg/kg (Krauskopf 1967).

Concentrations of zinc (Zn) in the references ranged from 35.1 mg/kg (R-AM) to 139.1 mg/kg (R-BF). The test treatments ranged from 35.2 mg/kg [TC-6(3)] to 260 mg/kg (TC-5 Special Sample) (Figure 3.38). A sevenfold difference was observed between reference treatment (R-AM) and test treatment (TC-5 Special Sample). Six test treatments, three references, and two controls had values below the concentration of Zn typically found in shale soil (80 mg/kg) (Krauskopf 1967).

FIGURE 3.37. Concentrations of Lead in Sediment Treatments

FIGURE 3.38. Concentrations of Zinc in Sediment Treatments

The QA/QC requirements were met for the majority of metals analyzed. The overall QA/QC results show that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix C.

3.3.5 Butyltins

Monobutyltin (MBT) concentrations were detected at TC-5 Upper Rep 3 at 4 (J) $\mu\text{g/kg}$ and at 19 $\mu\text{g/kg}$ in TC-5 Special Sample. Monobutyltin was undetected in control and reference treatments. Dibutyltin (DBT) concentrations ranged from 0.3 $\mu\text{g/kg}$ at TC-1 lower, TC-4 lower, and TC-7(3) to 11.4 $\mu\text{g/kg}$ at TC-5 Upper Rep 3 (Figure 3.39), a 38-fold difference. Dibutyltins concentrations in references ranged from 0.5 (J) at R-OS to 5.4 $\mu\text{g/kg}$ at R-AC. TC-5 Upper Reps 1, 3, and C-16 were the only test treatments with DBT values above R-AC. Tributyltin (TBT) concentrations ranged from 0.3 $\mu\text{g/kg}$ at TC-4 Upper to 23.5 $\mu\text{g/kg}$ at C-16 (Figure 3.40), a 78-fold difference. References R-BF and R-AC were the only two references with detected levels of TBT (1.9 $\mu\text{g/kg}$ and 16.2 $\mu\text{g/kg}$, respectively).

The QA/QC requirements were met for the majority of butyltins analyzed. The QA/QC results show that these data are acceptable for use in data analysis. A detailed QA/QC summary is presented in Appendix C.

3.4 TOXICOLOGICAL TESTING RESULTS

Solid-phase tests were conducted to evaluate the toxicity of seven Richmond Harbor test treatments (COMPS I through VI and TC-5 Upper Comp) relative to five reference treatments. In addition, two control treatments were used to validate the tests through examination of test organism survival. The solid-phase tests conducted with these sediments were a 10-day flow-through solid-phase test with the polychaete *N. caecoides* and the bentnose clam *M. nasuta* (acute toxicity), a 28-day flow-through solid-phase test with *N. caecoides* and *M. nasuta* (bioaccumulation exposure), and a 10-day static solid-phase test with the amphipod *R. abronius* (acute toxicity). The 10-day tests were considered valid if 90% or greater survival of test organisms occurred in native control treatment. After the tests were inspected for validity, the data were evaluated by ANOVA and Dunn's Modification to Tukey's HSD Test to determine if significant differences occurred between test treatments when compared to the five reference treatments (Section 2.5.2).

Suspended-particulate-phase tests were conducted concurrently with the solid-phase tests and included three marine species: the mysid shrimp *H. sculpta*, juvenile speckled

FIGURE 3.39. Concentrations of Dibutyltin in Sediment Treatments

FIGURE 3.40. Concentrations of Tributyltin in Sediment Treatments

sanddab *C. stigmaeus*, and larvae of the mussel *M. edulis*. The SPP tests were conducted with COMPs I through VI and TC-5 Upper Comp, using four concentrations [0% (seawater), 10%, 50%, and 100% SPP]. The SPP preparation is described in Section 2.2.3 and the toxicological testing procedures are discussed in Section 2.4.2. For each SPP test, control survival and water quality results were evaluated to validate the test. Survival values for the controls and 100% SPP treatments were compared using an independent, two-sample t-test. If the result was significant ($\alpha = 0.1$), and at least 50% reduction in survival of the 100% SPP relative to control was noted, LC50 and/or EC50 estimates were determined using the Trimmed Spearman-Kärber method.

3.4.1 10-Day Flow-Through Solid-Phase Test with *M. nasuta* and *N. caecoides*

The 10-day *M. nasuta* and *N. caecoides* solid-phase tests were validated by 100% survival of *M. nasuta* in the native control treatment C-SB, and 95% survival of *N. caecoides* in the native control treatment C-NE.

Mean survival of *M. nasuta* was 96% or greater in the seven Richmond Harbor test treatments and five reference treatments. The ANOVA and Dunn's Test showed no significant differences between test and reference treatments for the proportion (arcsine square-root transformation) of organisms surviving. Summary of the results from the ANOVA and Dunn's Modification to Tukey's HSD Test are shown in Tables 3.6 and 3.7.

Mean survival of *N. caecoides* ranged from 73% in COMP IV to 100% in the control treatment C-SB. The results from Dunn's Test for the proportion surviving (arcsine square-root transformation) (Table 3.8) showed test treatments COMP IV, TC-5 Upper Comp, and COMP III were statistically significantly different from R-BF and R-OS, and had a >10% difference in percent survival. The ANOVA results indicate statistically significant differences between the 12 test and reference treatments (Table 3.9).

3.4.2 28-Day Flow-Through Solid-Phase Test with *M. nasuta* and *N. caecoides*

The purpose of the 28-day solid-phase test using *M. nasuta* and *N. caecoides* was to provide results associated with the bioaccumulation potential of specific test treatments. The results of the *M. nasuta* and *N. caecoides* 28-day toxicological tests are presented in Table 3.10 and Appendix E. The tests were validated for both species by *M. nasuta* survival of 95% in the control treatment C-SB and *N. caecoides* survival of 95% in the control treatment C-NE.

TABLE 3.6. Results of Dunn's Test for the 10-Day Solid-Phase Flow-Through Test with *M. nasuta*

<u>Sediment Treatment</u>	<u>Mean Percent Survival</u>	<u>Statistical Grouping^(b)</u>
COMP IV	97.6	A
COMP II	96.0	A
R-PF	98.0	A
R-AM	98.0	A
R-BF	98.0	A
R-OS	99.0	A
COMP VI	99.0	A
R-AC	99.0	A
COMP III	99.0	A
COMP I	100.0	A
TC-5 Upper Comp	100.0	A
COMP V	100.0	A
C-SB	100.0	NA ^(a)
C-NE	99.0	NA

(a) NA Control treatments not included in statistical analysis.

(b) All of the test and reference were not statistically significant from each other as denoted by the common letter A in the statistical grouping column.

TABLE 3.7. ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with *M. nasuta*

<u>Source Variation</u>	<u>Sum of Squares</u>	<u>d.f. ^(a)</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Between Groups	0.088	11	0.008	0.626	0.7975
Within Groups	0.614	48	0.013		

(a) d.f. Degrees of freedom.

TABLE 3.8. Results of Dunn's Test for the 10-Day Solid-Phase Flow-Through Test with *N. caecoides*

<u>Sediment Treatment</u>	<u>Mean Percent Survival</u>	<u>Statistical Grouping^(a)</u>
COMP IV	73.0	A
TC-5 Upper Comp	79.0	A
COMP III	79.0	AB
COMP II	89.0	ABC
R-AC	91.0	ABC
COMP VI	91.0	ABC
COMP V	93.0	ABC
R-AM	93.0	ABC
COMP I	91.0	ABC
R-BF	92.0	ABC
R-OS	95.0	BC
R-PF	97.4	C
C-SB	100.0	NA ^(b)
C-NE	97.0	NA

(a) Test treatments COMP IV and TC-5 Upper Comp were statistically significant from R-OS because they do not have a letter B or C in the statistical grouping column; test treatments Comp IV, TC-5 Upper Comp, and Comp III were statistically significant from R-PF because they do not have a letter C in the statistical grouping column.

(b) NA Control treatments not included in statistical analysis.

TABLE 3.9. ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with *N. caecoides*

<u>Source Variation</u>	<u>Sum of Squares</u>	<u>d.f.^(a)</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Between Groups	0.817	11	0.074	3.924	0.0004
Within Groups	0.908	48	0.019		

(a) d.f. Degrees of freedom.

TABLE 3.10. Results of the 28-Day Solid-Phase Flow-Through Test with *M. nasuta* and *N. caecoides*

<u>Sediment Treatment</u>	<u>Mean Percent Survival of <i>M. nasuta</i></u>	<u>Mean Percent Survival of <i>N. caecoides</i></u>
COMP I	92.0	89.0
COMP II	89.6	93.5
COMP III	92.8	88.5
TC-5 Upper Comp	84.0	85.0
COMP IV	84.8	77.0
COMP V	90.4	90.5
COMP VI	87.2	96.5
R-AC	91.2	92.0
R-AM	89.6	94.5
R-BF	88.8	82.5
R-OS	91.2	97.5
R-PF	89.6	97.5
C-SB	95.0	95.0
C-NE	90.0	95.0

3.4.3 10-Day Static Solid-Phase Test with *R. abronius*

Results of the 10-day *R. abronius* test were validated by a 100% mean survival in the control treatment C-WB. Mean percent survival for the 10-day *R. abronius* test ranged from 58% in COMP III to 100% in C-WB. The ANOVA and Dunn's Test results (Tables 3.11 and 3.12) showed a significant difference in COMP III. COMP III had >10% reduction in percent survival when compared to the reference treatments R-BF and R-AM.

The results of the *R. abronius* reference toxicant test using a Cd standard were analyzed using the Trimmed Spearman-Kärber method (Section 2.5.3). The LC50 was estimated at 1.09 mg/L, indicating that a 50% decrease in survival was expected at that concentration. This LC50 is similar to those estimated during previous tests, suggesting that the *R. abronius* used for Richmond Harbor testing showed a similar sensitivity to Cd.

3.4.4 96-h Static Suspended-Particulate-Phase Test with *C. stigmaeus*

The 96-h *C. stigmaeus* SPP test was validated by greater than 90% mean survival in control treatments (Table 3.13). Greater than 90% mean survival was found in all 100% SPP treatments except for the sediment from TC-5 Upper Comp, which averaged 23% survival. The *C. stigmaeus* used in TC-5 Upper Comp were preserved in the event that a histopathological

TABLE 3.11. Results of Dunn's Test for the 10-Day Solid-Phase Static Test with *R. abronius*

<u>Sediment Treatment</u>	<u>Mean Percent Survival of <i>R. abronius</i></u>	<u>Statistical Grouping</u>
COMP III	58.0	A
R-OS	66.0	AB
R-AC	75.0	AB
COMP IV	76.0	AB
COMP I	77.0	AB
COMP II	80.0	AB
R-BF	82.0	AB
TC-5 Upper Comp	82.0	AB
COMP VI	83.0	AB
COMP V	87.0	AB
R-BF	88.0	B
R-AM	90.0	B
C-SB	88.0	NA(a)
C-WB	100.0	NA

(a) NA Not applicable.

TABLE 3.12. ANOVA Results for the 10-Day Solid-Phase Static Test with *R. abronius*

<u>Source Variation</u>	<u>Sum of Squares</u>	<u>d.f. (a)</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Between Groups	0.719	11	0.065	2.451	0.0161
Within Groups	1.281	48	0.027		

(a) d.f. Degrees of freedom

TABLE 3.13. Percent Survival Results for the 96-h Static Suspended-Particulate-Phase Test with *C. stigmaeus*

<u>Sediment Treatment</u>	<u>% SPP Concentration</u>	<u>Mean Percent Survival</u>
COMP I	0	95
COMP I	10	98
COMP I	50	95
COMP I	100	98
COMP II	0	95
COMP II	10	95
COMP II	50	93
COMP II	100	93
COMP III	0	93
COMP III	10	98
COMP III	50	95
COMP III	100	100
TC-5 Upper Comp	0	100
TC-5 Upper Comp	10	100
TC-5 Upper Comp	50	50
TC-5 Upper Comp	100	23
COMP IV	0	98
COMP IV	10	90
COMP IV	50	95
COMP IV	100	90
COMP V	0	98
COMP V	10	93
COMP V	50	98
COMP V	100	93
COMP VI	0	95
COMP VI	10	95
COMP VI	50	98
COMP VI	100	98

examination will be necessary. Water quality data parameters (Appendix G, Table G.3) remained within the targeted range during testing. Table 3.14 presents the t-test comparisons of control treatments to 100% SPP for each sediment, and shows that only one composite (TC-5 Upper Comp) had a significant difference in survival between the 0% and 100% SPP tests. Using the Trimmed Spearman-Kärber method, an LC50 of 75.4% SPP was calculated for this test treatment.

A reference toxicant test conducted with Cu was run concurrently with the SPP treatments. Results are presented in Appendix G. An LC50 value of 1.23 mg/L Cu was calculated using the Trimmed Spearman-Kärber method and is comparable to other tests that have been conducted with *C. stigmaeus* and Cu at the MSL.

3.4.5 96-h Static Suspended-Particulate-Phase Test with *H. sculpta*

The 96-h *H. sculpta* SPP test was validated by greater than 90% mean survival in all control treatments (0% SPP) (Table 3.15). Survival in all 100% SPP treatments remained at or above 85%. Water quality data (Appendix H, Table H.3) show that all measured parameters remained within acceptable ranges during the test. Table 3.16 presents t-test and LC50 values for this test and shows that survival between the control and 100% SPP dilutions was not statistically significantly different for any of the test treatments. Because of the high survival in all SPP treatments, LC50 values were not calculable and were reported as greater than 100% SPP.

TABLE 3.14. T-Test and LC50 Determinations for the 96-h Static Suspended-Particulate-Phase Test with *C. stigmaeus*

Sediment Treatment	Table t-value	d.f. ^(a)	Calculated t-value	Significant ^(b)	LC50 as Percent SPP
COMP I	2.447	6	NA ^(c)	NO	>100 ^(d)
COMP II	2.447	6	0.447	NO	>100
COMP III	2.447	6	NA	NO	>100
TC-5 Upper Comp	2.447	6	10.333	YES	75.4
COMP IV	2.447	6	1.567	NO	>100
COMP V	2.447	6	0.926	NO	>100
COMP VI	2.447	6	NA	NO	>100

(a) d.f. Degrees of freedom.

(b) $\alpha = 0.05$ for two sample t-test comparison of 0% and 100% SPP.

(c) NA Not applicable.

(d) Test organism survival was > 50% in all concentrations.

TABLE 3.15. Percent Survival Results for the 96-h Static Suspended-Particulate-Phase Test with *H. sculpta*

<u>Sediment Treatment</u>	<u>% SPP Concentration</u>	<u>Mean Percent Survival</u>
COMP I	0	100
COMP I	10	90
COMP I	50	100
COMP I	100	98
COMP II	0	100
COMP II	10	100
COMP II	50	75
COMP II	100	95
COMP III	0	100
COMP III	10	95
COMP III	50	90
COMP III	100	98
TC-5 Upper Comp	0	98
TC-5 Upper Comp	10	100
TC-5 Upper Comp	50	98
TC-5 Upper Comp	100	95
COMP IV	0	93
COMP IV	10	100
COMP IV	50	98
COMP IV	100	98
COMP V	0	93
COMP V	10	98
COMP V	50	98
COMP V	100	85
COMP VI	0	95
COMP VI	10	88
COMP VI	50	90
COMP VI	100	90

TABLE 3.16. T-Test and LC50 Determinations for the 96-h Static Suspended-Particulate-Phase Test with *H. sculpta*

Sediment Treatment	Table t-value	d.f. ^(a)	Calculated t-value	Significant ^(b)	LC50 as Percent SPP
COMP I	2.447	6	1.000	NO	>100 ^(c)
COMP II	2.447	6	1.732	NO	>100
COMP III	2.447	6	1.000	NO	>100
TC-5 Upper Comp	2.447	6	0.447	NO	>100
COMP IV	2.447	6	NA ^(d)	NO	>100
COMP V	2.447	6	0.701	NO	>100
COMP VI	2.447	6	NA	NO	>100

(a) d.f. Degrees of freedom.

(b) $\alpha = 0.05$ for two sample t-test comparison of 0 and 100% SPP.

(c) Test organism survival was >50% in all concentrations.

(d) NA Not applicable.

The *H. sculpta* reference toxicant test using zinc chloride ($ZnCl_2$) was analyzed using the Trimmed Spearman-Kärber method. The LC50 was estimated at 0.19 mg/L of Zn, meaning that a 50% decrease in survival could be expected at this concentration. This value is comparable to previous LC50 values determined for this species with Zn as a reference toxicant.

3.4.6 48-h Static Suspended-Particulate-Phase Test with Larval *M. edulis*

Water quality data for the bivalve SPP bioaccumulation test (Appendix I, Table I.2) show that all measured parameters remained within the acceptable range during testing. The results presented in Table 3.17 display the mean percent survival and the mean percent normal development for all treatments. Mean survival was greater than 84% in all control treatments. Table 3.18 presents the results of the independent, two sample t-tests comparing the survivals in the 0% and 100% SPP concentrations. Only one test treatment, COMP I, produced a significant difference in survival in the 100% SPP (72.6%). Because of the high survival in all SPP treatments, LC50 values were not calculable and are reported as greater than 100% SPP.

The mean percent of live larvae with fully developed shells was generally between 50% and 65% for all concentrations of the SPP treatments except for TC-5 Upper Comp, which was 2.2% (Table 3.17). The remainder of larvae were normal, but were incompletely developed, probably caused by early termination of the test. A criterion for normal versus abnormal development is not provided for mussels in ASTM (1978). The results of this test did meet the crite-

TABLE 3.17. Results of the 48-h Static Suspended-Particulate-Phase Test with *M. edulis*

<u>Sediment Treatment</u>	<u>% SPP Concentration</u>	<u>Mean Percent Survival</u>	<u>Mean Percent Fully Developed Larvae</u>
COMP I	0	96.9	64.5
COMP I	10	83.9	56.4
COMP I	50	75.0	55.1
COMP I	100	72.6	49.7
COMP II	0	84.4	60.9
COMP II	10	82.1	60.3
COMP II	50	68.4	52.9
COMP II	100	95.7	54.6
COMP III	0	92.0	61.7
COMP III	10	78.4	56.6
COMP III	50	94.7	65.3
COMP III	100	83.5	54.7
TC-5 Upper Comp	0	93.8 ^(a)	64.0 ^(b)
TC-5 Upper Comp	10	85.5	54.8
TC-5 Upper Comp	50	74.7	48.4
TC-5 Upper Comp	100	76.0	2.2
COMP IV	0	87.2	60.3
COMP IV	10	88.4	58.9
COMP IV	50	82.7	55.9
COMP IV	100	85.2	54.9
COMP V	0	89.1	59.0
COMP V	10	76.8	56.7
COMP V	50	83.0	56.0
COMP V	100	84.6	57.9
COMP VI	0	92.6	65.9
COMP VI	10	82.9	56.1
COMP VI	50	80.3	57.7
COMP VI	100	78.7	49.3

(a) Used mean control survival of COMP I, COMP III, and COMP VI to estimate control survival for TC-5 Upper Comp.

(b) Used mean control of fully developed larvae of COMP I, COMP III, and COMP VI to estimate control of fully developed larvae for TC-5 Upper Comp.

TABLE 3.18. T-Test and LC50 Determinations for the 48-h Static Suspended-Particulate-Phase Test Based on Percent Survival with *M. edulis*

<u>Sediment Treatment</u>	<u>Table t-value</u>	<u>d.f.^(a)</u>	<u>Calculated t-value</u>	<u>Significant^(b)</u>	<u>LC50 as Percent SPP</u>
COMP I	2.571	5	4.202	YES	>100 ^(c)
COMP II	2.571	5	NA ^(d)	NO	>100
COMP III	2.571	5	1.419	NO	>100
TC-5 Upper Comp	2.571	5	1.543 ^(e)	NO	>100
COMP IV	2.447	6	0.222	NO	>100
COMP V	2.447	6	0.319	NO	>100
COMP VI	2.447	6	2.778	NO	>100

(a) d.f. Degree of freedom.

(b) $\alpha = 0.05$ for two sample t-test comparison of 0% and 100% SPP.

(c) Test organism survival was > 50% in all concentrations.

(d) NA Not applicable.

(e) Used mean control survival of COMP I, COMP III, COMP VI to estimate control survival for TC-5 Upper Comp.

TABLE 3.19. T-Test and EC50 Determinations for the 48-h Static Suspended-Particulate-Phase Test Based on the Proportion of Normal *M. edulis* Larvae

<u>Sediment Treatment</u>	<u>Table t-value</u>	<u>d.f.^(a)</u>	<u>Calculated t-value</u>	<u>Significance^(b)</u>	<u>LC50 as Percent SPP</u>
COMP I	2.571	5	4.416	YES	>100 ^(c)
COMP II	2.571	5	1.058	NO	>100
COMP III	2.571	5	1.853	NO	>100
TC-5 Upper Comp ^(d)	2.571	5	46.794	YES	>57.7
COMP IV	2.447	6	1.031	NO	>100
COMP V	2.447	6	0.280	NO	>100
COMP VI	2.447	6	5.200	YES	>100

(a) d.f. Degrees of freedom.

(b) $\alpha = 0.05$ for two sample t-test comparison of 0% and 100% SPP.

(c) Normal development was >50% in all concentrations relative to controls.

(d) Used mean control of fully developed larvae of COMP I, COMP III, and COMP VI to estimate control of fully developed larvae for TC-5 Upper Comp.

tion of 60% normal development for hard-shelled clams. Table 3.19 shows that two treatments (COMP I and COMP VI) produced significant differences in percent of fully developed larval between the 0% and 100% SPP concentrations. No EC50 values were calculable because of the high percent normal development in the 100% SPP concentrations relative to the controls. The test treatment TC-5 Upper Comp produced the lowest percentage (2.2) of fully developed larvae and generated an EC50 of 57.7%.

A reference toxicant test was also conducted using *M. edulis* larvae. An LC50 value of 14.5 mg/L for Cu reduced the percent survival of larvae to 50% compared to controls calculated by the Trimmed Spearman-Kärber method. Using the same method, an EC50 value of 6.60 mg/L Cu was determined based on the reduction of normal larval development in the Cu solutions compared to controls. These values are within the range of LC50s and EC50s estimated during other tests at the MSL, indicating that the larvae tested showed comparable sensitivity.

3.5 TISSUE BIOACCUMULATION

M. nasuta and *N. caecoides* were tested in a 28-day solid phase test using COMPs I through VI and TC-5 Upper Comp to evaluate the bioaccumulation potential of these sediment treatments. The tissue of *M. nasuta* and *N. caecoides* were analyzed for PAHs, pesticides, PCBs, metals, and butyltins. Complete tissue chemistry results in wet and dry weight, quality control data, and quality control summaries for these tests are presented in Appendixes J and K. The tissue chemistry results, summarized in the following section, were used in a statistical evaluation that consisted of Dunn's Test for comparison of all means of test treatments relative to reference treatments (Appendixes L and M). Dunn's Test is a conservative model that uses an experiment-wise error rate (0.1), allowing comparisons of all possible treatment combinations and denotes significant differences among test and reference treatments. During statistical analysis, test treatments were omitted from statistical comparisons if all replicate values for a compound were undetected. Reference treatments were used regardless of whether the values were detected or undetected. When needed, the detection limit value was used in place of -undetected values.

3.5.1 Polynuclear Aromatic Hydrocarbon Bioaccumulation in *M. nasuta*

Tables 3.20 and 3.21 present the mean concentrations of LPAH and HPAH compounds for test, reference, and control treatments as well as background tissue information. The back-

TABLE 3.20. Mean Low Molecular Weight PAH Concentrations in the Tissues of *M. nasuta*

Sediment Treatment	(concentrations in µg/kg dry weight)			
	Napthalene	Fluorene	Phenanthrene	Anthracene
COMP I	13.14	5.12	15.08	3.54 J ^(a)
COMP II	12.72	6.17 UJ ^(b)	12.65	2.42 J
COMP III	11.41	4.19 J	10.14	3.20 UJ
TC-5 Upper Comp	20.96	6.54	27.88	6.11
COMP IV	13.96	4.75	9.98	4.75 UJ
COMP V	15.27	5.46	16.48	4.83
COMP VI	21.09	5.93 UJ	16.02	5.09
R-AC	15.50	11.70	111.96	45.51
R-AM	15.55	7.26	46.04	18.15
R-BF	15.69	5.16	14.02	3.39
R-OS	12.43	5.04 UJ	10.89	2.61 UJ
R-PF	13.35	5.30	11.17	3.55 UJ
C-NE	12.15	4.70 J	15.78	1.19 J
C-SB	10.49	4.76 UJ	10.43	3.73 UJ
Background	9.57	3.91 J	14.91	3.72 UJ

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

(b) U Analyte was not present above the level of associated value.

ground tissues were taken from *M. nasuta* that were kept in clean sediment and then allowed to depurate prior to subsampling the tissue for chemical analysis. These tissues were chemically analyzed to determine if *M. nasuta* were exposed to contaminants prior to testing.

Results of Dunn's Test for LPAH and HPAH are summarized in Table 3.22 and 3.23, respectively. The LPAH table indicates that test treatment TC-5 Upper Comp had significantly higher levels of phenanthrene in tissues of *M. nasuta* relative to R-OS, R-PF, and R-BF. TC-5 Upper Comp also produced significant elevations of anthracene in tissues of *M. nasuta* relative to R-OS.

Examination of the results for the HPAH statistical evaluation produced six observations: 1) none of the *M. nasuta* tissues exposed to the test treatments had concentrations of HPAHs elevated above R-AC or R-AM, 2) five test treatments (COMPs I, II, V, VI, and TC-5 Upper Comp) had significantly higher tissue concentrations of fluoranthene, pyrene, chrysene, benzo(b)-fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene compared to R-OS and R-PF, 3) in addition to these compounds, pyrene was elevated in three test treatments when

TABLE 3.21. Mean High Molecular Weight PAH Concentrations in the Tissues of *M. nasuta*

(concentrations in µg/kg dry weight)									
<u>Sediment Treatment</u>	<u>Fluor-anthene</u>	<u>Pyrene</u>	<u>Benzo(a) anthracene</u>	<u>Chrysene</u>	<u>Benzo(b) fluor-anthene</u>	<u>Benzo(k) fluor anthene</u>	<u>Benzo(a) pyrene</u>	<u>Indeno (1,2,3-c) pyrene</u>	<u>Benzo (g,h,i) perylene</u>
COMP I	36.02	61.42	10.84	15.97	24.51	16.15	15.68	9.20	10.98
COMP II	25.42	48.89	6.99	11.70	21.01	14.28	14.57	9.00	11.24 U (a) J (b)
COMP III	11.38	10.51	3.52 UJ	4.47	7.52 UJ	4.44 UJ	4.37 UJ	8.33 U	9.84 U
TC-5 Upper Comp	154.17	267.23	44.94	69.35	80.93	61.72	62.08	22.49	27.07
COMP IV	8.00	5.55	5.47 UJ	4.36	8.00 UJ	6.87 UJ	8.00 U	9.60 U	13.02 U
COMP V	41.63	146.49	18.76	26.50	57.06	37.37	35.83	14.35	18.17
COMP VI	34.97	149.63	17.54	24.73	55.03	38.39	34.79	13.35	16.81
R-AC	1124.66	2614.47	242.06	299.76	327.48	244.02	358.85	102.38	105.28
R-AM	287.09	316.09	115.81	182.84	75.95	86.86	105.19	29.82	30.42
R-BF	45.69	48.62	12.73	22.25	32.63	17.58	21.31	10.74	17.30
R-OS	12.31	8.67	3.86 UJ	5.19	4.41 UJ	3.66 UJ	3.72 UJ	5.29 UJ	7.26 UJ
R-PF	9.81	7.62	6.95 UJ	3.83	6.97 UJ	6.15 UJ	5.91 UJ	10.01 U	13.58 U
C-NE	17.00	10.93	2.82 J	8.60	2.68 J	1.24 J	0.89 J	5.28 UJ	7.29 UJ
C-SB	24.06	14.18	2.78 J	6.87	6.87	4.23	6.14 UJ	8.00 UJ	10.86 UJ
Background	70.10	48.54	6.29 J	22.06	10.75	6.69	5.16 UJ	6.97 UJ	11.63 U

(a) U Analyte was not present above the level of associated value.

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

TABLE 3.22. Low Molecular Weight PAHs in Tissues of *M. nasuta* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment and Mean Tissue Concentration ($\mu\text{g/kg}$ dry weight)	<u>R-AC</u>	<u>R-AM</u>	<u>R-BF</u>	<u>R-OS</u>	<u>R-PF</u>
<u>Napthalene</u>	15.50	15.55	15.69	12.43	13.35
None are significantly elevated					
<u>Fluorene</u>	11.70	7.26	5.16	5.04 U ^(a) J ^(b)	5.30
None are significantly elevated					
<u>Phenanthrene</u>	111.96	46.04	14.02	10.89	11.17
TC-5 Upper Comp 27.88	--- ^(c)	---	S ^(d)	S	S
<u>Anthracene</u>	45.51	18.15	3.39	2.61 UJ	3.55 UJ
TC-5 Upper Comp 6.11	---	---	---	S	---

(a) U Analyte was not present above the level of associated value.

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

(c) — Not significantly elevated ($\alpha = 0.1$).

(d) S Significant ($\alpha = 0.1$).

compared to R-BF, 4) test treatments COMP I, TC-5 Upper Comp, COMP V, and COMP VI showed elevated levels of benzo(a)anthracene relative to R-OS and R-PF, 5) test treatments COMP V, TC-5 Upper Comp, and COMP VI showed elevated levels of pyrene when compared to R-BF, R-OS, and R-PF, and 6) COMP V, VI, and TC-5 Upper Comp had elevated levels of indeno(1,2,3-c)pyrene and benzo(g,h,i)perylene relative to R-OS. Results of ANOVA and Dunn's Test comparing mean tissue concentrations and statistical groupings for individual compounds are presented in Appendix L.

TABLE 3.23. High Molecular Weight PAHs in Tissues of *M. nasuta* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of all Means

Sediment Treatment and Mean Tissue Concentration ($\mu\text{g/kg dry weight}$)		<u>R-AC</u>	<u>R-AM</u>	<u>R-BE</u>	<u>R-OS</u>	<u>R-PF</u>
<u>Fluoranthene</u>		1124.66	287.09	45.69	12.31	9.81
COMP I	36.02	---(a)	---	---	S ^(b)	S
COMP II	25.42	---	---	---	S	S
TC-5 Upper Comp	154.17	---	---	S	S	S
COMP V	41.63	---	---	---	S	S
COMP VI	34.97	---	---	---	S	S
<u>Pyrene</u>		2614.47	316.09	48.62	8.67	7.62
COMP I	61.42	---	---	---	S	S
COMP II	48.89	---	---	---	S	S
TC-5 Upper Comp	267.23	---	---	S	S	S
COMP V	146.49	---	---	S	S	S
COMP VI	149.63	---	---	S	S	S
<u>Benzo(a)anthracene</u>		242.06	115.81	12.73	3.86 U^(c)J^(d)	6.95 UJ
COMP I	10.84	---	---	---	S	S
TC-5 Upper Comp	44.94	---	---	S	S	S
COMP V	18.76	---	---	---	S	S
COMP VI	17.54	---	---	---	S	S
<u>Chrysene</u>		299.76	182.84	22.25	5.19	3.83
COMP I	15.97	---	---	---	S	S
COMP II	11.70	---	---	---	S	S
TC-5 Upper Comp	69.35	---	---	S	S	S
COMP V	26.50	---	---	---	S	S
COMP VI	24.73	---	---	---	S	S

TABLE 3.23. (contd)

Sediment Treatment and Mean Tissue Concentration ($\mu\text{g/kg dry weight}$)		<u>R-AC</u>	<u>R-AM</u>	<u>R-BE</u>	<u>R-QS</u>	<u>R-PE</u>
<u>Benzo(b)fluoranthene</u>		327.48	75.95	32.63	4.41 UJ	6.97 UJ
COMP I	24.51	---	---	---	S	S
COMP II	21.01	---	---	---	S	S
TC-5 Upper Comp	80.93	---	---	S	S	S
COMP V	57.06	---	---	---	S	S
COMP VI	55.03	---	---	---	S	S
<u>Benzo(k)fluoranthene</u>		244.02	86.86	17.58	3.66 UJ	6.15 UJ
COMP I	16.15	---	---	---	S	S
COMP II	14.28	---	---	---	S	S
TC-5 Upper Comp	61.72	---	---	S	S	S
COMP V	37.37	---	---	---	S	S
COMP VI	38.39	---	---	---	S	S
<u>Benzo(a)pyrene</u>		358.85	105.19	21.31	3.72 UJ	5.91 UJ
COMP I	15.68	---	---	---	S	S
COMP II	14.57	---	---	---	S	S
TC-5 Upper Comp	62.08	---	---	S	S	S
COMP V	35.83	---	---	---	S	S
COMP VI	34.79	---	---	---	S	S
<u>Indeno(1,2,3-c)pyrene</u>		102.38	29.82	10.74	5.29 UJ	10.01 U
TC-5 Upper Comp	22.49	---	---	---	S	S
COMP V	14.35	---	---	---	S	S
COMP VI	13.35	---	---	---	S	S
<u>Benzo(g,h,i)perylene</u>		105.28	30.42	17.30	7.26 UJ	13.58 U
TC-5 Upper Comp	27.07	---	---	---	S	---
COMP V	18.17	---	---	---	S	---
COMP VI	16.81	---	---	---	S	---

(a) --- Not significantly elevated ($\alpha = 0.1$).(b) S Significant ($\alpha = 0.1$).

(c) U Analyte was not present above the level of associated value.

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

The QA/QC requirements were met for the majority of PAHs analyzed in *M. nasuta* tissues. The overall results of QA/QC results indicate that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix J.

3.5.2 Pesticide and PCB Bioaccumulation in *M. nasuta*

Chlorinated pesticide and PCB mean tissue concentrations are presented in Table 3.24. Based on detectable or estimated concentrations, 8 of the 18 pesticide compounds and 1 PCB (aroclor 1254) were used in a statistical analysis. Table 3.25 shows the results of Dunn's Test. Except for COMP IV, pesticide levels of 4,4'-DDD and 4,4'-DDE in tissues of *M. nasuta* test treatments were all statistically significant when compared to at least one reference treatment. COMPs V and VI were significantly higher than all reference treatments for 4,4'-DDD and 4,4'-DDE, and COMP VI was significantly higher than R-AM and R-BF for dieldrin. Alpha, delta, and gamma BHC, 4,4'-DDT and endosulfan II were not statistically different between sediment and reference treatments. Aroclor 1254 concentrations in the tissues of *M. nasuta* test treatments showed significant differences when compared to reference treatments; six test treatments were significantly higher than at least two reference treatments (R-OS and R-PF). Complete *M. nasuta* tissue chemistry data in both wet and dry weight pesticide and PCB concentrations, quality control data, and quality control summaries are contained in Appendix J.

The QA/QC requirements were met for the majority of pesticides and PCBs analyzed. The results of QA/QC evaluations show that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix J.

3.5.3 Metals Bioaccumulation in *M. nasuta*

Mean metals concentrations in the tissues of *M. nasuta*, expressed in mg/kg dry weight, are presented in Table 3.26. This table also shows the ratio or fold factor of the lowest metals concentrations to the highest concentrations for all sediment treatments (including control and background). These ratios ranged from 1.2 to 2.6 for each of the 10 metals evaluated. All of the metals concentrations were detectable and were used in the statistical analysis.

The results of Dunn's Test are summarized in Table 3.27. Lead was the only metal that was statistically significantly different in comparison to the reference treatments. Test treatments TC-5 Upper Comp, COMP V, and COMP VI had significantly higher lead concentrations when compared to the reference treatments R-OS and R-PF.

TABLE 3.24. Mean Pesticide and PCB Concentrations in the Tissues of *M. nasuta*

Sediment Treatment	(concentrations in $\mu\text{g/kg}$ dry weight)							Endo- sulfan II	Aroclor 1254
	Alpha BHC	Delta BHC	Gamma BHC	4,4' DDD	4,4' DDE	4,4' DDT	Dieldrin		
COMP I	1.116	0.704 U(a)E(b)	4.179 E	4.104	4.704	1.288 UJ(c)	0.688 J	2.079 U	78.013
COMP II	0.564	0.676 U	2.863 E	8.423	5.060	1.423 U	1.209 JE	1.269 UJE	92.039
COMP III	0.545	0.653 U	2.904 E	2.285	1.593	1.373 U	3.069 UJ	2.019 U	58.732
TC-5 Upper Comp	0.792	0.665 U	3.002 E	11.178	9.719	1.398 U	2.081 JE	2.057 U	173.525
COMP IV	0.943	0.753 U	3.221 E	0.483 UJ	0.945 UJ	1.583 U	7.852 U	2.329 U	37.798
COMP V	1.447	0.655 UJE	4.108 E	66.266	18.332	1.047 UJE	6.245	1.478 UJE	158.738
COMP VI	1.792	0.822 UJ	4.561 E	79.833	18.541	1.269 UJ	7.294	1.750 UJE	202.853
R-AC	0.995	0.532 UJE	3.594 E	4.688	3.917	1.400 U	4.489 UJ	2.059 U	129.624
R-AM	2.041	0.939 U	3.565 JE	0.532 UJ	2.413	1.612	2.931 UJ	1.701 UJ	88.554
R-BF	1.339	0.667 U	3.629 E	2.542	3.934	1.403 U	0.764 J	1.650 UJ	99.709
R-OS	1.107	0.514 UJE	4.094 E	0.505	3.991	1.330 U	4.128 UJ	1.575 UJ	22.827
R-PF	0.753	0.587 UJ	3.286 E	0.529	4.446	1.651 U	8.186 U	2.429 U	35.565
C-NE	2.048	0.647 U	3.823 E	0.436 U	2.490	1.339 UJ	0.708 J	1.690 UJ	46.015
C-SB	0.955	0.733 U	3.550 UE	0.494 U	1.140	1.541 U	6.340 UJ	2.268 U	36.470
Background	0.932	0.597 UJE	3.753 E	0.556	0.998	1.413 U	5.728 UJ	1.656 UJ	23.813

(a) U The analyte was not present above the level of associated value.

(b) E Value is an estimate; analyte not detected on confirmation column.

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

TABLE 3.25. Pesticides and PCBs in Tissues of *M. nasuta* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment
and Mean Tissue
Concentration
(mo/kg dry weight)

	<u>R-AC</u>	<u>R-AM</u>	<u>R-BE</u>	<u>R-OS</u>	<u>R-PF</u>
<u>Alpha BHC</u>	0.995	2.041	1.339	1.107	0.753

None are significantly elevated

<u>Delta BHC</u>	0.532 U ^(a) J ^(b) E ^(c)	0.939 U	0.667 U	0.514 UJE	0.667 UJ
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None are significantly elevated

<u>Gamma BHC</u>	3.594 E	3.565 JE	3.629 E	4.094 E	3.286 E
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None are significantly elevated

<u>4,4' DDD</u>	4.688	0.532 UJ	2.542	0.505	0.529
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COMP I	4.104	---	S ^(e)	---	S	S
COMP II	8.423	---	S	---	S	S
COMP III	2.285	---	S	---	S	S
TC-5 Upper Comp	11.178	---	S	S	S	S
COMP V	66.266	S	S	S	S	S
COMP VI	79.833	S	S	S	S	S

<u>4,4' DDE</u>	3.917	2.413	3.934	3.991	4.446
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COMP I	4.704	---	S	---	---	---
COMP II	5.060	---	S	---	---	---
COMP III	1.593	---	-	---	---	---
TC-5 Upper Comp	9.719	S	S	S	S	S
COMP V	18.332	S	S	S	S	S
COMP VI	18.541	S	S	S	S	S

<u>4,4' DDT</u>	1.400 U	1.612	1.403 U	1.330 U	1.651 U
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None are significantly elevated

TABLE 3.25. (contd)

Sediment Treatment and Mean Tissue Concentration (mg/kg dry weight)		<u>R-AC</u>	<u>R-AM</u>	<u>R-BE</u>	<u>R-OS</u>	<u>R-PE</u>
<u>Dieldrin</u>		4.489 UJ	2.931 UJ	0.764 J	4.128 UJ	8.186 U
COMP V	6.245	---	---	---	---	---
COMP VI	7.294	---	S	S	---	---
<u>Endosulfan II</u>		2.059 U	1.701 UJ	1.650 UJ	1.575 UJ	2.429 U
None are significantly elevated						
<u>Aroclor 1254</u>		129.624	88.554	99.709	22.827	35.565
COMP I	78.013	---	---	---	S	S
COMP II	92.039	---	---	---	S	S
COMP III	58.732	---	---	---	S	S
TC-5 Upper Comp	173.525	---	S	S	S	S
COMP IV	37.798	---	-	-	S	---
COMP V	158.738	---	S	S	S	S
COMP VI	202.853	S	S	S	S	S

(a) U Analyte was not present above the level of associated value.

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

(c) E Value is an estimate; analyte not detected on confirmation volume.

(d) --- Not significantly elevated ($\alpha = 0.1$).

(e) S Significant ($\alpha = 0.1$).

The QA/QC requirements were met for the majority of the metals analyzed with the exception of 8 out of 40 replicate comparisons. The results of QA/QC evaluations show that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix J.

The results of individual ANOVA and Dunn's Tests for metals are presented in Appendix L. These tables show *M. nasuta* metals levels in test treatments relative to the reference treatments.

TABLE 3.26. Mean Metals Concentrations in the Tissues of *M. nasuta*

Sediment Treatment	(concentrations in mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP I	0.457	31.6	0.168	2.44	20.26	0.086	4.17	1.67	1.75	99.8
COMP II	0.476	29.8	0.182	1.89	18.79	0.071	4.56	1.81	1.44	107.2
COMP III	0.535	33.5	0.237	2.59	19.62	0.065	5.45	1.55	1.50	123.1
TC-5 Upper Comp	0.234	33.2	0.265	2.51	17.90	0.102	5.41	2.13	1.53	127.4
COMP IV	0.510	29.2	0.160	2.62	18.19	0.054	5.26	1.42	1.26	104.7
COMP V	0.351	31.5	0.223	2.24	19.25	0.105	5.57	2.14	1.75	135.1
COMP VI	0.622	30.5	0.213	2.14	21.72	0.094	5.60	2.32	1.57	122.1
R-AC	0.468	28.4	0.194	2.38	17.54	0.065	5.13	1.84	1.76	115.9
R-AM	0.305	28.7	0.253	2.26	17.66	0.084	4.54	1.62	1.67	133.0
R-BF	0.243	28.3	0.259	1.95	17.54	0.101	5.17	2.03	1.60	126.4
R-OS	0.502	27.0	0.222	2.71	14.70	0.066	5.62	1.22	1.65	96.9
R-PF	0.363	29.1	0.338	2.96	16.45	0.076	4.83	1.20	1.43	122.0
C-SB	0.399	30.5	0.189	1.58	21.34	0.070	3.81	1.50	1.69	114.6
C-NE	0.312	30.1	0.295	1.77	19.94	0.102	4.58	1.44	1.69	134.8
Background	0.869	30.2	0.319	2.61	23.30	0.071	3.49	2.39	1.44	132.6
Ratio (a)	2.6	1.2	2.1	1.6	1.5	1.9	1.5	1.9	1.4	1.4

(a) The highest observed value divided by the lowest observed value.

TABLE 3.27. Metals in Tissues of *M. nasuta* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment and Mean Tissue Concentration (mg/kg dry weight)		R-AC	R-AM	R-BE	R-OS	R-PF
<u>Silver</u> None are significantly elevated		0.468	0.305	0.243	0.502	0.363
<u>Arsenic</u> None are significantly elevated		28.4	28.7	28.3	27.0	29.1
<u>Cadmium</u> None are significantly elevated		0.194	0.253	0.259	0.222	0.338
<u>Chromium</u> None are significantly elevated		2.38	2.26	1.95	2.71	2.96
<u>Copper</u> None are significantly elevated		17.54	17.66	17.54	14.70	16.45
<u>Mercury</u> None are significantly elevated		0.065	0.084	0.101	0.066	0.076
<u>Nickel</u> None are significantly elevated		5.13	4.54	5.17	5.62	4.83
<u>Lead</u>		1.84	1.62	2.03	1.22	1.20
TC-5 Upper Comp	2.13	---(a)	---	---	S ^(b)	S
COMP V	2.14	---	---	---	S	S
COMP VI	2.32	---	---	---	S	S
<u>Selenium</u> None are significantly elevated		1.76	1.67	1.60	1.65	1.43
<u>Zinc</u> None are significantly elevated		115.9	133.0	126.4	96.9	122.0

(a) --- Not significantly elevated ($\alpha = 0.1$)

(b) S Significantly elevated ($\alpha = 0.1$)

3.5.4 Butyltin Bioaccumulation in *M. nasuta*

Mean butyltin concentrations ($\mu\text{g/kg}$ dry weight) in *M. nasuta* tissues exposed to test, reference, and control treatments are summarized in Table 3.28. Tributyltin concentrations ranged from 38.6 $\mu\text{g/kg}$ (COMP I) to 94 $\mu\text{g/kg}$ (C-NE), a two-fold difference. Dibutyltin concentrations ranged from undetected at 2.5 $\mu\text{g/kg}$ (COMP I) to 11.9 $\mu\text{g/kg}$ (R-AC), a five-fold difference. Table 3.29 presents the results obtained from Dunn's Test and shows no significant increase in butyltin concentrations between test and reference treatments. The ANOVA and Dunn's Test results for comparison of mean butyltins in *M. nasuta* tissues are presented in Appendix L.

The QA/QC requirements were met for the majority of butyltins analyzed. Although *M. nasuta* tissues exposed to sediment composites were not statistically significantly different from the reference treatments, butyltin levels in the tissues were consistently higher across all test treatments when compared to previous studies at the MSL. Further examination of these data showed that all tissue samples (including reference and control) exposed to the MSL filtered

TABLE 3.28. Mean Butyltin Concentrations in the Tissues of *M. nasuta*

<u>Sediment Treatment</u>	<u>(concentrations in $\mu\text{g/kg}$ dry weight)</u>	
	<u>Tributyltin</u>	<u>Dibutyltin</u>
COMP I	38.6	2.5 U ^(a)
COMP II	58.8	6.8
COMP III	53.8	4.8
TC-5 Upper Comp	53.5	10.1
COMP IV	56.9	9.6
COMP V	55.4	6.4
COMP VI	45.9	4.8
R-AC	77.5	11.9
R-AM	73.7	10.1
R-BF	67.4	7.0
R-OS	48.2	9.4
R-PF	45.1	2.7 U
C-NE	94.0	11.0
C-SB	50.1	4.9
Background	14.4	2.5 U

(a) U Analyte was not present above the level of associated value.

TABLE 3.29. Butyltins in Tissues of *M. nasuta* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment and Mean Tissue Concentration ($\mu\text{g/kg dry weight}$)	<u>R-AC</u>	<u>R-AM</u>	<u>R-BE</u>	<u>R-QS</u>	<u>R-PF</u>
<u>Tributyltin</u>	77.5	73.7	67.4	48.2	45.1
None are significantly elevated					
<u>Dibutyltin</u>	11.9	10.1	7.0	9.4	2.7 U ^(a)
None are significantly elevated					

(a) U Analyte was not present above the level of associated value.

seawater system showed relatively high levels of tributyltin when compared to background tissue samples held in raw seawater. This suggests a possible source of TBT contamination associated with the seawater system, which to date, has not been resolved. For this reason, the bioaccumulation of butyltins in the tissues of *M. nasuta* is inconclusive for the Richmond Harbor COMPs. Sediment chemistry data, however, suggest the possibility for bioaccumulation of TBT after exposure to sediment from the TC-5 Upper Comp and COMP II. The presence of elevated butyltin levels in the tissue of *M. nasuta* exposed to these COMPs would not affect conclusions regarding their suitability for ocean disposal because other contaminants were present at significant levels in the tissues of test organisms exposed to these COMPs when compared to a given reference. A detailed QA/QC summary is presented in Appendix K.

3.5.5 Polynuclear Aromatic Hydrocarbon Bioaccumulation in *N. caecoides*

Mean detectable concentrations ($\mu\text{g/kg dry weight}$) of PAHs in the tissues of *N. caecoides* are presented in Table 3.30. Five of the 16 PAH compounds had detectable concentrations that were subsequently used in a statistical comparison.

The results of Dunn's Test are summarized in Table 3.31 and show no significant elevations of PAH in the tissues of *N. caecoides* for any test treatments relative to the reference treatment R-AC. This table shows that only four PAHs, phenanthrene, fluoranthene, pyrene, and chrysene were significantly elevated in *N. caecoides* tissues from test treatments relative to one or more reference treatments. TC-5 Upper Comp was the only test treatment with signifi-

TABLE 3.30. Mean Low and High Molecular Weight PAH Concentrations Detected in the Tissues of *N. caecoides*

Sediment Treatment	(concentrations in µg/kg dry weight)				
	Napthalene	Phenanthrene	Fluoranthene	Pyrene	Chrysene
COMP I	48.87	22.32	21.21	58.74	13.29
COMP II	19.58	19.18	21.37	67.48	14.62
COMP III	14.39 J ^(a)	15.41	12.02 J	19.65	5.88 J
TC-5 Upper Comp	24.65 J	56.60	210.17	491.66	87.64
COMP IV	26.54 J	20.38	12.64 J	15.45 J	4.75 J
COMP V	16.93	20.04	28.44	188.07	25.62
COMP VI	27.85 J	20.85	28.51	191.61	25.47
R-AC	29.86	319.66	1948.85	5907.89	318.76
R-AM	48.08	58.10	125.61	273.46	51.78
R-BF	31.55	25.06	29.11	55.70	19.10
R-OS	23.43	15.84	11.15 J	13.73 J	7.48 U ^(b) J
R-PF	19.86	23.07	18.54	19.74	6.52 J
C-NE	24.55	24.49	14.71	16.61	5.81 J
C-SB	18.81	16.17	22.88	27.33	8.76 J
Background	15.55	18.00	10.38	10.98	5.30

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

(b) U Analyte was not present above the level of associated value.

cantly higher phenanthrene, fluoranthene, pyrene, and chrysene relative to R-BF, R-OS, and R-PF and higher concentrations of fluoranthene and pyrene relative to R-AM. Results of ANOVA and Dunn's Test comparing mean *N. caecoides* tissue concentrations and statistical groupings for individual PAHs are presented in Appendix M. These tables show the relationship of *N. caecoides* tissue levels between each test and reference treatment.

The QA/QC requirements were met for the majority of PAHs analyzed. In a few cases, the detection limit was elevated because of limited sample amounts. The results of QA/QC evaluations show that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix K.

3.5.6 Pesticide and PCB Bioaccumulation in *N. caecoides*

Chlorinated pesticide and PCB analysis of *N. caecoides* tissues are presented in Table 3.32. Only two pesticides (4,4'-DDE and 4,4'-DDD) and one PCB (aroclor 1254) were found at

TABLE 3.31. Low and High Molecular Weight PAHs in Tissues of *N. caecoides* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment and Mean Tissue Concentration ($\mu\text{g/kg}$ dry weight)		<u>R-AC</u>	<u>R-AM</u>	<u>R-BF</u>	<u>R-OS</u>	<u>R-PF</u>
<u>Naphthalene</u>		29.86	48.08	31.55	23.43	19.86
None are significantly elevated						
<u>Phenanthrene</u>		319.66	58.10	25.06	15.84	23.07
TC-5 Upper Comp		56.60	--- ^(a)	---	S ^(b)	S
<u>Fluoranthene</u>		1948.85	125.61	29.11	11.15 J ^(c)	18.54
COMP I	21.21	---	---	---	S	---
COMP II	21.37	---	---	---	S	---
TC-5 Upper Comp	210.17	---	S	S	S	S
COMP V	28.44	---	---	---	S	S
COMP VI	28.51	---	---	---	S	S
<u>Pyrene</u>		5907.89	273.46	55.70	13.73 J	19.74
COMP I	58.74	---	---	---	S	S
COMP II	67.48	---	---	---	S	S
TC-5 Upper Comp	491.66	---	S	S	S	S
COMP V	188.07	---	---	S	S	S
COMP VI	191.61	---	---	S	S	S
<u>Chrysene</u>		318.76	51.78	19.10	7.48 U ^(d) J	6.52 J
COMP I	13.29	---	---	---	S	S
COMP II	14.62	---	---	---	S	S
TC-5 Upper Comp	87.64	---	---	S	S	S
COMP V	25.62	---	---	---	S	S
COMP VI	25.47	---	---	---	S	S

(a) --- Not significant ($\alpha = 0.1$).

(b) S Significant ($\alpha = 0.1$).

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

(d) U Analyte was not present above the level of associated value.

TABLE 3.32. Mean Pesticide and PCB Concentrations in the Tissues of *N. caecoides*

<u>Sediment Treatment</u>	<u>(concentrations in µg/kg dry weight)</u>		
	<u>4,4'-DDE</u>	<u>4,4'-DDD</u>	<u>Aroclor 1254</u>
COMP I	12.70	5.97	93.82
COMP II	14.58	12.97	172.22
COMP III	5.88	2.19	75.53
TC-5 Upper Comp	23.27	18.80	410.42
COMP IV	2.81 U ^(a) J ^(b)	2.95 U	125.01 UJ
COMP V	40.41	76.11	317.81
COMP VI	37.33	105.48	362.74
R-AC	10.02	5.91	186.47
R-AM	5.08	1.94 U	96.74
R-BF	9.40	2.78	151.91
R-OS	7.94	1.73 U	73.75 U
R-PF	8.86	1.42 U	60.21 U
C-NE	4.59	1.12 U	42.81
C-SB	4.08	1.31 U	43.44
Background	3.04	0.56 U	23.68

(a) U Analyte was not present above the level of associated value.

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

detectable levels that allowed statistical evaluation. Table 3.33 shows the results of the statistical analysis. Test treatments COMP I, COMP II, TC-5 Upper Comp, COMP V, and COMP VI had significantly higher concentrations of 4,4'-DDE, 4,4'-DDD and aroclor 1254 when compared to one or more of the reference treatments. COMP IV was the only test treatment with lower levels of 4,4'-DDE, 4,4'-DDD, and aroclor 1254 than all five reference treatments. Results of ANOVA and Dunn's Test comparing mean *N. caecoides* tissue concentrations and statistical groupings for individual pesticides and PCBs are presented in Appendix M.

The QA/QC requirements were met for the majority of pesticides and PCBs analyzed. Detection limit goals were met for pesticides, but were exceeded in 11 of 75 PCB samples. Higher PCB detection limits were a result of the limited quantity of tissue available for analysis. The results of QA/QC evaluations show that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix J.

TABLE 3.33. Pesticides and PCBs in Tissues of *N. caecoides* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment and Mean Tissue Concentration ($\mu\text{g/kg}$ dry weight)		<u>R-AC</u>	<u>R-AM</u>	<u>R-BF</u>	<u>R-OS</u>	<u>R-PE</u>
4,4-DDE		10.02	5.08	9.40	7.94	8.86
COMP I	12.70	--- ^(a)	S ^(b)	---	---	---
COMP II	14.58	---	S	---	S	---
TC-5 Upper Comp	23.27	S	S	S	S	S
COMP V	40.41	S	S	S	S	S
COMP VI	37.33	S	S	S	S	S
4,4-DDD		5.91	1.94 U^(c)	2.78	1.73 U	1.42 U
COMP I	5.97	---	---	---	---	S
COMP II	12.97	---	S	S	S	S
TC-5 Upper Comp	18.80	---	S	S	S	S
COMP V	76.11	S	S	S	S	S
COMP VI	105.48	S	S	S	S	S
Aroclor 1254		186.47	96.74	151.91	73.75 U	60.21 U
COMP II	172.22	---	---	---	S	S
TC-5 Upper Comp	410.42	S	S	S	S	S
COMP V	317.81	---	S	S	S	S
COMP VI	362.74	S	S	S	S	S

(a) --- Not significantly elevated ($\alpha = 0.1$).

(b) S Significant ($\alpha = 0.1$).

(c) U Analyte was not present above the level of associated value.

3.5.7 Metals Bioaccumulation in *N. caecoides*

Mean metals concentrations in the tissues of *N. caecoides*, expressed in mg/kg dry weight, are presented in Table 3.34. This table also shows the comparison between the lowest concentrations and the highest concentrations for all sediment treatments (including control and background).

TABLE 3.34. Mean Metals Concentrations in the Tissues of *N. caecoides*

Sediment Treatment	(concentrations in mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP I	0.033	34.7	1.17	0.77	14.16	0.080	4.65	1.05	1.76	200.7
COMP II	0.048	31.1	1.11	0.67	13.82	0.075	5.78	0.96	1.45	203.1
COMP III	0.030	28.1	1.04	0.85	11.16	0.079	5.70	0.74	1.36	194.9
TC-5 Upper Comp	0.047	35.8	0.97	1.16	11.55	0.064	5.48	1.26	2.04	193.1
COMP IV	0.024	28.2	1.12	0.69	11.49	0.069	5.48	0.62	1.59	189.4
COMP V	0.030	31.1	1.08	0.73	11.84	0.065	3.76	1.12	1.88	190.9
COMP VI	0.035	32.8	1.17	0.89	13.20	0.069	4.88	1.24	1.68	201.6
R-AC	0.038	28.5	1.17	0.77	13.21	0.062	5.44	0.96	1.72	204.5
R-AM	0.056	23.5	1.18	0.84	12.07	0.078	5.56	0.62	1.57	196.7
R-BF	0.031	29.6	0.95	0.91	10.80	0.084	4.41	1.07	1.46	186.0
R-OS	0.041	24.1	1.16	0.86	11.86	0.074	5.33	0.62	1.87	182.1
R-PF	0.029	25.6	1.11	0.89	11.88	0.078	5.30	1.44	1.48	186.4
C-SB	0.034	27.1	0.99	0.94	12.22	0.047	5.04	0.67	1.92	186.6
C-NE	0.035	24.8	1.15	0.71	13.45	0.069	3.87	0.62	1.43	173.0
Background	NM ^(a)	NM	NM	NM	NM	NM	NM	NM	NM	NM
Ratio ^(b)	2.3	1.5	1.2	1.7	1.3	1.8	1.5	2.0	1.5	1.2

(a) NM Not measured.

(b) The highest observed value divided by the lowest observed value.

The results of the Dunn Test are summarized in Table 3.35. This table shows that As was the only metal that exhibited significant differences between test and reference treatments. These test treatments were COMP I, TC-5 Upper Comp, and COMP VI relative to reference treatments R-AM, R-OS and R-PF.

Mean tissue concentrations are shown with the ANOVA and Dunn Test results for each metal in Appendix M. These tables show *N. caecoides* metals levels in the test treatments relative to each other and to the reference treatments. The statistical groupings show treatments that were similar as well as those that were different.

The QA/QC requirements were met for metals analyzed in *N. caecoides* tissues. The results of QA/QC evaluations show that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix K.

3.5.8 Butyltin Bioaccumulation in *N. caecoides*

Mean butyltin concentrations ($\mu\text{g/kg}$ dry weight) in *N. caecoides* tissues exposed to test, reference, and control treatments are summarized in Table 3.36. Tributyltin was detected in nine treatments (two test, three reference, and two control), dibutyltin was detected in three treatments (three test and four reference). These two compounds were then used in the statistical analysis comparing sediment to reference treatments.

Table 3.37 presents the results of Dunn's Test for butyltin concentrations in *N. caecoides*. This table shows that no test treatments had significantly higher concentrations of butyltins compared to any of the reference treatments. The ANOVA and Dunn's Test results for comparison of mean butyltins in *N. caecoides* tissues are presented in Appendix M. These tables show how the reference treatments compare to each other as well as to test treatments.

The QA/QC requirements were met for the majority of butyltins analyzed. Most of the samples showed elevated target detection limits beyond $10 \mu\text{g/kg}$ wet weight. This was attributed to the limited tissue available for extraction. The overall results of QA/QC results indicate that these data are acceptable for use in analysis. A detailed QA/QC summary is presented in Appendix K.

TABLE 3.35. Metals in Tissues of *N. caecoides* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

Sediment Treatment and Mean Tissue Concentration (mg/kg dry weight)	<u>R-AC</u>	<u>R-AM</u>	<u>R-BE</u>	<u>R-OS</u>	<u>R-PF</u>
<u>Silver</u>	0.038	0.056	0.031	0.041	0.029
None are significantly elevated					
<u>Arsenic</u>	28.5	23.5	29.6	24.1	25.6
COMP I 34.7	---(a)	S ^(b)	---	S	S
TC-5 Upper Comp 35.8	---	S	---	S	S
COMP VI 32.8	---	S	---	S	---
<u>Cadmium</u>	1.17	1.18	0.95	1.16	1.11
None are significantly elevated					
<u>Chromium</u>	0.77	0.84	0.91	0.86	0.89
None are significantly elevated					
<u>Copper</u>	13.21	12.07	10.80	11.86	11.88
None are significantly elevated					
<u>Mercury</u>	0.062	0.078	0.084	0.074	0.078
None are significantly elevated					
<u>Nickel</u>	5.44	5.56	4.41	5.33	5.30
None are significantly elevated					
<u>Lead</u>	0.96	0.62	1.07	0.62	1.44
None are significantly elevated					
<u>Selenium</u>	1.72	1.57	1.46	1.87	1.48
None are significantly elevated					
<u>Zinc</u>	204.5	196.7	186.0	182.1	186.4
None are significantly elevated					

(a)--- Not significantly elevated ($\alpha = 0.1$).

(b) S Significant ($\alpha = 0.1$).

TABLE 3.36. Mean Butyltin Concentrations in the Tissues of *N. caecoides*

<u>Sediment Treatment</u>	<u>(concentrations in µg/kg dry weight)</u>	
	<u>Tributyltin</u>	<u>Dibutyltin</u>
COMP I	171.81	69.13 U ^(a) J ^(b)
COMP II	114.37 UJ	82.46 U
COMP III	181.74 UJ	97.59 U
TC-5 Upper Comp	112.39 UJ	93.57 U
COMP IV	139.00 UJ	66.00 UJ
COMP V	97.50	49.64
COMP VI	99.35	61.96
R-AC	76.81	77.57 UJ
R-AM	119.03	45.31 UJ
R-BF	146.92 UJ	57.00
R-OS	105.77	78.53 U
R-PF	88.79	51.51 UJD
C-NE	111.94	55.57 U
C-SB	105.94	55.70 UJD
Background	NM ^(c)	NM

(a) U Analyte was not present above the level of associated value.

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

(c) NM Not measured.

TABLE 3.37. Butyltins in Tissues of *N. caecoides* That Are Significantly Different from Reference Tissue Concentrations Using Dunn's Test for Comparison of All Means

<u>Sediment Treatment and Mean Tissue Concentration (µg/kg dry weight)</u>	<u>R-AC</u>	<u>R-AM</u>	<u>R-BF</u>	<u>R-OS</u>	<u>R-PF</u>
Tributyltin	76.81	119.03	146.92 U ^(a) J ^(b)	105.77	88.79
None are significantly elevated					
Dibutyltin	77.57 UJ	45.31 UJ	57.00	78.53 U	51.51 UJ
None are significantly elevated					

(a) U Analyte was not present above the level of associated value.

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

4.0 DISCUSSION AND CONCLUSIONS

The following section presents a discussion of the results pertinent to the Richmond Harbor project including geologic evaluations, sediment chemistry results, and toxicological and bioaccumulation potential. Test treatments are statistically compared to reference treatments to determine if significant differences occur. For the purposes of this discussion, the term "significant acute toxicity" indicates that the test treatment does not comply with the benthic bioassay criteria for ocean disposal defined under CFR 40, Section 227.13(c). The primary comparisons are acute toxicity and bioaccumulation potential. Sediment chemistry results are to be used in support of toxicity tests and bioaccumulation results in order to evaluate appropriate disposal options.

4.1 GEOLOGIC EVALUATIONS

Geologic evaluations were performed on sediment cores representing the material proposed for dredging. These evaluations determined the proportion of Older Bay Mud (OBM) and Younger Bay Mud (YBM) within dredging prisms, and provide USACE with the information needed to estimate the quantity of material that is suitable or unsuitable for unconfined open-water disposal. Table 4.1 shows that most of the test treatments were composed of YBM, which is generally a clay or silty clay material often mixed with sand. The OBM was prevalent only at stations C-19 (COMP II), C-29 (COMP VI), C-33 (COMP V), and C-38 (COMP VI), where it typically exhibited a high plasticity, suggesting that it is more cohesive than the YBM.

4.2 SEDIMENT CHEMISTRY

According to the 1991 Implementation Manual, sediment chemistry results are intended to provide information about chemical contaminants of concern that could potentially cause toxicity or bioaccumulation. Section 3.3 presents the sediment chemistry results of the 57 sediment treatments and shows these treatments compared to reference treatment contaminant levels. For the conventional parameters, the majority of sediments were predominantly fine-grained (silt and clay) and were representative of YBM. The sediment treatments with a higher proportion of fine-grained sediments representative of YBM also exhibited higher levels of TOC, TVS, oil and grease, and TPH than OBM sediments.

TABLE 4.1. Summary of Geologic Descriptions

Sediment Treatment	Mudline -ft MLLW	Sediment Thickness, ft		Physical Description (to -40 ft)
		YBM ^(a)	OBM ^(b)	
C-1	36.4	4.2	0.0	Clayey sand with shell fragments
C-3	36.0	3.6	0.0	Silty clay
C-5	36.4	3.3	0.0	Silty clay with sand
C-6	36.3	4.7	0.0	Clayey sand with gravelly sand
C-8	36.4	5.5	0.0	Silts and fine sands; clay
C-10	36.0	4.6	0.0	Silts and fine sands; clay; silty sands
C-11	37.3	2.5	0.0	Clayey sand
C-16	36.2	2.8	1.9	YBM-clay; OBM-clayey sand
C-18	36.1	2.7	1.6	YBM-clayey sand; OBM-clay with silts
C-19	35.9	1.8	3.2	YBM-clayey sand; OBM-sandy clays
C-20	36.2	3.3	1.0	YBM-clayey sand; OBM-sandy silt
C-23	32.8	6.9	0.0	High plasticity clay
C-24	36.0	4.3	0.0	Clayey sand
C-25	35.0	3.7	1.6	YBM-clay; OBM-clay with iron oxides
C-26	36.1	3.7	0.8	YBM-clay; OBM-clayey sand
C-29	35.0	3.2	7.3	YBM-clay; OBM-high plasticity clay
C-30	35.3	4.5	0.2	YBM-clay; OBM-clayey sand
C-32	35.3	3.4	2.1	YBM-clay; OBM-high plasticity clay
C-33	35.0	4.5	5.9	YBM-clay; OBM-high plasticity clay
C-35	36.2	3.3	1.7	YBM-clay; OBM-high plasticity clay
C-36	36.1	3.4	1.4	YBM-clay; OBM-high plasticity clay
C-37	36.1	3.0	1.9	YBM-clay; OBM-clay with silty sands
C-38	36.1	2.4	2.5	YBM-clay; OBM-high plasticity clay
TC-1	11.3	20.9	4.3	YBM-clay; OBM-clayey sands
TC-2	11.5	17.3	3.3	YBM-clay; OBM-high plasticity clay
TC-3	8.5	22.3	3.5	YBM-clay; OBM-clay with gravelly sands
TC-4	6.2	23.3	9.5	YBM-clay; OBM-gravelly sands
TC-5	21.9	12.2	2.9	YBM-clay; OBM-clay
TC-6	6.2	38.8	0.0	High plasticity clays
TC-7	11.0	29.5	0.0	High plasticity clays

(a) YBM - Younger Bay Mud.

(b) OBM - Older Bay Mud.

The majority of sediment treatments had detectable levels of PAH. Reference treatment R-AC had the highest detectable level of total PAHs. COMP II, TC-5 Upper Rep 3, COMP V, and COMP VI had lower levels of PAH compared to R-AC and higher PAH levels relative to the remaining four reference treatments (R-AM, R-BF, R-PF, and R-OS). The results of pesticide analysis showed that three pesticides, 4,4' DDD, 4,4' DDE, and 4,4' DDT, were found at detectable levels in sediments. Test treatments C-38 and C-36 exhibited the highest levels of 4,4'-DDD and 4,4'-DDE, while COMP VI had substantially higher levels of 4,4'-DDT. Aroclor 1254 was the only detectable PCB in the sediment treatments of which TC-5 Upper Comp produced the highest level. The results of the metals analyses showed that TC-5 Upper Comp, TC-5 Upper Rep 3, and TC-5 Special Sample produced consistently higher levels of Ag, As, Cd, Cu, Hg, Pb, and Zn relative to the other sediment treatments. The remaining three metals showed varying levels of Cr and Ni among the test treatments and Se was undetected for most of the test treatments. The results for butyltin analyses showed the highest DBT levels were found at TC-5 Upper Rep 3, TC-5 Upper Rep 1, and C-16; C-16 had much higher levels of TBT than any other test or reference treatments.

4.3 TOXICOLOGY AND BIOACCUMULATION POTENTIAL

The Richmond Harbor test treatments (COMPs) that resulted in significant acute toxicity or bioaccumulation are discussed in this section. The conclusions generated from the acute toxicity results vary depending on the reference treatment to which the results are compared. However, four observations were consistently noted for the comparison of test to reference treatments. First, acute 10-day toxicity for *N. caecoides* was shown for COMP IV and TC-5 Upper Comp when compared to R-OS, and for COMP III, TC-5 Upper Comp, and COMP IV when compared to R-PF. Second, acute 10-day toxicity was also observed for *R. abronius* in relation to R-AM and R-BF. Third, *C. stigmaeus* displayed acute toxicity to the SPP derived from TC-5 Upper Comp (calculated LC50 of 75.4%). These tissues were preserved in the event that a histopathological examination was necessary. Fourth, acute toxicity was not observed in the 10-day *M. nasuta* test relative to any reference treatment.

The conclusions generated from the bioaccumulation results also vary depending on the reference treatment to which the results are compared. However, five observations were consistently noted for the comparison of test to reference treatments. First, elevated levels of LPAHs in the tissues of *M. nasuta* were due to phenanthrene and anthracene; elevated levels of HPAHs were due to the presence of 9 of the 10 PAH compounds. Second, elevated levels of

LPAHs in the tissues of *N. caecoides* were due to phenanthrene; significantly elevated levels of HPAHs were due to the presence of fluoranthene, pyrene, and chrysene. Third, elevated levels of pesticides and PCBs in the tissues of *M. nasuta* were from 4,4'-DDD, 4,4'-DDE, dieldrin, and aroclor 1254; tissues of *N. caecoides* exhibited elevated levels of 4,4'-DDD, 4,4'-DDE, and aroclor 1254. Although the levels of 4,4'-DDT were elevated in the test sediments, it was not detected at a significant level in the tissues of *M. nasuta* or *N. caecoides*. However, 4,4'-DDD and 4,4'-DDE were present at significant levels in the tissues of both organisms. The reason for non-significant 4,4'-DDT levels in tissues is unknown; however, the ratios of 4,4'-DDD to 4,4'-DDE do not suggest metabolism of 4,4'-DDT by test organisms in tissues. Fourth, butyltins were not elevated in test organism tissue relative to the references. Finally, elevated levels of metals in tissues were limited to Pb in *M. nasuta* and As in *N. caecoides*. What follows is a comparison of toxicological and bioaccumulation data for the test treatment tissues of *M. nasuta* and *N. caecoides* relative to each reference.

4.3.1 Comparison of Test Treatments to the Reference Treatment R-AC

Table 4.2 summarizes the acute toxicity, bioaccumulation results, and the ratio of the test treatment concentrations relative to the Alcatraz Island dredged material disposal site, reference treatment R-AC. No significant acute toxicity to test organisms was observed for any test treatments relative to R-AC.

Elevated levels of pesticides (4,4'-DDD and 4,4'-DDE) and PCBs (aroclor 1254) were observed in the tissues of *M. nasuta* and *N. caecoides* exposed to test treatments TC-5 Upper COMP, COMP V, and COMP VI relative to R-AC. Metals, butyltins, and PAHs in tissues of *M. nasuta* and *N. caecoides* were not elevated in any test treatment when compared to R-AC.

Comparison of test treatment data to the reference R-AC produced nine "responses," where a response is defined as significant acute toxicity or elevated tissue levels of PAHs, pesticides, PCBs, metals, or butyltins relative to the reference treatments. Reference treatment R-AC produced the lowest observable number of responses of any reference treatment in this study.

4.3.2 Comparison of Test Treatments to the Reference Treatment R-AM

Table 4.3 provides the acute toxicity, bioaccumulation results, and the ratio of the highest treatment concentrations relative to the environs samples near the Alcatraz Island dredged material disposal site, reference treatment R-AM. Significant acute toxicity was observed only in test treatment COMP III for *R. abronius*.

TABLE 4.2. Summary of Significant Acute Toxicity and Bioaccumulation for Test Treatments
Relative to the Reference R-AC

Sediment Treatment	Acute Toxicity	<u><i>M. nasuta</i> Bioaccumulation</u>					<u><i>N. caecoides</i> Bioaccumulation</u>				
		PAH	PCB	PEST	Metals	Butyltins	PAH	PCB	PEST	Metals	Butyltins
COMP I	--- (a)	---	---	---	---	---	---	---	---	---	---
COMP II	---	---	---	---	---	---	---	---	---	---	---
COMP III	---	---	---	---	---	---	---	---	---	---	---
TC-5 Upper Comp	---	---	---	2.5(b)	---	---	---	2.2(b)	2.3(b)	---	---
COMP IV	---	---	---	---	---	---	---	---	---	---	---
COMP V	---	---	---	12.9(b)	---	---	---	---	12.9(b)	---	---
COMP VI	---	---	1.6(b)	17.0(b)	---	---	---	1.9(b)	17.8(b)	---	---

(a) Not significant.

(b) Value represents the highest ratio of a test treatment relative to the reference R-AC.

TABLE 4.3. Summary of Significant Acute Toxicity and Bioaccumulation for Test Treatments Relative to the Reference R-AM

Sediment Treatment	Acute Toxicity	<u>M. nasuta Bioaccumulation</u>					<u>N. caecoides Bioaccumulation</u>				
		PAH	PCB	PEST	Metals	Butyltins	PAH	PCB	PEST	Metals	Butyltins
COMP I	---(a)	---	---	7.7 (b)	---	---	---	---	2.5 (b)	1.5 (b)	---
COMP II	---	---	---	9.3 (b)	---	---	---	---	6.7 (b)	---	---
COMP III	Rhe(c)	---	---	2.5 (b)	---	---	---	---	---	---	---
TC-5 Upper Comp	---	---	2.0 (b)	12.4 (b)	---	---	1.8 (b)	4.2 (b)	9.7 (b)	1.5 (b)	---
COMP IV	---	---	---	---	---	---	---	---	---	---	---
COMP V	---	---	1.8 (b)	124.56 (b)	---	---	---	3.3 (b)	39.0 (b)	---	---
COMP VI	---	---	2.3 (b)	89.0 (b)	---	---	---	3.7 (b)	54.0 (b)	1.4 (b)	---

(a) Not significant.

(b) Value represents the highest ratio of a test treatment relative to the reference R-AM.

(c) Rhe is the 10-day static *Rhepoxynlus abronius* test.

Significantly elevated levels of pesticides (4,4'-DDD and 4,4'-DDE) were observed in tissues of *M. nasuta* for COMP I, COMP II, COMP III, TC-5 Upper Comp, COMP V, and COMP VI when compared to R-AM. Significantly elevated levels of dieldrin were observed on tissues of *M. nasuta* for COMP VI. The concentrations of Aroclor 1254 in *M. nasuta* tissues exposed to TC-5 Upper Comp, COMP V, and COMP VI were approximately twice those observed in tissues exposed to R-AM. There was no evidence of bioaccumulation potential for PAHs, metals, or butyltins in the tissues of *M. nasuta*.

Elevated levels of PAHs, PCBs, pesticides, and the metal As were observed in *N. caecoides* tissues exposed to one or more of the test treatments when compared to R-AM. Fluoranthene and pyrene were elevated in the tissues of *N. caecoides* for TC-5 Upper Comp. Aroclor 1254 was elevated in the tissues of *N. caecoides* for TC-5 Upper Comp, COMP V, and COMP VI. 4,4'-DDE and 4,4'-DDD were elevated in tissues of *N. caecoides* for COMP I, COMP II, TC-5 Upper Comp, COMP V, and COMP VI. Arsenic was found at elevated levels in the tissues of *N. caecoides* for at least one or more of the following test treatments: COMP I, TC-5 Upper Comp, and COMP VI. No significant bioaccumulation of butyltins was observed in *N. caecoides* relative to R-AM.

Comparison of the acute toxicity and bioaccumulation results of test treatments relative to R-AM produced 22 responses. This was the second lowest observed number of responses relative to all references (R-BF also had 22 responses).

4.3.3 Comparison of Test Treatments to the Reference Treatment R-BF

Table 4.4 presents the results of acute toxicity, bioaccumulation results, and the ratio of test treatment concentrations relative to the Bay Farm Borrow Pit, reference treatment R-BF. Significant acute toxicity was observed with *R. abronius* exposed to COMP III relative to R-BF.

Significantly elevated levels of PAHs, PCBs, and pesticides were observed in the tissues of *M. nasuta* exposed to test treatments TC-5 Upper Comp, COMP V, and COMP VI. There was no evidence of bioaccumulation potential for metals or butyltins in the tissues of *M. nasuta*.

Significantly elevated levels of PAHs, pesticides, and PCBs were also observed in the tissues of *N. caecoides* exposed to one or more of the following test treatments: COMP II, TC-5 Upper Comp, COMP V, and COMP VI relative to R-BF. There was no evidence of elevated levels of metals or butyltins in *N. caecoides* tissues relative to R-BF. Comparison of acute toxicity and bioaccumulation results of test treatments to the reference R-BF produced 22 responses.

TABLE 4.4. Summary of Significant Acute Toxicity and Bioaccumulation for Test Treatments
Relative to the Reference R-BF

Sediment Treatment	Acute Toxicity	<u><i>M. nasuta</i> Bioaccumulation</u>					<u><i>N. caecoides</i> Bioaccumulation</u>				
		PAH	PCB	PEST	Metals	Butyltins	PAH	PCB	PEST	Metals	Butyltins
COMP I	---(a)	---	---	---	---	---	---	---	---	---	---
COMP II	---	---	---	---	---	---	---	---	4.7(b)	---	---
COMP III	Rhe(c)	---	---	---	---	---	---	---	---	---	---
TC-5 Upper Comp	---	5.5(b)	1.7(b)	4.4(b)	---	---	8.8(b)	2.7(b)	6.8(b)	---	---
COMP IV	---	---	---	---	---	---	---	---	---	---	---
COMP V	---	3.0(b)	1.6(b)	24.0(b)	---	---	3.4(b)	2.1(b)	27.0(b)	---	---
COMP VI	---	3.1(b)	2.0(b)	31.0(b)	---	---	3.4(b)	2.4(b)	38.0(b)	---	---

(a) Not significant.

(b) Value represents the highest ratio of a test treatment relative to the reference R-BF.

(c) Rhe is the 10-day static *Rhepoxynius abronius* test.

4.3.4 Comparison of Test Treatments to the Reference Treatment R-OS

Table 4.5 summarizes the acute toxicity, bioaccumulation results, and the ratio of test treatment concentrations relative to the off-shelf reference site, R-OS. Significant acute toxicity was noted in *N. caecoides* exposed to test treatments TC-5 Upper Comp and COMP IV.

Significantly elevated levels of LPAH, HPAH, PCBs, pesticides, and the metal Pb were noted in the tissues of *M. nasuta* when compared to R-OS. Tissue levels of PAHs were elevated above R-OS for the following test treatments: COMP I, CCMP II, TC-5 Upper Comp, COMP V, and COMP VI. The PCB aroclor 1254 was elevated in all test treatments. Pesticides were elevated in all test treatments except for COMP IV. Lead was significantly elevated in the tissue of *M. nasuta* for TC-5 Upper Comp, COMP V, and COMP VI when compared to R-OS. There was no evidence of significantly elevated levels of butyltins in the tissues of *M. nasuta*.

Significantly elevated levels of PAHs, pesticides, PCBs, and the metal As were observed in the tissues of *N. caecoides* when compared to R-OS. Tissue levels of PAHs were elevated in test treatments COMP I, COMP II, TC-5 Upper Comp, COMP V, and COMP VI. Tissue levels of PCBs were elevated in COMP II, TC-5 Upper Comp, COMP V, and COMP VI. Pesticide tissue levels were elevated in *N. caecoides* for COMP II, TC-5 Upper Comp, COMP V, and COMP VI. Arsenic was significantly elevated for test treatments COMP I, TC-5 Upper Comp, and COMP VI. There was no evidence of significantly elevated levels of butyltins in tissues of *N. caecoides* relative to R-OS.

Comparison of acute toxicity and bioaccumulation results of test treatments to the reference R-OS produced 41 responses. References R-OS and R-PF had the highest total observed responses of all references.

4.3.5 Comparison of Test Treatments to the Reference Treatment R-PF

Table 4.6 summarizes acute toxicity, bioaccumulation results, and the ratio of test treatment concentrations relative to the Point Reyes reference treatment, R-PF. Significant acute toxicity was observed for *N. caecoides* exposed to test treatments COMP III, TC-5 Upper Comp, and COMP IV.

Significantly elevated levels of contaminants were observed in tissues of *M. nasuta* exposed to all test treatments except COMP IV relative to R-PF. Tissue levels of PAHs were elevated above R-PF for one or more of the following test treatments: COMP I, COMP II, TC-5

TABLE 4.5. Summary of Significant Acute Toxicity and Bioaccumulation for Test Treatments
Relative to the Reference R-OS

Sediment Treatment	Acute Toxicity	<u><i>M. nasuta</i> Bioaccumulation</u>					<u><i>N. caecoides</i> Bioaccumulation</u>				
		PAH	PCB	PEST	Metals	Butyltins	PAH	PCB	PEST	Metals	Butyltins
COMP I	---(a)	7.1 (b)	3.4 (b)	8.1 (b)	---	---	4.3 (b)	---	---	1.4 (b)	---
COMP II	---	5.6 (b)	4.0 (b)	16.7 (b)	---	---	4.9 (b)	2.3 (b)	7.5 (b)	---	---
COMP III	---	---	2.6 (b)	4.5 (b)	---	---	---	---	---	---	---
TC-5 Upper Comp	Nep(c)	30.8 (b)	7.6 (b)	22.0 (b)	1.7 (b)	---	36.0 (b)	5.6 (b)	10.9 (b)	1.5 (b)	---
COMP IV	Nep	---	1.7 (b)	---	---	---	---	---	---	---	---
COMP V	---	16.9 (b)	7.0 (b)	120.0 (b)	1.75 (b)	---	13.7 (b)	4.3 (b)	44.0 (b)	---	---
COMP VI	---	17.3 (b)	8.9 (b)	158.0 (b)	1.9 (b)	---	14.0 (b)	4.9 (b)	61.0 (b)	1.4 (b)	---

(a) Not significant.

(b) Value represents the highest ratio of a test treatment relative to the reference R-OS.

(c) Nep is the 10-day flow-through *Nephtys caecoides* static toxicity test.

TABLE 4.6. Summary of Significant Acute Toxicity and Bioaccumulation for Test Treatments Relative to the Reference R-PF

Sediment Treatment	Acute Toxicity	<u>M. nasuta Bioaccumulation</u>					<u>N. caecoides Bioaccumulation</u>				
		PAH	PCB	PEST	Metals	Butyltins	PAH	PCB	PEST	Metals	Butyltins
COMP I	---(a)	8.1 (b)	2.2 (b)	8.6 (b)	---	---	3.0 (b)	---	4.2 (b)	1.4 (b)	---
COMP II	---	6.4 (b)	2.6 (b)	17.7 (b)	---	---	3.4 (b)	2.9 (b)	9.1 (b)	---	---
COMP III	Nep(c)	---	1.6 (b)	4.8 (b)	---	---	---	---	---	---	---
TC-5 Upper Comp	Nep	35.0 (b)	4.9 (b)	23.5 (b)	1.8 (b)	---	25.0 (b)	6.8 (b)	13.2 (b)	1.4 (b)	---
COMP IV	Nep	---	---	---	---	---	---	---	---	---	---
COMP V	---	19.2 (b)	4.5 (b)	127.0 (b)	1.8 (b)	---	9.5 (b)	5.3 (b)	54.0 (b)	---	---
COMP VI	---	19.6 (b)	5.7 (b)	168.0 (b)	1.9 (b)	---	9.7 (b)	6.0 (b)	74.0 (b)	---	---

(a) Not significant.

(b) Value represents the highest ratio of a test treatment relative to the reference R-PF.

(c) Nep is the 10-day flow-through *Nephtys caecoides* static toxicity test.

Upper Comp, COMP V, and COMP VI. Pesticides and the PCB aroclor 1254 were significantly elevated in *M. nasuta* tissues exposed to all test treatments except COMP IV. Lead was present in the tissue of *M. nasuta* at significantly elevated concentrations for test treatments TC-5 Upper Comp, COMP V, and COMP VI. There was no evidence of significantly elevated levels of butyltins in the tissues of *M. nasuta* for any test treatment.

Significantly elevated levels of contaminants were also observed in the tissues of *N. caecoides* relative to tissues exposed to the reference R-PF. Tissue levels of PAHs were elevated above R-PF for one or more of the following test treatments: COMP I, COMP II, TC-5 Upper Comp, COMP V, and COMP VI. Pesticides and PCBs were significantly elevated in tissues of *N. caecoides* for COMP I, COMP II, TC-5 Upper Comp, COMP V, and COMP VI. Arsenic was significantly elevated in test treatments COMP I and TC-5 Upper Comp. There was no evidence of significant elevation of butyltins relative to R-PF.

Comparison of test treatment acute toxicity and bioaccumulation to the reference R-PF produced 41 responses. This was the highest total observed and equal to the responses observed in R-OS.

4.4 CONCLUSIONS

The tiered approach to evaluating potential impacts of ocean disposal of dredged material is presented in the 1991 Implementation Manual. This approach consists of a series of activities (tests) and decision modules (determination of compliance) that aid in interpreting physical, chemical, and biological data related to the evaluation of proposed dredged sediment. In this study, water column toxicity, deposited sediment toxicity, and deposited sediment bioaccumulation potential were evaluated. The following summarizes the tests conducted using the determination of compliance definitions provided by the 1991 Implementation Manual.

4.4.1 Water Column

Estimates of toxicity in the water column were evaluated by exposing three marine species (*H. sculpta*, *C. stigmaeus*, and *M. edulis*) to three concentrations of SPP and a sea-water-only control. The SPP tests showed acute toxicity and a calculable LC50 of 75.4% SPP in the *C. stigmaeus* test for TC-5 Upper Comp. Under 1991 Implementation Manual guidelines, the limiting permissible concentration for dissolved plus suspended contaminants (represented by the SPP) cannot exceed 0.01% of the acutely toxic concentration at the boundaries of the

disposal site after allowing 4 h for initial mixing. This means that a concentration greater than 0.75% SPP would have to be present at the boundary of the disposal site after initial mixing to exceed the acutely toxic concentration if the dredge material was composed of sediment from TC-5 Upper Comp.

4.4.2 Deposited Sediment Toxicity

Deposited sediment toxicity was determined by exposing three species of marine organisms (*M. nasuta*, *N. caecoides*, and *R. abronius*) to test sediment treatments. The 1991 Implementation Manual guidelines concerning determination of compliance for deposited sediment toxicity are based on whether the mortality of organisms exposed to test sediments (dredged material) is statistically significantly different from reference and whether test organism mortality in test treatments exceeds the reference treatment by 20% (*R. abronius*) or 10% (other species). If mortality in test treatments is statistically significantly different from the reference mortality and exceeds the reference by the above percentages, the test material does not comply with the benthic bioassay criteria of Section 227.13(c) and Appendix A of the 1991 Implementation Manual.

The toxicological test conducted by the MSL showed only two tests (*N. caecoides* and *R. abronius*) where significant acute toxicity was observed when COMPs were statistically compared to the five reference treatments via Dunn's Test at $\alpha = 0.10$. Test treatments producing significant toxicity in *R. abronius* were COMP III relative to the references R-AM and R-BF. Test treatments producing significant toxicity in *N. caecoides* were COMP III relative to R-PF and TC-5 Upper Comp and COMP IV relative to both R-OS and R-PF. Based on these tests, sediment treatments COMP III, TC-5 Upper Comp, and COMP IV do not comply with the benthic bioassay criteria of Section 227.13(c) and Appendix A of the 1991 Implementation Manual.

4.4.3 Bioaccumulation

The potential for bioaccumulation of contaminants was evaluated through 28-day solid-phase flow-through tests with *M. nasuta* and *N. caecoides*. The concentrations of contaminants were compared to existing Food and Drug Administration (FDA) limits, and also compared through Dunn's Test to determine whether statistically significant levels of contaminants were present ($\alpha = 0.10$) relative to reference treatments. The tissue chemistry results were compared to existing FDA action limits shown in Table 4.7 and showed no evidence of bioaccumulation that would exceed FDA limits. However, statistically significant elevations of contaminants were present in the tissues of *M. nasuta* and *N. caecoides* when compared to the five references. In

TABLE 4.7. FDA Action Limits

<u>Substance</u>	<u>Action Level, ppm (wet wt)</u>	<u><i>M. nasuta</i></u>	<u><i>N. caecoides</i></u>
Metals			
Methyl Mercury	1.0	---(a)	---
Pesticides			
Benzene Hexachloride (BHC)	0.3	---	---
Chlordane	0.3	.01	.057
Chlodecone (Kepone)	0.3	---	---
DDT + DDE	5.0	.005	.01
Dichlorophenoxyacetic acid	1.0	---	---
Dieldrin + Aldrin	0.3	.002	.02
Endrin	0.3	.002	.02
Fluidone	0.5	---	---
Heptachlor + Heptachlor Epoxide	0.3	.0007	.01
Hexachlorobenzene (HBC)	0.3	---	---
Isopropylamine	0.25	---	---
Mirex	0.1	---	---
Simazine	12.0	---	---
Toxaphene	5.0	.01	.05
Industrial Chemicals			
PCBs	2.0	.03	.2
Dioxin	25.0	---	---

(a) --- Compound was not included in analysis.

most cases, the PAH, pesticide, and PCB levels were at least twice that observed in a given reference. Elevated metals concentrations were at levels less than twice that observed in tissues exposed to reference treatments. Statistical analysis of butyltin concentrations showed no evidence of significant increases in tissue concentrations for test sediments relative to reference tissues. This result was in contrast to the relatively high levels of butyltins noted in some of the sediment cores contributing to the COMPs.

Comparison of test treatment data to the reference R-AC produced the fewest toxicological and bioaccumulation responses (9); comparison to the reference R-OS and R-PF produced the most (41 each). The references R-AM and R-BF produced 22 responses each. Again, the significance of the comparisons is dependent upon the reference to which the test treatments

are compared. According to the 1991 Implementation Manual, further evaluation of the test sediments and the proposed dredged material they represent may be necessary to determine whether these materials can be disposed of in the ocean. These evaluations may take the form of numerical modeling, case-specific testing, or other management action as defined by the 1991 Implementation Manual and developed by the District Engineer and Regional Administrator. The summary results presented in Tables 4.1 through 4.6 should aid in this decision and policy making.

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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 Richmond Harbor Program sediments (Figure A.1). However, in the few instances where these characteristics did apply, they were described under the "COMMENTS" column.

Core Data Log

Core #: _____ Logger: _____ Date: _____ Page of _____

Depth Below Water Surface (m)	Depth Below Mudline (m)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
0														
5														
10														
15														

FIGURE A.1. Log Form Used to Record Sediment Descriptions

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% Gravel	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	Sils and Clays	Low Liquid Limit	ML Sils 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	Sils or fine sandy silts with moderate plasticity
		CH	Clays of high plasticity, fat clays

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 versus 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

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 Richmond Harbor 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

GEOLOGIC ANALYSES DATA

Core Data Log

Core #: C-1

Logger: Bjornstad/Cadoret

Date: 6/24/91

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[illegible]

Core Data Log

Core #: C-3

Logger: Bjornstad/Cadore

Date: 6/24/91

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Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
36.0	0	S	L	M	CL	SY4/1 dark gray	VS	N	H	N	FS Silt	S w/ HCl	All YBM	↑
						SY3/2 dark olive gray								Gas voids
38.0											FS			↓
39.6														↓
														↓
5														↓
														↓
10														↓
														↓
15														↓

Core Data Log

Core #: C-5

Logger: Cadoret

Date: 6/24/91

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Core #: C-5		Logger: GAGGOL													
Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments	
36.4	0		R	L	M	CL	5Y4/1 dark gray ↓ 5Y3/1 very dark gray	VS	N	H ↓ M ↓ H	N	FS ↓ VFS	S w/ HCl	All YBM	↑ Composite chemistry samples ↓
38.0															
39.7															
	5														
	10														
	15														

Core Data Log

Core #: C-6

Logger: Cadoret

Date: 6/24/91

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[illegible]

Logger: Bjornstad

Date: 6/24/91

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Core Data Log

Core #: C-10

Logger: Bjornstad

Date: 6/24/91

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[illegible]

Core Data Log

Core #: C-11

Logger: Cadoret

Date: 6/24/91

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[illegible]

Core Data Log

Core #: C-16

Logger: Bjornstad

Date: 6/24/91

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[illegible]

Core Data Log

Core #: C-18

Logger: Cadoret

Date: 6/24/91

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Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
36.1	0		R	L	M	CL	5Y4/1 dark gray 5Y3/1 very dark gray	VS	N	H	N	VFS	S w/ HCl	
38.0			S/R	L/M	M/M	CL/ML	5Y3/1, very dark gray 5Y5/1, gray	S		M		G/Silt		YBM OBM mottled with YBM
40.0		Fe o	NA	NA	NA	SC/CL	10YR4/3, brown	F		S/L		MP Silt	N	OBM iron oxide nodules and organics
40.4		Fe	S	M	M	CH	10YR5/3, brown			H				
	5													
	10													
	15													

Core Data Log

Core #: C-19

Logger: Bjornstad/Cadoret

Date: 6/24/91

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[illegible]

Core Data Log

Core #: C-20

Logger: Cadoret

Date: 6/25/91

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[illegible]

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B.12

Core Data Log

Core #: C-24

Logger: Cadoret

Date: 6/25/91

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[illegible]

Core Data Log

Core #: C-25

Logger: Bjornstad

Date: 6/25/91

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[illegible]

Core Data Log

Core #: C-26

Logger: Bjornstad

Date: 6/25/91

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Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
36.1	0	S	M	M	CL	5Y4/2, dark grayish brown 5Y4/1 dark gray	VS	N	H	N	FS Silt	N	S w/ HCl	High dry strength
38.0						5Y2.5/1 black								
40.0		NA	NA	NA	SM	5GY4/1 dark greenish gray	S				FP	N		YBM OBM Angular pebbles
40.6					SW						MP			
	5													
	10													
	15													

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B.16

Core Data Log

Core #: C-30

Logger: Cadoret

Date: 6/25/91

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Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
35.3	0	R	M	M	CL	5Y4/1 dark gray	VS	N	H	N	VFS	Sw/HCl		
36.7						5Y3/1 very dark gray		N						
38.0														
40.0		S	M	M		5Y4/1 dark gray	S		S		MS	N		Gas voids High dry strength YBM OBM Composite chemistry samples
	5													
	10													
	15													

Core Data Log

Core #: C-32

Logger: Cadoret

Date: 6/25/91

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Core Data Log

Core #: C-35

Logger: Cadoret

Date: 6/25/91

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[illegible]

Core Data Log

Core #: C-36

Logger: Cadoret

Date: 6/25/91

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[illegible]

Core Data Log

Core #: C-37

Logger: Bjornstad

Date: 6/25/91

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[illegible]

Core Data Log

Core #: C-38

Logger: Bjornstad/Cadoret

Date: 6/25/91

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[illegible]

Core Data Log

Core #: TC-1

Logger: Bjornstad/Cadoret

Date: 6/26/91

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Depth Below Water Surface (m)	Depth Below Mudline (m)	Lithology	Disturbance	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HC Reaction	Maximum Particle Size	Odor	Comments
11.3	0		R	M	M	CL	5Y4/1 dark gray	VS	N	H	N	Silt	O Weak S w/ HCl	<ul style="list-style-type: none"> Slight sewage odor Medium dry strength
12.0			S		H	CH	2.5Y2/0, black 5Y3/1 5Y3/1 very dark gray	S		M H			N	<ul style="list-style-type: none"> Whole <u>Macoma</u>
14.0														
16.0	5													<ul style="list-style-type: none"> Whole <u>Macoma</u>
18.0														
20.0														<ul style="list-style-type: none"> Shell fragments
22.0	10													<ul style="list-style-type: none"> Very high dry strength Shell fragments
24.0														
26.0	15		NA S	NA M	NA H	SMACH CH	5Y4/1 dark gray 5GY4/1 dark greenish gray			M L H		MS Silt		<ul style="list-style-type: none"> sand strata 1.5 cm thick organic material in horizontal mats < 0.5 cm thick reduced Very high dry strength
28.0														
30.0														
32.0	20		N				5GY4/1 dark greenish gray	F H				VFP		<ul style="list-style-type: none"> YBM OBM oxidized Very high dry strength rounded pebbles hematite nodules
34.0			NA	NA	NA	SC	5GY4/1 dark greenish gray	F				CP		<ul style="list-style-type: none"> gradational contact clayey sand w/gravels 40 % vlp-ss, 40 % sand, pred. m-ss, 20 % fines, pebbles rounded, highly weathered
36.0	25													
36.5														
30														

Composite chemistry sample 1/2

Composite chemistry sample 2/2

Core Data Log

Core #: TC-2

Logger: Bjornstad/Cedoret

Date: 6/25/91

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Depth Below Water Surface (m)	Depth Below Mudline (m)	Lithology	Consistency	Toughness	Plasticity	Type	Color	Consistency	Conservation	Structure	HC Reaction	Medium Particle Size	Odor	Comments
11.5	0	R	M	M	CL	2.5Y2/0, black	VS	N	H	N	VFS	O	Weak S w/ HCl	• Sewage odor
12.0						6Y4/1, dark gray 2.5Y2/0, black 6Y4/1, dark gray 6Y4/1, dark gray mottled with 2.5Y2/0, black								
14.0														
16.0		S		H	CH	5GY4/1 dark greenish gray			H		Z	N		• Whole Macoma
18.0	5						S							• Shell fragments
20.0														• Very high dry strength
22.0	10													• Oyster shells
24.0		NA S	NA M	NA H	SM CH	5Y4/1 dark gray 5GY4/1 dark greenish gray			L H		MS Z			• Very high dry strength
26.0	15													• organic • oxidized material in horizontal mats < 0.5 cm thick, 14C sample
28.0														• Very high dry strength
30.0		N				5Y3/1 very dark gray 5GY4/1 dark greenish gray	F H				MP Z CP			• Rippup clasts of OBM
32.1	20	NA	NA	NA	SM									YBM OBM • Rounded quartz pebble • High dry strength • 6% subangular to rounded pebbles • Hematite nodules • Very high dry strength
25														
30														

Core Data Log

Core #: TC-2, 12 inch core

Logger: Cedarat

Date: 6/20/91

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Depth Below Water Surface (ft)	Depth Below Seam Head (ft)	Unitary	Distancy	Tray/rows	Particly	Type	Color	Consistency	Composition	Structure	MO Reaction	Maximum Particle Size	Other	Comments
11.5	0													• Soft, black, oily silt, stratified with grayish green silt. Strong odor of hydrogen sulfide.
12.0														↓
14.0														• Sticky, slightly firm, greenish gray, silty clay with small shells.
16.0	5													↓
18.0														
20.0														
22.0	10													
24.0														
26.0														
28.0	15													• Firm, silty clay with small shells.
30.0														↓
32.0														• Silty clay with many roots.
34.0	20													↓
36.0														• Firm grayish green, silty clay.
38.0														↓
40.0														
42.0	25													• Soft, sticky, greenish gray, silty clay.
44.0														↓
46.0														
48.0	30													YBM OBM • Very firm, dark grayish green, silty clay with granules-MP. Pebbles are rounded.
50.0														↓
52.0														
54.0	35													• Stratified, greenish gray, sandy gravel. Subangular to rounded gravels.
56.0														↓
58.0														
60.0														

Core Data Log

Core #: TC-3

Logger: Bjornstad/Cadoret

Date: 6/27/91

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Depth Below Water Surface (m)	Depth Below Mudline (m)	Lithology	Consistency	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Notes
8.5	0	R	L	L	ML	SY3/1 very dark gray SY2.5/1, black SY3/1 very dark gray	VS	N	H	N	VFS	S	• Medium dry strength • Whole and fragmented shells • Medium dry strength
10.0		S	M	M	CH						Z	N	
12.0													• Slightly finer
14.0	5												• Very high dry strength • Whole <u>Macoma</u>
16.0													
18.0	10												
20.0													
22.0													• Very high dry strength • Dense oyster hash
24.0	15												
26.0													
28.0	20	NA S	NA M	NA M	SP/CH CH				S H		MP Z		• CH stratum • Fine organics • Very high dry strength
30.0													
32.0		NA	NA	NA	SM SW/SP	5GY4/1 dark greenish gray 5Y4/1 dark greenish gray 10YR4/3 brown	H		S		S N	MP	YBM OBM • carbonate nodules • High dry strength • oxidized
34.0	25											CP	
34.3													
30													

Composite chemistry sample 1/2

Composite chemistry sample 2/2

Core Data Log

Core #: TC-3, 12 inch

Logger: Cadoret

Date: 6/20/91

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Depth Below Wave Surface (ft)	Depth Below Mudline (ft)	Lithology	Discontinuity	Toughness	Plasticity	Type	Color	Consistency	Orientation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
8.5	0													• Dark gray silt Many whole <u>Macoma</u>
10.0														↓
12.0														• Gray, slightly firm, clayey silt Whole <u>Macoma</u>
14.0	5													↓
16.0														
18.0														
20.0	10													• Dense oyster hash
22.0														↓ ↓
24.0	15													• Firm, greenish gray silty clay
26.0														↓
28.0														
30.0	20													
32.0														YBM ↓
34.0	25													OBM • Friable, greenish gray silty sand
36.0														↓
38.0														• Friable, brown, stratified sandy gravel
40.0														↓
42.0	30													
44.0														• Very firm, yellow brown, clayey silt
45.5	37													↓

Core Data Log

Core #: TC-4, 12 inch core

Logger: Cadoret

Date: 6/20/91

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Core Data Log

Core #: TC-4

Logger: Bjornstad/Cadoret

Date: 6/26/91

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Depth Below Mean Surface (ft)	Depth Below Mudline (ft)	Lithology	Grain Size	Toughness	Plasticity	Type	Color	Consistency	Orientation	Structure	NO Reaction	Medium Particle Size	Other	Comments
6.2	0		NA	NA	NA	SM	5Y3/1 very dark gray	VS	N	H	N	FS	N	<ul style="list-style-type: none"> Silty sand, ~20% mud Silty sand, ~50% mud Medium dry strength Shell hash
8.0			S	M	H	CH		S				Z		
10.0														<ul style="list-style-type: none"> Whole Macoma Very high dry strength
12.0				M				VS						<ul style="list-style-type: none"> Very high dry strength
14.0														
16.0	10							S						<ul style="list-style-type: none"> High dry strength
18.0								VS						<ul style="list-style-type: none"> Very high dry strength Whole Macoma Oyster shells
20.0								S						<ul style="list-style-type: none"> Very high dry strength
22.0								VS						<ul style="list-style-type: none"> Shell fragments
24.0								S						
26.0	20							VS				FS		<ul style="list-style-type: none"> Medium dry strength
28.0								S				Z		<ul style="list-style-type: none"> Very high dry strength
30.0							5G4/1 dark greenish gray	H		M		Z		<ul style="list-style-type: none"> YBM OBM Medium pebbles
32.0	25		NA	NA	NA	SM	2.5Y4/4 olive brown	F		L		FP		<ul style="list-style-type: none"> Very high dry strength Low water modulus Carbonate nodules Small organic nodules Very high dry strength Graded beds
34.0						SP	2.5Y4/2 dk grayish brn			H		MS		
36.0						SM	2.5Y4/4 olive brown			H		VFS		
38.0						SP	2.5Y4/2 olive brown			M		MS		
40.0						SM	2.5Y4/4 olive brown			H		VFS		
42.0						SP	2.5Y4/2 olive brown			H		CS		
44.0						SM	2.5Y4/4 olive brown			H		VFS		<ul style="list-style-type: none"> Loose sand
46.0	30					SW	10YR2/2 very dark brown	F		H		MP		
48.0							2.5Y4/4			L				
50.0			S	M	M	CH	2.5Y4/2 dk grayish brn	H		H		Z		<ul style="list-style-type: none"> Very high dry strength

Core Data Log

Core #: TC-5

Logger: Bjornstad/Cadoret

Date: 6/25/91

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Depth Below Water Surface (ft)	Depth Below Mudline (ft)	Lithology	Dilatancy	Toughness	Plasticity	Type	Color	Consistency	Cementation	Structure	HCl Reaction	Maximum Particle Size	Odor	Comments
21.9	0	R	M	M	CL	5Y4/1 dark gray 2.5YN2/0 black 5Y4/1 dark gray 2.5YN2/0 5Y4/1 dark gray 2.5YN3/0 very dark gray	VS	N	H M H S H M	N	Z	S n/ HCl		Two 1 cm thick black laminae
24.0														Very high dry strength Gas voids Few shell fragments
26.0														
28.0	5					2.5YN2/0 black			H			P/S		Composite chemistry sample 1/2
30.0					CL/SM CL				S H S		FS Z			Three SM strata each 0.5 cm thick
32.0	10					5Y3/1 very dark gray								Shell fragments Organic rich
34.0						5Y2.5/1 black		S	H		MP			YBM OBM Rounded pebbles and blue-gray riprap clasts Very high dry strength
36.0						5GY4/1 greenish gray		F						Very high dry strength Composite chemistry sample 2/2
	15													

Core Data Log

Date: 6/27/91

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Core #: TC-6

Logger: Calcare/Bjornstad

Core Data Log

Core #: TC-7

Logger: Cadoret/Bjornstad

Date: 6/27/91

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Depth Below Water Surface (m)	Depth Below Mudline (m)	Lithology	Distancy	Toughness	Plasticity	Type	Color	Consistency	Commentation	Structure	NO Reaction	Maximum Particle Size	Odor	Comments
11.0	0		R	M	M	ML	5Y3/1 very dark gray	VS	N	H	N	Z	S	<ul style="list-style-type: none"> Whole and fragmented shells Medium dry strength ALL YBM
12.0														
14.0						CH								
16.0	5												N	<ul style="list-style-type: none"> Small brown organics
18.0														
20.0														
22.0														
24.0								S						<ul style="list-style-type: none"> Shell fragments
26.0	15													<ul style="list-style-type: none"> High dry strength
28.0														
30.0														<ul style="list-style-type: none"> Firmer Very high dry strength
32.0	20		NA	NA	NA	SP/ML		VS		S		MS		<ul style="list-style-type: none"> Well sorted silty vl-ms, predominately ls. Stratified with CH strata 1-7 cm in width Medium dry strength
34.0			S	M	M	CH		S		H		Z		
36.0	25													
38.0														<ul style="list-style-type: none"> High dry strength
40.0														
40.5	30													

APPENDIX C

SEDIMENT CHEMISTRY AND QUALITY ASSURANCE DATA

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Grain Size
LABORATORY: Soil Technologies, Inc.
MATRIX: Sediment
SAMPLE NUMBER: 57

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
ASTM D421 & D422	NA	NA	NA

HOLDING TIMES NOT APPLICABLE

DETECTION LIMITS NOT APPLICABLE

METHOD BLANKS NOT APPLICABLE

MATRIX SPIKES NOT APPLICABLE

SRMs NOT APPLICABLE

REPLICATES Three samples were analyzed in triplicate (TC-5 Upper Comp, R-BF, and R-AM) with each extraction batch. Precision was measured by Relative Standard Deviation (RSDs) between replicates. Comparison of sand, silt, and clay summations resulted in RSD values ranging from 0% to 2%.

SURROGATES NOT APPLICABLE

ADDITIONAL INFORMATION

All samples were corrected for the quantity of salt and dispersant contained in the fluid collected during analyses of the pipette fraction. This consisted of extracting a 20-mL aliquot of the seawater/dispersant mixture, evaporative drying, weighing of the residual material remaining, and subtraction and correction of all fractions measured by pipette. The salt/dispersant mass was reported with the raw data.

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Total Organic Carbon (TOC)
LABORATORY: Global Geochemistry Corporation
MATRIX: Sediment
SAMPLE NUMBER: 57

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
5310	NA	±10%	0.1%

HOLDING TIMES Holding times have not been set for TOC analyses of sediments. All samples were freeze dried upon receipt at the laboratory. Samples were analyzed within 2 months of laboratory sample receipt, which is consistent with recommendations for other organic analyses.

DETECTION LIMITS Detection limits were acceptable (<0.1%).

METHOD BLANKS Three method blanks were analyzed. Blank contamination was at levels less than 0.01%, ranging from 0.006% to 0.009%. These values are less than 1/10 the target detection limits of 0.1% and do not require blank correction.

MATRIX SPIKES Not applicable.

SRMs One standard reference material, MESS-1, obtained from the National Research Council of Canada (NRCC) was analyzed in triplicate. Although not certified for TOC, frequent analyses at MSL indicated an estimated value of 2.3%. Values obtained ranged from 2.29% to 2.33%, indicating acceptable accuracy for this method.

REPLICATES Three samples were analyzed in triplicate (TC-5 Upper Comp, R-AM, and R-BF). Precision was measured by Relative Standard Deviation (RSD) between replicates. The RSDs for the replicates ranged from 0% to 4%, indicating acceptable precision for the method.

Seven samples were also analyzed in duplicate. Relative percent differences ranged from 0% to 7%, indicating acceptable analytical precision for this method.

SURROGATES Not applicable.

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Total Volatile Solids (TVS)
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: Sediment
SAMPLES NUMBER: 57

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
MSL-M-2	NA	±10%	0.1%

HOLDING TIMES

Holding times have not been set for TVS analyses on sediments. Samples were held frozen or freeze dried and analyzed within 2 months of sample receipt at the laboratory.

DETECTION LIMITS

Detection limits were acceptable for all samples (<0.1%)

METHOD BLANKS

Two method blanks were analyzed with these samples and they were measured at 0.0013% and 0.0014% in each blank. These levels were below the method detection limit and do not require blank correction or affect sample results.

MATRIX SPIKES

NOT APPLICABLE

SRMs

NOT APPLICABLE

REPLICATES

Three samples were analyzed in triplicate (TC-5 Upper Comp, R-AM, and R-BF). Precision was measured by Relative Standard Deviation (RSD) between replicates. The RSDs for the triplicates ranged from 1% to 3%, indicating acceptable precision of the method.

SURROGATES

NOT APPLICABLE

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Oil and Grease/Total Petroleum Hydrocarbons (TPHs)
LABORATORY: Twin City Testing
MATRIX: Sediment
SAMPLES NUMBER: 57

QA/QC REQUIREMENTS

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Oil and Grease	413.2	50% - 150%	±20%	20 mg/kg
TPH	418.1	50% - 150%	±20%	20 mg/kg

HOLDING TIMES

Holding times have not been set for oil and grease in sediment. All samples were held frozen and analyzed within 2 months of laboratory receipt, which is consistent with recommendations for other organic analyses.

DETECTION LIMITS

Detection limits were acceptable for all samples (< 20 ppm)

METHOD BLANKS

Three oil and grease method blanks were analyzed with the samples. Oil and grease levels in the method blanks ranged from 3.31 to 7.14 mg/kg. Two method blanks were analyzed for TPH analyses with levels ranging from 0.47 to 5.34 mg/kg. Blank levels were in most cases, less than 1/5 the target detection limit goals. Blank corrections were not required.

MATRIX SPIKES

Three blank spikes were analyzed with each extraction batch. The spiking solution was consistent with EPA Method 413.2 (EPA 1991) and was spiked into samples of clean sand that were extracted and analyzed. Recoveries for both oil and grease and TPH ranged from 89% to 154%. All values were within the range of recovery except for the recovery of one TPH spike. Spike recovery data indicated acceptable accuracy of the method.

Three sets of matrix spike/matrix spike duplicate samples (COMP I, COMP III, and COMP IV) were analyzed with the samples. Matrix spike recoveries ranged from 31% to 131% with two spike recoveries outside of the QC goals. Relative Percent Differences (RPDs) between the recoveries ranged from 9% to 45%, with RPDs for two of the three sets of spike duplicates exceeding the precision goal of 20%.

Blank spikes tended to be more reproducible than actual matrix spikes, indicating somewhat reduced accuracy resulting from sediment matrix effects.

REPLICATES

Three samples were analyzed in triplicate (TC-5 Upper Comp, R-BF, and R-AM). Relative Standard Deviation (RSD) between replicates ranged from 9% to 46%. Four out of the six RSD values calculated exceeded the QC goal for precision.

SRMs

NOT APPLICABLE

SURROGATES

NOT APPLICABLE

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs)
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: Sediment
SAMPLE NUMBER: 57

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
8270	40% - 120%	±30%	20 µg/kg

HOLDING TIMES

The following is a list of QC extraction and analysis dates for the three batches of sediment samples analyzed for PAHs:

	<u>Extraction Date</u>	<u>GC Analysis Date</u>
Batch A:	10/30/91	11/25/91
Batch B:	9/18/91	11/13/91-11/15/91
Batch C:	11/05/91	12/25/91-12/30/91
Batch D (reruns):	01/30/92	02/27/92

Samples were kept frozen until used in extraction. Batch A, Batch C, and Batch D extracts were analyzed within the EPA recommended 40-day (EPA 1986) holding time. However, due to instrument problems, Batch B was not analyzed for up to 57 days. Matrix spikes and surrogate compounds were added to all samples at the time of extraction. Recoveries of matrix spike and surrogates indicate that no serious bias was introduced for Batch B PAH analyses.

DETECTION LIMITS

The achieved detection limits for all PAH compounds were much lower than the target detection limit goals of < 20 µg/kg and are acceptable.

METHOD BLANKS

Four method blanks were analyzed (one with each extraction batch). Two LPAHs (naphthalene and phenanthrene) were present in all method blanks. Three HPAHs (fluoranthene, pyrene, and benzo(ghi)-perylene) were present in two of the four method blanks. Levels of naphthalene and phenanthrene in Blank A were approximately two times the target detection limit. The remaining three blanks were approximately 1/2 the target detection limits of 20 µg/kg. All sample values associated with Blank A were flagged with a "B" to note possible blank contamination. The HPAH contaminants in the blanks were less than the target detection limits and were not flagged with a "B".

MATRIX SPIKES

Three samples (COMP I, COMP III, and COMP IV) were spiked in duplicate with all sixteen PAH compounds. These spikes were measured to assess the accuracy of the method. Recoveries for LPAH compounds ranged from 19% to 93%. All recoveries for Batch B and Batch C were within the QA/QC requirements. Recovery for all PAH compounds in Batch A spike duplicate were consistently below the lower QC limit of 40%. Since surrogate recoveries for this sample were acceptable, the most probable explanation is that the sample was inadvertently spiked low and should not affect the quality of samples analyzed with this batch.

The HPAH spike recoveries ranged from 36% to 209% with the majority of the recoveries within the QA/QC requirements. However, pyrene recoveries were high (172% and 209%) for both spikes in Batch C. These recoveries suggest that the pyrene values associated with Batch C may be biased high.

SRMs

One SRM compound, 1941 (NIST) was analyzed with each extraction batch. Values were within 30% of the certified mean value.

REPLICATES

Four samples (COMP III, COMP IV, TC-5 Upper Comp, and R-BF) were analyzed in triplicate. Precision of the method was measured by determining the Relative Standard Deviation (RSD). The LPAH replicate analyses showed acceptable precision with RSD ranging from 5% to 26%. The HPAH RSDs ranged from 4% to 30%, again, indicating acceptable precision of the method.

SURROGATES

Three radiolabelled surrogates (naphthalene d8, acenaphthalene d10, and perylene d12) were added to samples prior to extraction to assess the efficiency of the method. Naphthalene recoveries ranged from 1% to 82%. The QA/QC Plan does not require re-extraction unless recoveries are below 20%. One sample had a recovery less than 20% for naphthalene and was subsequently re-extracted producing a naphthalene d8 recovery of 1%; a second re-extraction was not required. Re-extractions were not required for acenaphthene and perylene, which had recoveries of 38% to 80% and 37% to 138%, respectively.

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs)
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: Sediment
SAMPLE NUMBER: 57

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
8080	40% - 120%	±30%	20 µg/kg

HOLDING TIMES

The following is a list of extraction dates and GC run dates for the three batches of sediment samples analyzed for PCB/Pesticides:

	<u>Extraction Date</u>	<u>Analysis Date</u>
Batch A:	10/30/91	11/25/91
Batch B:	09/18/91	11/13/91-11/15/91
Batch C:	11/05/91	12/25/91-12/30/91
Batch D (re-runs):	01/30/92	02/27/92

Samples were frozen until used in extractions. Batch A, Batch C, and Batch D extracts were analyzed within the EPA recommended 40-day (EPA 1986) holding time. However, Batch B was not analyzed for 57 days. Matrix spikes and surrogate compounds were added to all samples at the time of extraction. Matrix spike recoveries were somewhat elevated (see below), indicating extract evaporation may have occurred during the longer holding time and the values associated with this batch may be biased high.

DETECTION LIMITS All PCB detection limits were within the detection limit goals. Detection limits for six of the pesticides were elevated (10 µg/kg) in three samples (C-8, R-BF Rep. 2 and 3) due to matrix interferences. Detection limits for toxaphene were below the target detection limit of 30 µg/kg.

METHOD BLANKS Six method blanks were analyzed for the pesticide and PCB samples. Pesticides and PCBs were not detected in any of the sediment samples.

MATRIX SPIKES Three samples (COMP I, COMP III, and COMP IV) were spiked in duplicate to assess the accuracy of the method. A portion of the samples were spiked with 19 pesticides and a separate aliquot of these samples were spiked with aroclor 1254. One pesticide spike duplicate for Batch A was lost after extraction; therefore, only a matrix spike is available for that batch.

Pesticide recoveries (excluding endrin) for COMP I and COMP IV ranged from 73% to 172%. All but 6 of 21 recovery measurements for Batch A and Batch C spikes were within the QA/QC requirements. Batch B had higher recoveries for all pesticides ranging from 131% to 219% (excluding endrin). The sample results for Batch B may also be elevated, although surrogate recoveries for these samples were not significantly higher than the other batches.

Endrin recoveries for all matrix spikes were high, ranging from 257% to 548%. No corrective action was taken.

The PCB spike recoveries ranged from 74% to 125%. One recovery value for the spike from Batch A exceeded the QA/QC requirements. This indicates acceptable accuracy of the method. Relative percent differences (RPDs) between the spike and spike duplicates ranged from 8% to 38% with one RPD value from Batch C slightly exceeding the precision goal of $\pm 30\%$, indicating acceptable precision of the method.

SRMs

One SRM, 1941 (NIST), was analyzed with each batch of samples for pesticides. Pesticide values are reported for this SRM; however, they are not certified and are considered consensus values and were obtained from only one laboratory using a different method. Three pesticides consensus values (4,4'-DDT, 4,4'-DDD, and 4,4'-DDE) were elevated above the target consensus values. These elevated SRM values indicate that the accuracy of the pesticide analyses may be biased high. However, these consensus values are not certified and in themselves may be biased low.

Consensus values were not provided for aroclor concentrations.

REPLICATES

Three samples (TC-5 Upper Comp, R-AM, and R-BF) were analyzed in triplicate to assess precision as measured by the Relative Standard Deviation (RSD). Only one pesticide was detected in one set of triplicates and a value of 5% was obtained indicating acceptable precision of the measurement. Aroclor precision was measured in all three sets of triplicates. The RSDs ranged from 4% to 37% with only the RSD value from Batch B exceeding the precision goal.

SURROGATES

Two surrogate compounds were added to all samples prior to analyses, tetrachloro-metaxylene (TCMX) and octachloronaphthalene (OCN). All recoveries were within the QA/QC requirements with the exception of two TCMX values of 30.5% and 129% and one sample with an OCN recovery of 24.9%. Because no pesticides or PCBs were detected in these samples and the recovery was greater than 20%, re-extraction was not required.

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, and Zn)
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: Sediment
SAMPLE NUMBER: 57

QA/QC REQUIREMENTS

	<u>QA/QC Document</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limits (dry wt)</u>
Arsenic	PNL-SP-19	NA	±20%	1.0 mg/kg
Cadmium	MSL-M-33	75% - 125%	±20%	0.1 mg/kg
Chromium	PNL-SP-19	NA	±20%	1.0 mg/kg
Copper	PNL-SP-19	NA	±20%	1.0 mg/kg
Lead	PNL-SP-19	NA	±20%	1.0 mg/kg
Mercury	MSL-M-11	75% - 125%	±20%	0.02 mg/kg
Nickel	PNL-SP-19	NA	±20%	1.0 mg/kg
Selenium	MSL-M-33	75% - 125%	±20%	0.5 mg/kg
Silver	MSL-M-33	75% - 125%	±20%	1.0 mg/kg
Zinc	PNL-SP-19	NA	±20%	1.0 mg/kg

HOLDING TIMES

All metals were analyzed within the recommended holding times specified by EPA/USACE (1991). Samples were immediately freeze dried, digested, and analyzed within the 6 month recommended holding times for metals in sediments.

DETECTION LIMITS

All detection limit goals were met.

METHOD BLANKS

Three method blanks were digested with the samples. Two of the three blanks were analyzed by GFAA for Ag and Cd. Blanks did not produce values for Ag but low levels of Cd were detected. All values associated with the blanks corrected for Cd levels. (NOTE: Blank amount was less than 10% of any sample value and does not affect the results.) All three method blanks were analyzed in duplicate for Hg. Low levels of Hg were detected in method blanks; all values were corrected for Hg blank levels. (NOTE: Method blanks are not requested for As, Cr, Cu, Ni, Pb, Se, and Zn due to the method of analysis XRF, which precludes the use of method blanks.)

MATRIX SPIKES

Three samples (COMP I, COMP III, COMP IV) were spiked in duplicate to assess the accuracy of the method. Matrix spikes were appropriate for Ag, Cd, and Hg. Recoveries ranged from 80% to 111% and were within the QA/QC requirements, which indicated acceptable accuracy of the method. Relative Percent Differences (RPDs) between spike and spike duplicate recoveries ranged from 1% to 9% and were within the precision requirements.

SRMs

SRM 1646, an estuarine sediment (obtained from NIST), was analyzed for all metals with the exception of Ag and Se (1646 is not certified for these metals). Three separate aliquots of this sample were analyzed to assess accuracy of the measurement. Cd, Cr, and Ni were out of the certified range but were within the QA/QC requirements. A second SRM, BEST-1, a marine sediment (obtained from the NRCC) was analyzed for Hg. All measurements were below the certified range but were within the QA/QC requirements.

REPLICATES

Three samples (TC-5 Upper Comp, R-AM, and R-BF) were analyzed in triplicate to assess precision of the method as measured by Relative Standard Deviation (RSD). The RSD values ranged from 0% to 39%. Four out of thirty measurements exceeded QA/QC requirements, indicating acceptable precision for the methods.

SURROGATES

Not Applicable

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: Sediment
SAMPLES NUMBER: 57

QA/QC REQUIREMENTS

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Monobutyltin	MSL-M-4	-	±30%	10 µg/kg
Dibutyltin	MSL-M-4	40% - 120%	±30%	10 µg/kg
Tributyltin	MSL-M-4	40% - 120%	±30%	10 µg/kg

HOLDING TIMES

Holding times have not been established for butyltin compounds in sediment. Samples were frozen until used for extraction. Analyses were performed within 2 months of sample receipt at the laboratory, which is consistent with recommendations for other organic analyses.

DETECTION LIMITS

Detection limit goals (1 µg/kg) were met.

METHOD BLANKS

Five method blanks were analyzed. Butyltins were undetected in all method blanks with the exception of dibutyltin in the blank from Batch D. The value detected was less than 1/5 the target detection limit and does not require correction for blank contamination or affect the quality of sample data.

MATRIX SPIKES

Three butyltin compounds, mono-, di-, and tributyltin were spiked for three samples (COMP I, COMP III, and COMP IV). Tri- and dibutyltin matrix spike recoveries ranged from 54% to 120% and were within the QA/QC requirements.

The RPD values between spike duplicates ranged from 1% to 39%, with all but one value within the QA/QC requirements.

SRMs

Standard Reference Material (SRM) PACS-1, obtained from the National Research Council of Canada (NRCC), was analyzed to assess the accuracy of butyltin methods. (Note: As required by the NRCC, these values are reported after being corrected for surrogate recoveries.) All but one tributyltin recovery were within the certified values. Dibutyltin recoveries were more variable and were not within the certified ranges. The MSL's past experience has resulted in recoveries similar to those reported here; therefore, no corrective action was taken. The variability of the analyses indicates that the measurements are either not precise or the SRM itself is non-homogeneous.

REPLICATES

Three samples (TC-5 Upper Comp, R-AM, and R-BP) were analyzed in triplicate. Precision was measured by Relative Standard Deviation (RSD) and ranged from 0% to 49% with one out of six measurements exceeding QA/QC requirements.

SURROGATES

One compound, triphenyltin, was added prior to extraction as a surrogate to assess the efficiency of the method. Surrogate recoveries ranged from 53% to 134%. All values were within the QA/QC requirements, with the exception of one sample, C-19, which had a recovery of 134%. The tri- and dibutyltin values associated with the elevated recoveries were undetected.

ADDITIONAL INFORMATION

The current compound used as a surrogate for butyltin analyses is triphenyltin. All pentyltin recoveries were within the QA/QC requirements. A few samples that initially exceeded these goals were re-extracted and analyzed.

The surrogate compound used in the past was tripropyltin. This compound is significantly more volatile than tributyltin and recoveries have been consistently low. For this reason, use of the new surrogate compound triphenyltin was initiated. Recent experiments in the laboratory have shown that the recoveries of the triphenyltin more accurately reflect the behavior of butyltin compounds.

TABLE C.1. Total Polynuclear Aromatic Hydrocarbons (PAHs) Found in Sediment Treatments, Richmond Harbor Program

Sediment Treatment	Analytical Batch	(µg/kg dry weight)		
		Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP I	C	193.41	1474.86	1668.27
C-1	A	164.93	867.91	1032.84
C-3	A	176.70	792.78	969.48
C-5	A	234.61	1661.51	1896.12
C-6	A	169.78	1357.69	1527.47
C-8	A	152.83	1023.63	1176.46
C-10	B	216.82	1962.23	2179.05
COMP II	A	810.27	1873.60	2683.87
C-11	B	170.16	1454.24	1624.40
C-16	B	103.84	915.55	1019.39
C-18	B	159.83	1223.22	1383.05
C-19	B	35.79	302.48	338.27
C-20	B	86.59	896.51	983.10
C-23	B	70.06	636.31	706.01
COMP III Replicate 1	B	67.80	348.10	415.90
COMP III Replicate 2	B	59.51	321.22	380.73
COMP III Replicate 3	B	62.03	345.73	407.76
TC-1 Upper	B	56.62	346.40	403.02
TC-2 Upper	B	87.16	1142.23	1229.39
TC-3 Upper	C	15.44	26.89	42.33
TC-4 Upper	B	272.22	1077.98	1350.20
TC-5 Upper Comp	A	187.25	1923.65	2110.90
TC-5 Upper Replicate 1	C	231.61	1948.80	2180.41
TC-5 Upper Replicate 2	C	206.55	1783.67	1990.22
TC-5 Upper Replicate 3	C	258.96	2397.28	2656.24
TC-5 Special Sample	C	387.85	1940.39	2328.24
COMP IV Replicate 1	A	55.47	30.31	85.78
COMP IV Replicate 2	A	54.19	36.00	90.19
COMP IV Replicate 3	A	63.96	28.37	92.33
TC-1 Lower	B	16.22	37.58	53.80
TC-2 Lower	B	50.10	425.10	475.20
TC-3 Lower	C	13.38	2.42	15.80
TC-4 Lower	C	22.07	461.79	483.86
TC-5 Lower	B	18.64	62.34	80.98

TABLE C.1. (contd)

Sediment Treatment	Analytical Batch	(µg/kg dry weight)		Total PAHs
		Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	
COMP V	A	238.53	2295.80	2534.33
C-24	B	27.97	54.94	82.91
C-26	B	150.56	1325.97	1476.53
C-30	C	168.93	1842.32	2011.25
C-33	C	144.86	1312.68	1457.54
C-35	A	138.51	814.98	953.49
C-37	A	94.50	681.07	775.57
COMP VI	A	305.46	2417.28	2722.74
C-25	B	96.52	836.88	933.40
C-29	A	111.75	749.52	861.27
C-32	A	51.23	407.67	458.90
C-36	B	225.99	1616.25	1842.24
C-38	B	111.81	1072.42	1184.23
TC-6 (1) ^(a)	C	73.36	681.77	755.13
TC-6 (1) Duplicate	C	78.54	667.93	746.47
TC-6 (2)	C	23.54	18.97	42.51
TC-6 (3)	C	10.90	2.24	13.14
TC-6 (4)	C	21.60	19.67	41.27
TC-7 (1) ^(a)	C	12.58	11.28	23.86
TC-7 (2)	C	25.65	15.42	41.07
TC-7 (3)	C	36.75	0.00	36.75
TC-7 (4)	C	21.18	6.29	27.47
R-AC	A	607.57	5696.86	6304.43
R-AM	B	534.55	1838.62	2373.17
R-BF	A	226.76	2460.25	2687.01
R-BF	A	170.46	1846.26	2016.72
R-BF	A	212.43	1494.49	1706.92
R-OS	A	77.44	114.67	192.11
R-PF	A	198.28	699.31	897.59
C-SB	A	169.97	328.57	498.54
C-WB	A	18.75	6.34	25.09
C-NE	A	35.00	12.77	47.77

(a) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs) in Sediment, Richmond Harbor Program

Sediment Treatment	Analytical Batch	LPAHs ($\mu\text{g/kg}$ dry weight)					
		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Target DL (a)		20.0	20.0	20.0	20.0	20.0	20.0
Achieved DL (High)		8.88	9.75	14.89	13.05	20.0	6.61
Achieved DL (Low)			2.41	3.03	2.49		2.02
COMP I	C	40.34	9.24	13.26	9.42	97.31	23.84
C-1	A	31.77 B ^(b)	7.38	10.79	7.88 U ^(c)	94.95 B	20.04
C-3	A	35.90 B	7.30 U	12.53	9.17 U	104.11 B	24.16
C-5	A	38.76 B	10.08	12.07	12.25	123.18 B	38.27
C-6	A	26.83 B	9.42	8.87	9.91	87.39 B	27.36
C-8	A	36.82 B	6.30	9.40	7.75	71.39 B	21.17
C-10	B	36.09	11.41	12.44 U	10.91 U	134.90	34.42
COMP II	A	143.49 B	117.28	119.23	123.40	160.18 B	146.69
C-11	B	28.79	8.73	7.65	9.58	93.53	21.88
C-16	B	20.19	5.20	5.89 U	5.39	60.72	12.34
C-18	B	29.73	7.52	5.99	8.50	88.40	19.69
C-19	B	7.72	3.04 U	4.64 U	4.07 U	23.82	4.25
C-20	B	17.13	8.45 U	12.91 U	11.32 U	55.74	13.72
C-23	B	9.01	3.73 U	3.73 U	5.28	46.08	9.69
COMP III Replicate 1	B	23.20	4.77 U	7.28 U	6.38 U	36.68	7.92
COMP III Replicate 2	B	20.07	4.01 U	6.13 U	5.37 U	34.26	5.18
COMP III Replicate 3	B	13.55	7.15 U	10.92 U	9.57 U	41.10	7.38
TC-1 Upper	B	16.13	3.81 U	5.82 U	5.10 U	33.90	6.59
TC-2 Upper	B	8.88 U	9.75 U	14.89 U	13.05 U	73.58	13.58
TC-3 Upper	C	6.67	2.41 U	3.26 U	2.94 U	8.77	2.35 U
TC-4 Upper	B	24.71	20.89	8.82	12.49	172.95	32.36
TC-5 Upper Comp	A	33.06 B	10.94	9.58 U	16.92	96.72 B	29.61
TC-5 Upper Replicate 1	C	36.62	11.31	11.88	23.63	108.92	39.25
TC-5 Upper Replicate 2	C	33.47	8.84	10.75	21.91	97.46	34.12
TC-5 Upper Replicate 3	C	37.33	11.43	11.81	24.02	133.87	40.50
TC-5 Special Sample	C	30.28	8.87	19.19 X ^(d)	51.83	223.55	54.13
COMP IV Replicate 1	A	32.63 B	3.76 U	5.42 U	4.72 U	22.84 B	3.53 U
COMP IV Replicate 2	A	31.40 B	4.05 U	5.84 U	5.09 U	22.79 B	3.80 U
COMP IV Replicate 3	A	36.43 B	4.94 U	7.13 U	6.21 U	27.53	4.64 U
TC-1 Lower	B	5.46	4.84 U	7.39 U	6.47 U	10.76	4.47 U
TC-2 Lower	B	11.87	2.86 U	4.37 U	3.83 U	30.82	7.41
TC-3 Lower	C	8.88	3.40 U	4.60 U	4.15 U	4.50 X	3.32 U
TC-4 Lower	C	12.95	6.53 U	8.83 U	7.96 U	9.12	6.38 U
TC-5 Lower	B	9.43	7.16 U	10.93 U	9.58 U	9.21	6.61 U
COMP V	A	70.64 B	11.96	13.35 U	11.63 U	110.69 B	45.24
C-24	B	10.35	5.47 U	8.35 U	7.32 U	17.62	5.05 U
C-26	B	31.06	7.08	7.76 U	8.39	80.28	23.75
C-30	C	37.99	10.74	12.97 U	11.69 U	85.21	34.99
C-33	C	45.04	9.35	10.08 U	9.09 U	59.63	30.84
C-35	A	30.70 B	6.53	8.08	6.84	66.58 B	19.78
C-37	A	31.83 B	7.34 U	10.60 U	9.23 U	44.04 B	18.63
COMP VI	A	89.54 B	16.81	13.64	13.18	124.97 B	47.32
C-25	B	23.59	5.40 U	8.24 U	7.23 U	58.73	14.20
C-29	A	33.32 B	5.39	5.84	5.19	46.60 B	15.41
C-32	A	20.35 B	4.28 U	6.18 U	5.38 U	30.88 B	10.06
C-36	B	32.82	10.43	22.23	17.74	106.87	35.90
C-38	B	19.59	8.90	9.39 U	8.23 U	59.42	23.90

TABLE C.2. (contd)

Sediment Treatment	Analytical Batch	LPAHs ($\mu\text{g/kg}$ dry weight)					
		Naphtha- lene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
TC-6 (1) ^(e)	C	19.57	5.25	4.55 U	4.26	35.93	8.35
TC-6 (1) Duplicate	C	34.60	7.18 U	9.71 U	8.76 U	35.92	8.02
TC-6 (2)	C	12.52	3.56 U	4.81 U	4.34 U	11.02	3.48 U
TC-6 (3)	C	7.31	2.60 U	3.51 U	3.17 U	3.59	2.54 U
TC-6 (4)	C	13.29	4.28 U	5.79 U	5.22 U	8.31	4.18 U
TC-7 (1) ^(e)	D	5.07	2.58 U	3.62 U	3.04 U	7.51	2.02 U
TC-7 (2)	C	15.13	4.04 U	5.46 U	4.92 U	10.52	3.94 U
TC-7 (3)	C	13.04	5.65 U	7.64 U	6.89 U	4.49	5.71
TC-7 (4)	C	14.43	4.04 U	5.47 U	4.93 U	6.75	3.95 U
R-AC	A	76.94 B	23.27	53.24	37.48	308.42 B	108.22
R-AM	B	14.52	19.08	8.23 U	21.69	287.50	191.76
R-BF Replicate 1	A	53.93 B	13.00	11.59	11.37	109.71 B	27.16
R-BF Replicate 2	A	36.29 B	8.91	7.64	8.63	86.82 B	22.17
R-BF Replicate 3	A	39.62 B	12.74	9.62 U	11.79	113.33 B	34.95
R-OS	A	42.08 B	3.70 U	5.34 U	4.65 U	35.36 B	3.48 U
R-PF	A	23.99 B	6.25	8.28	10.18	110.56 B	39.02
C-SB	A	77.05 B	6.92 U	9.99 U	11.24	73.36 B	8.32
C-WB	A	9.17 B	2.24 U	3.23 U	2.81 U	9.58 B	2.10 U
C-NE	A	16.80 B	5.07 U	7.31 U	6.37 U	18.20 B	4.76 U

(a) DL Detection limits.

(b) B Analyte detected above target detection limit in blank associated with batch of samples.

(c) U The analyte was not present above the level of the associated value.

(d) X Indicates relative intensities of the primary/confirmation ion vary by greater than $\pm 20\%$ of these masses in the reference mass spectrum due to interferences to the confirmation ion (qualifies analyte data).

(e) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.3. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs) in Sediment, Richmond Harbor Program

Sediment Treatment	Analytical Batch	HPAHs ($\mu\text{g}/\text{kg}$ dry weight)									
		Fluoranthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) Pyrene	Indeno (1,2,3-c,d) Pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
Target DL (a)		20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Achieved DL (High)		4.84	4.82	5.92	4.99	4.48	4.06	5.81	5.34	5.16	4.13
Achieved DL (Low)		1.34	1.33	1.64	1.38	1.24	1.12	1.61	1.48	1.43	1.14
COMP I	C	206.95	20.64	95.06	102.03	153.46	113.02	253.73	254.05	23.49	252.43
C-1	A	112.15	179.05	60.46	60.06	73.23	55.53	129.12	98.13	9.68	90.50
C-3	A	137.92	17.82	64.82	64.20	82.36	60.06	143.26	109.47	10.39	102.48
C-5	A	215.43	324.98	118.11	113.80	144.58	102.71	246.69	198.12	21.22	175.87
C-6	A	169.75	256.00	90.68	86.68	120.81	84.48	204.46	174.57	18.84	151.42
C-8	A	137.54	201.71	65.10	65.12	89.37	64.39	149.81	125.13	12.98	112.48
C-10	B	269.72	408.08	114.32	152.99	190.85	138.20	232.63	212.27	27.80	215.37
COMP II	A	166.82	175.47	211.73	162.85	186.66	177.38	221.39	203.42	200.43	167.45
C-11	B	204.47	297.54	79.05	116.85	149.74	98.19	170.41	156.58	21.03	160.38
C-16	B	110.52	183.27	50.43	65.35	100.96	66.67	113.13	105.03	15.19	105.00
C-18	B	152.28	245.12	70.96	92.79	125.77	88.86	148.19	138.79	19.44	141.02
C-19	B	36.49	56.84	17.21	22.94	34.68	21.98	35.52	35.35	4.97	36.50
C-20	B	97.20	173.87	51.30	72.61	102.58	68.56	111.16	100.49	14.77	103.97
C-23	B	87.87	121.62	35.60	49.40	69.55	43.98	75.87	70.18	9.48	72.76
COMP III Replicate 1	B	44.12	62.23	19.39	27.63	40.53	23.52	39.70	39.42	7.55	44.01
COMP III Replicate 2	B	40.08	57.53	19.33	25.61	38.04	22.36	37.42	35.97	5.75	39.13
COMP III Replicate 3	B	43.26	61.20	23.23	31.12	38.29	25.54	40.32	36.27	6.67	39.83
TC-1 Upper	B	44.65	66.12	19.86	27.16	39.58	22.81	41.16	38.60	5.18	41.28
TC-2 Upper	B	141.15	211.11	66.89	90.66	122.14	86.16	143.64	130.18	17.74	132.56
TC-3 Upper	C	3.75	4.70	2.05 U ^(b)	2.96	5.67	1.41 U	2.72	3.06	1.79 U	4.03
TC-4 Upper	B	225.04	296.43	81.38	90.28	70.18	55.85	95.56	77.03	12.62	73.61
TC-5 Upper Comp	A	221.16	319.16	110.26	133.76	184.06	136.82	264.89	275.09	10.62	267.90
TC-5 Upper Replicate 1	C	215.91	320.61	115.38	136.23	182.50	125.82	268.45	279.69	31.52	272.69
TC-5 Upper Replicate 2	C	197.98	292.67	101.15	127.57	168.60	115.38	246.76	258.52	29.21	245.83
TC-5 Upper Replicate 3	C	273.10	382.85	137.62	170.54	227.09	167.08	327.01	341.83	42.26	327.90
TC-5 Special Sample	C	268.13	364.37	127.31	176.08	167.33	108.38	243.52	229.94	26.30	229.03

C.5

TABLE C.3. (contd)

Sediment Treatment	Analytical Batch	HPAHs ($\mu\text{g/kg}$ dry weight)									
		Fluoranthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) Pyrene	Indeno (1,2,3-c,d) Pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
COMP IV Replicate 1	A	6.90	9.96	3.42 U	2.96	6.29	2.21 U	3.42 U	3.12 U	3.07 U	4.20
COMP IV Replicate 2	A	7.18	10.64	3.68 U	3.05	6.74	2.38 U	3.68 U	3.58	3.31 U	4.81
COMP IV Replicate 3	A	7.50	11.13	4.49 U	3.49 U	5.80	2.91 U	4.50 U	4.11 U	4.03 U	3.94
TC-1 Lower	B	4.91	6.78	2.78 U	4.69	7.94	1.79 U	3.50	3.82	1.82 U	5.94
TC-2 Lower	B	55.81	82.16	24.22	34.61	49.46	29.40	48.51	46.29	6.70	47.94
TC-3 Lower	C	2.37 U	2.42	2.90 U	2.44 U	2.20 U	1.99 U	2.85 U	2.62 U	2.53 U	2.03 U
TC-4 Lower	C	6.55	8.11	5.57 U	7.14	7.38	4.20	5.47 U	6.27	4.86 U	6.34
TC-5 Lower	B	6.41	10.09	4.11 U	5.46	8.06	4.91	8.42	8.49	2.70 U	10.50
COMP V	A	199.15	376.52	141.71	166.43	248.80	182.37	361.27	306.40	40.46	272.69
C-24	B	7.37	9.27	3.56	5.64	11.82	2.03 U	4.97	5.09	2.06 U	7.22
C-26	B	149.88	273.08	70.70	99.08	150.44	101.04	161.85	149.03	20.11	150.76
C-30	C	180.72	312.15	106.36	126.20	188.69	136.11	258.08	261.06	32.48	240.47
C-33	C	111.50	214.71	75.22	94.84	139.80	106.93	189.04	182.36	23.65	174.63
C-35	A	77.36	141.17	48.30	53.66	89.22	64.81	128.45	105.38	13.09	93.54
C-37	A	54.74	137.27	35.77	46.48	80.41	59.72	106.00	79.31	10.62	70.75
COMP VI	A	227.53	409.19	150.70	165.86	266.02	186.45	380.34	313.44	42.09	275.66
C-25	B	97.98	165.54	49.30	63.56	88.83	64.51	104.02	93.92	13.34	95.88
C-29	A	76.96	144.60	50.77	53.69	75.25	55.56	110.75	90.66	11.06	80.22
C-32	A	41.75	85.31	24.85	28.12	42.32	28.94	58.45	48.03	7.43	42.47
C-36	B	149.83	339.76	89.52	142.53	198.38	150.26	197.90	162.99	29.73	155.35
C-38	B	90.70	207.34	57.21	99.07	138.43	102.07	138.35	111.16	22.71	105.38
TC-6 (1)(c)	C	67.05	94.84	42.42	45.82	66.65	49.35	105.65	100.86	11.12	98.01
TC-6 (1) Duplicate	C	66.40	94.84	40.27	45.02	63.66	49.64	104.64	96.78	10.46	96.22
TC-6 (2)	C	3.27	4.42	3.03 U	3.14	4.90	2.09 U	2.98 U	2.74 U	2.65 U	3.24
TC-6 (3)	C	1.81 U	2.24	2.22 U	1.87 U	1.68 U	1.52 U	2.18 U	2.00 U	1.93 U	1.55 U
TC-6 (4)	C	5.06	5.25	3.65 U	3.08 U	5.32	2.51 U	3.59 U	3.29 U	3.19 U	4.04
TC-7 (1)(c)	D	2.28	2.85	1.14 U	2.19	2.60	0.72 U	0.93 U	0.96 U	0.94 U	1.36
TC-7 (2)	C	3.62	4.59	3.44 U	2.90 U	4.36	2.37 U	3.38 U	3.11 U	3.00 U	2.83
TC-7 (3)	C	3.94 U	3.93 U	4.82 U	4.06 U	3.66 U	3.31 U	4.73 U	4.35 U	4.21 U	3.37 U
TC-7 (4)	C	3.08	3.21	3.45 U	2.90 U	2.62 U	2.37 U	3.39 U	3.11 U	3.01 U	2.41 U

TABLE C.3. (contd)

Sediment Treatment	Analytical Batch	HPAHs ($\mu\text{g/kg}$ dry weight)									
		Fluoran- thene	Pyrene	Benzo(a) Anthra- cene	Chrysene	Benzo(b) Fluoran- thene	Benzo(k) Fluoran- thene	Benzo(a) Pyrene	Indeno (1,2,3- c,d) Pyrene	Dibenzo (a,h) Anthra- cene	Benzo (g,h,i) Perylene
R-AC	A	767.53	1424.27	350.58	320.57	407.72	305.36	843.65	658.76	55.72	562.70
R-AM	B	321.65	436.79	198.52	231.57	101.18	139.51	192.71	106.12	23.93	86.64
R-BF Replicate 1	A	254.72	371.85	145.00	146.66	240.57	171.82	393.61	373.38	37.67	324.97
R-BF Replicate 2	A	189.46	272.33	104.23	113.04	187.99	124.69	293.95	285.61	28.90	246.06
R-BF Replicate 3	A	171.40	247.03	93.49	103.15	139.80	99.85	232.94	203.53	20.15	183.15
R-OS	A	15.54	22.15	5.52	9.68	18.72	2.18 U	12.70	14.52	3.02 U	15.84
R-PF	A	102.54	150.06	84.61	79.14	41.17	49.36	98.56	46.47	9.27	38.13
C-SB	A	70.84	60.43	21.24	47.30	34.66	19.08	25.01 X ^(d)	25.23	5.65 U	24.78
C-WB	A	2.85	3.49	2.04 U	1.58 U	1.49 U	1.32 U	2.04 U	1.86 U	1.83 U	1.35 U
C-NE	A	5.13	7.64	4.61 U	3.58 U	3.37 U	2.98 U	4.61 U	4.21 U	4.14 U	3.05 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

(c) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic description.

(d) X Indicates relative intensities of the primary/confirmation ion vary by greater than $\pm 20\%$ of these masses in the reference mass spectrum due to interferences to the confirmation ion (qualifies analyte data).

TABLE C.4. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs) in Sediment, Richmond Harbor Program

Sediment Treatment	Analytical Batch	LPAHs ($\mu\text{g/kg}$ dry weight)					
		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Method Blanks							
Blank	A	40.67	5.71 U ^(a)	9.73	7.17 U	52.25	5.36 U
Blank	B	9.21	4.93 U	7.54 U	6.61 U	10.25	4.56 U
Blank	C	12.23	5.88 U	7.96 U	7.17 U	5.81	5.75 U
Blank	D	7.28	2.15 U	3.02 U	2.53 U	3.21	1.68 U
Matrix Spikes							
COMP I	C	40.34	9.24	13.26	9.42	97.31	23.84
COMP I MS	C	111.27	101.38	99.00	105.77	172.36	135.54
Concentration Recovered		70.93	92.14	85.74	96.35	75.05	111.70
Amount Spiked		178.00	178.00	178.00	178.00	178.00	178.00
Percent Recovery		40%	52%	48%	54%	42%	63%
COMP I	C	40.34	9.24	13.26	9.42	97.31	23.84
COMP I MSD	C	88.64	109.44	105.77	123.75	228.4	179.21
Concentration Recovered		48.30	100.20	92.51	114.33	131.09	155.37
Amount Spiked		196.00	196.00	196.00	196.00	196.00	196.00
Percent Recovery		25% ^(b)	51%	47%	58%	67%	79%
MS/MSD RPD		47% ^(c)	1%	2%	7%	45% ^(c)	23% ^(c)
MS/MSD I-STAT		0.24	0.01	0.01	0.04	0.23	0.12
COMP III Replicate 1	B	23.20	4.77 U	7.28 U	6.38 U	36.68	7.92
COMP III MS Replicate 1	B	143.58	150.77	160.98	183.27	239.78	172.51
Concentration Recovered		120.38	150.77	160.98	183.27	203.10	164.59
Amount Spiked		218.34	218.34	218.34	218.34	218.34	218.34
Percent Recovery		55%	69%	74%	84%	93%	75%
COMP III Replicate 1	B	23.20	4.77 U	7.28 U	6.38 U	36.68	7.92
COMP III MSD Replicate 1	B	152.43	140.26	156.18	175.42	231.09	153.49
Concentration Recovered		129.23	140.26	156.18	175.42	194.41	145.57
Amount Spiked		218.34	218.34	218.34	218.34	218.34	218.34
Percent Recovery		59%	64%	72%	80%	89%	67%
MS/MSD RPD		7%	7%	3%	4%	4%	12%
MS/MSD I-STAT		0.04	0.04	0.02	0.02	0.02	0.06
COMP IV Replicate 1	A	32.63	3.76 U	5.42 U	4.72 U	22.84 B	3.53 U
COMP IV MS Replicate 1	A	118.30 8 ^(d)	112.21	109.07	112.98	132.46 B	123.96
Concentration Recovered		85.67	112.21	109.07	112.98	109.62	123.96
Amount Spiked		145.00	145.00	145.00	145.00	145.00	145.00
Percent Recovery		59%	77%	75%	78%	76%	85%
COMP IV Replicate 1	A	32.63	3.76 U	5.42 U	4.72 U	22.84 8	3.53 U
COMP IV MSD Replicate 1	A	62.25 B	26.34	29.29	28.15	75.25 8	37.20
Concentration Recovered		29.62	26.34	29.29	28.15	52.41	37.20
Amount Spiked		145.00	145.00	145.00	145.00	145.00	145.00
Percent Recovery		20% ^(b)	18% ^(b)	20% ^(b)	19% ^(b)	36% ^(b)	26% ^(b)
MS/MSD RPD		97% ^(c)	124% ^(c)	115% ^(c)	120% ^(c)	71% ^(c)	108% ^(c)
MS/MSD I-STAT		0.49	0.62	0.58	0.60	0.35	0.54

TABLE C.4. (contd)

Sediment Treatment	Analytical Batch	LPAHs ($\mu\text{g/kg}$ dry weight)					
		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
<u>Standard Reference Material</u>							
Certified value		NC ^(e)	NC	NC	NC	577.0 ±59.0	202.0 ±42.0
SRM 1941-1	A	NA ^(f)	NA	NA	NA	385.43	131.38
SRM 1941-2	B	NA	NA	NA	NA	525.82	153.03
SRM 1941-3	B	NA	NA	NA	NA	521.61	150.67
SRM 1941-4	C	NA	NA	NA	NA	538.58	207.35
<u>Analytical Duplicates</u>							
TC-6 (1) ^(g) Duplicate 1	C	19.57	5.25	4.55 U	4.26	35.93	8.35
TC-6 (1) Duplicate 2	C	34.60	7.18 U	9.71 U	8.76 U	35.92	8.02
RPD		55% ^(c)	NA	NA	NA	0%	4%
I-STAT		0.28	NA	NA	NA	0.00	0.02
<u>Analytical Replicates</u>							
COMP III Replicate 1	B	23.20	4.77 U	7.28 U	6.38 U	36.68	7.92
COMP III Replicate 2	B	20.07	4.01 U	6.13 U	5.37 U	34.26	5.18
COMP III Replicate 3	B	13.55	7.15 U	10.92 U	9.57 U	41.10	7.38
RSD		26%	NA	NA	NA	9%	21%
COMP IV Replicate 1	A	32.63 B	3.76 U	5.42 U	4.72 U	22.84 B	3.53 U
COMP IV Replicate 2	A	31.40 B	4.05 U	5.84 U	5.09 U	22.79 B	3.80 U
COMP IV Replicate 3	A	36.43 B	4.94 U	7.13 U	6.21 U	27.53 B	4.64 U
RSD		8%	NA	NA	NA	11%	NA
TC-5 Upper Replicate 1	C	36.62	11.31	11.88	23.63	108.92	39.25
TC-5 Upper Replicate 2	C	33.47	8.84	10.75	21.91	97.46	34.12
TC-5 Upper Replicate 3	C	37.33	11.43	11.81	24.02	133.87	40.50
RSD		6%	14%	6%	5%	16%	9%
R-8F Replicate 1	A	53.93 B	13.00	11.59	11.37	109.71 B	27.16
R-8F Replicate 2	A	36.29 B	8.91	7.64	8.63	86.82 B	22.17
R-8F Replicate 3	A	39.62 B	12.74	9.62 U	11.79	113.33 B	34.95
RSD		22%	20%	NA	16%	14%	23%

(a) U The analyte was not present above the level of the associated value.

(b) Recovery outside quality control range (40%-120%).

(c) Value exceeds relative precision allowance of 30%.

(d) B Analyte detected above target detection limit in blank associated with batch samples.

(e) NC Not certified.

(f) NA Not applicable.

(g) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.5. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs) in Sediment, Richmond Harbor Program

		HPAHs ($\mu\text{g/kg}$ dry weight)									
Sediment Treatment	Analytical Batch	Fluoranthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) Pyrene	Indeno (1,2,3-c,d) Pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
Method Blanks											
Blank 1	A	10.82	15.71	5.19 U ^(a)	4.03 U	3.8 U	3.36 U	5.19 U	4.74 U	4.66 U	3.43 U
Blank 2	B	3.22 U	3.36 U	2.84 U	2.83 U	2.05 U	1.83 U	2.15 U	1.60 U	1.86 U	1.38
Blank 3	C	4.11 U	4.09 U	5.02 U	4.23 U	3.81 U	3.45 U	4.93 U	4.53 U	4.38 U	3.51 U
Blank 4	D	2.00	2.58	0.95 U	0.91 U	0.73 U	0.60 U	0.78 U	0.80 U	0.78 U	0.45 U
Matrix Spikes											
COMP I	C	206.95	20.64	95.06	102.03	153.46	113.02	253.73	254.05	23.49	252.43
COMP I MS	C	270.77	326.27	229.17	207.04	269.32	225.77	359.61	362.26	204.38	341.39
Concentration Recovered		63.82	305.63	134.11	105.01	115.86	112.75	105.88	108.21	180.89	88.96
Amount Spiked		178.00	178.00	178.00	178.00	178.00	178.00	178.00	178.00	178.00	178.00
Percent Recovery		36% ^(b)	172% ^(b)	75%	59%	65%	63%	59%	61%	102%	50%
COMP I	C	206.95	20.64	95.06	102.03	153.46	113.02	253.73	254.05	23.49	252.43
COMP I MSD	C	353.99	429.55	305.52	273.85	332.66	287.19	465.06	465.34	267.46	430.99
Concentration Recovered		147.04	408.91	210.46	171.82	179.20	174.17	211.33	211.29	243.97	178.56
Amount Spiked		196.00	196.00	196.00	196.00	196.00	196.00	196.00	196.00	196.00	196.00
Percent Recovery		75%	209% ^(b)	107%	88%	91%	89%	108%	108%	124% ^(b)	91%
MS/MSD RPD		71% ^(c)	19%	35% ^(c)	39% ^(c)	34% ^(c)	34% ^(c)	58% ^(c)	56% ^(c)	20%	58% ^(c)
MS/MSD I-STAT		0.35	0.10	0.18	0.20	0.17	0.17	0.29	0.25	0.10	0.29
COMP III Replicate 1	B	44.12	62.23	19.39	27.63	40.53	23.52	39.70	39.42	7.55	44.01
COMP III MS Replicate 1	B	276.75	293.02	275.28	279.59	311.38	279.45	271.27	289.72	299.13	268.86
Concentration Recovered		232.63	230.79	255.89	251.96	270.85	255.93	231.57	250.30	291.58	224.85
Amount Spiked		218.34	218.34	218.34	218.34	218.34	218.34	218.34	218.34	218.34	218.34
Percent Recovery		107%	106%	117%	115%	124% ^(b)	117%	106%	115%	134% ^(b)	103%
COMP III Replicate 1	B	44.12	62.23	19.39	27.63	40.53	23.52	39.70	39.42	7.55	44.01
COMP III MSD Replicate 1	B	260.02	278.85	239.9	244.77	265.42	243.99	233.15	247.22	251.56	230.18
Concentration Recovered		215.90	216.62	220.51	217.14	224.89	220.47	193.45	207.80	244.01	186.17
Amount Spiked		218.34	218.34	218.34	218.34	218.34	218.34	218.34	218.34	218.34	218.34
Percent Recovery		99%	99%	101%	99%	103%	101%	89%	95%	112%	85%
MS/MSD RPD		7%	6%	15%	15%	19%	15%	18%	19%	18%	19%
MS/MSD I-STAT		0.04	0.03	0.07	0.07	0.09	0.07	0.09	0.09	0.09	0.09

TABLE C.5. (contd)

			HPAHs ($\mu\text{g}/\text{kg}$ dry weight)									
Sediment Treatment	Analytical Batch	Fluoranthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) Pyrene	Indeno (1,2,3-c,d) Pyrene	Olbenzo (a,h) Anthracene	Benzo (g,h,i) Perylene	
CDMP IV Replicate 1	A	6.90 B ^(d)	9.96 B	3.42 U	2.96	6.29	2.21 U	3.42 U	3.12 U	3.07 U	4.20	
COMP IV MS Replicate 1	A	141.13 B	148.51 B	189.89	145.08	173.06	162.25	202.58	198.10	196.74	158.93	
Concentration Recovered		134.23	138.55	189.89	142.12	166.77	162.25	202.58	198.10	196.74	154.73	
Amount Spiked		145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	
Percent Recovery		93%	96%	131% ^(b)	98%	115%	112%	140% ^(b)	137% ^(b)	136% ^(b)	107%	
COMP IV Replicate 1	A	6.90 B	9.96 B	3.42 U	2.96	6.29	2.21 U	3.42 U	3.12 U	3.07 U	4.20	
COMP IV MSD Replicate 1	A	102.79 B	147.53 B	79.68	73.19	105.7	80.39	146.39	128.00	52.53	120.30	
Concentration Recovered		95.89	137.57	79.68	70.23	99.41	80.39	146.39	128.00	52.53	116.10	
Amount Spiked		145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	
Percent Recovery		66%	95%	55%	48%	69%	55%	101%	88%	36% ^(b)	80%	
MS/MSD RPD		33% ^(c)	1%	82% ^(c)	68% ^(c)	51% ^(c)	67% ^(c)	32% ^(c)	43% ^(c)	116% ^(c)	29% ^(c)	
MS/MSD I-STAT		0.17	0.00	0.41	0.34	0.25	0.34	0.16	0.21	0.58	0.14	
<u>Standard Reference Material</u>												
Certified value		1220.0 ± 240.0	1080.0 ± 200.0	550.0 ± 79.0	NC ^(e)	780.0 ± 190.0	444.0 ± 49.0	670.0 ± 130.0	569.0 ± 40.0	NC	516.0 ± 83.0	
SRM 1941-1	A	859.31	839.57	496.36	NA ^(f)	719.25	564.05	651.20	630.59	NA	444.59	
SRM 1941-2	B	1031.0	980.27	461.95	NA	801.89	605.48	516.04	533.20	NA	427.83	
SRM 1941-3	B	1024.1	971.21	453.55	NA	807.52	615.48	522.52	544.41	NA	436.74	
SRM 1941-4	C	1132.0	1009.5	595.11	NA	962.65	748.69	750.02	881.01	NA	653.31	
<u>Analytical Duplicates</u>												
TC-6 (1) ^(g) Duplicate 1	C	67.05	94.84	42.42	45.82	66.65	49.35	105.65	100.80	11.12	98.01	
TC-6 (1) Duplicate 2	C	66.40	94.84	40.27	45.02	63.66	49.64	104.64	96.78	10.46	96.22	
RPD		1%	0%	5%	2%	5%	1%	1%	4%	6%	2%	
I-STAT		0.00	0.00	0.03	0.01	0.02	0.00	0.00	0.02	0.03	0.01	
<u>Analytical Replicates</u>												
COMP III Replicate 1	B	44.12	62.23	19.39	27.63	40.53	23.52	39.70	39.42	7.55	44.01	
COMP III Replicate 2	B	40.08	57.53	19.33	25.61	38.04	22.36	37.42	35.97	5.75	39.13	
COMP III Replicate 3	B	43.26	61.20	23.23	31.12	38.29	25.54	40.32	36.27	6.67	39.83	
RSD		5%	4%	11%	10%	4%	7%	4%	5%	14%	6%	

TABLE C.5. (contd)

Sediment Treatment	Analytical Batch	HPAHs ($\mu\text{g/kg}$ dry weight)									
		Fluoranthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) Pyrene	Indeno (1,2,3-c,d) Pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
COMP IV Replicate 1	A	6.90 B	9.96 B	3.42 U	2.96	6.29	2.21 U	3.42 U	3.12 U	3.07 U	4.20
COMP IV Replicate 2	A	7.18 B	10.64 B	3.68 U	3.05	6.74	2.38 U	3.68 U	3.58	3.31 U	4.81
COMP IV Replicate 3	A	7.50 B	11.13 B	4.49 U	3.49 U	5.80	2.91 U	4.50 U	4.11 U	4.03 U	3.94
RSD		4%	6%	NA	NA	7%	NA	NA	NA	NA	10%
TC-5 Upper Replicate 1	C	215.91	320.61	115.38	136.23	182.50	125.82	268.45	279.69	31.52	272.69
TC-5 Upper Replicate 2	C	197.98	292.67	101.15	127.57	168.60	115.38	246.76	258.52	29.21	245.83
TC-5 Upper Replicate 3	C	273.10	382.85	137.62	170.54	227.09	167.08	327.01	341.83	42.26	327.90
RSD		17%	14%	16%	16%	16%	20%	15%	15%	20%	15%
R-BF Replicate 1	A	254.72 B	371.85 B	145.00	146.66	240.57	171.82	393.61	373.38	37.67	324.97
R-BF Replicate 2	A	189.46 B	272.33 B	104.23	113.04	187.99	124.69	293.95	285.61	28.90	246.06
R-BF Replicate 3	A	171.40 B	247.03 B	93.49	103.15	139.80	99.85	232.94	203.53	20.15	183.15
RSD		21%	22%	24%	19%	27%	28%	26%	30%	30%	28%

(a) U The analyte was not present above the level of the associated value.

(b) Recovery outside quality control range (40-120%).

(c) Value exceeds relative precision allowance of 30%.

(d) B Analyte detected above target range in blank associated with batch samples.

(e) NC Not certified.

(f) NA Not applicable.

(g) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.6. Surrogate Recoveries for Polynuclear Aromatic Hydrocarbons (PAHs)
Including Quality Control Data for Sediment, Richmond Harbor
Program

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Surrogate Percent Recoveries</u>		
		<u>Naph- thalene d8</u>	<u>Acenaph- thalene d10</u>	<u>Perylene d12</u>
COMP I	C	62	68	108
C-1	A	70	80	110
C-3	A	44	49	62
C-5	A	49	62	86
C-6	A	48	62	92
C-8	A	44	49	63
C-10	B	60	66	96
COMP II	A	44	51	87
C-11	B	60	64	79
C-16	B	71	72	94
C-18	B	61	65	88
C-19	B	45	55	87
C-20	B	39 ^(a)	55	83
C-23	B	39 ^(a)	55	92
COMP III Replicate 1	B	71	73	82
COMP III Replicate 2	B	81	77	90
COMP III Replicate 3	B	42	53	83
TC-1 Upper	B	76	79	90
TC-2 Upper	B	1 ^(a)	51	80
TC-3 Upper	C	41	52	82
TC-4 Upper	B	67	72	65
TC-5 Upper Comp	A	52	65	113
TC-5 Upper Replicate 1	C	58	70	107
TC-5 Upper Replicate 2	C	55	65	102
TC-5 Upper Replicate 3	C	59	74	118
TC-5 Special Sample	C	30 ^(a)	53	93
COMP IV Replicate 1	A	65	72	128 ^(a)
COMP IV Replicate 2	A	70	76	132 ^(a)
COMP IV Replicate 3	A	74	80	126 ^(a)
TC-1 Lower	B	40	52	82
TC-2 Lower	B	62	72	92
TC-3 Lower	C	49	58	88
TC-4 Lower	C	70	73	98
TC-5 Lower	B	82	79	78

TABLE C.6. (contd)

Sediment Treatment	Analytical Batch	Surrogate Percent Recoveries		
		Naphthalene d8	Acenaphthalene d10	Perylene d12
COMP V	A	62	67	138 ^(a)
C-24	B	73	77	86
C-26	B	54	62	80
C-30	C	59	66	107
C-33	C	60	64	95
C-35	A	44	51	71
C-37	A	50	56	70
COMP VI	A	65	72	132 ^(a)
C-25	B	66	67	88
C-29	A	45	56	81
C-32	A	35 ^(a)	38 ^(a)	40
C-36	B	55	57	77
C-38	B	52	65	94
TC-6 (1) ^(b) Duplicate 1	C	73	76	121 ^(a)
TC-6 (1) Duplicate 2	C	75	78	116
TC-6 (2)	C	72	75	101
TC-6 (3)	C	46	50	69
TC-6 (4)	C	68	71	99
TC-7 (1) ^(b)	C	29 ^(a)	39 ^(a)	37 ^(a)
TC-7 (2)	C	56	60	85
TC-7 (3)	C	35 ^(a)	44	61
TC-7 (4)	C	64	66	82
R-AC	A	62	72	123 ^(a)
R-AM	B	59	61	89
R-BF	A	62	71	109
R-BF	A	43	55	98
R-BF	A	41	48	74
R-OS	A	49	62	116
R-PF	A	53	61	98
C-SB	A	58	72	119
C-WB	A	36 ^(a)	47	78
C-NE	A	44	59	92

TABLE C.6. (contd)

Sediment Treatment	Analytical Batch	Surrogate Percent Recoveries		
		Naph- thalene d8	Acenaph- thalene d10	Perylene d12
<u>Quality Control Data</u>				
<u>Method Blanks</u>				
Blank 1	A	0 ^(c)	0 ^(c)	0 ^(c)
Blank 2	B	50	57	72
Blank 3	C	57	62	56
Blank 4	D	36 ^(a)	44	36 ^(a)
<u>Matrix Spikes</u>				
COMP I MS	C	44	49	83
COMP I MSD	C	32 ^(a)	47	93
MS/MSD RPD		32	4	11
MS/MSD I-STAT		.16	.02	.06
COMP III MS Replicate 1	B	55	67	98
COMP III MSD Replicate 1	B	61	69	86
MS/MSD RPD		10	3	13
MS/MSD I-STAT		.05	.01	.07
COMP IV MS Replicate 1	A	58	68	116
COMP IV MSD Replicate 1	A	68	74	130 ^(a)
MS/MSD RPD		16	8	11
MS/MSD I-STAT		.08	.04	.06
<u>Analytical Duplicates</u>				
TC-6 (1)	C	73	76	121 ^(a)
TC-6 (1) Duplicate	C	75	78	116
RPD		3	3	4
I-STAT		.01	.01	.02
<u>Analytical Triplicates</u>				
COMP III Replicate 1	B	71	73	82
COMP III Replicate 2	B	81	77	90
COMP III Replicate 3	B	42	53	83
RSD		31	19	5

TABLE C.6. (contd)

Sediment Treatment	Analytical Batch	Surrogate Percent Recoveries		
		Naph- thalene d8	Acenaph- thalene d10	Perylene d12
COMP IV Replicate 1	A	65	72	128 ^(a)
COMP IV Replicate 2	A	70	76	132 ^(a)
COMP IV Replicate 3	A	74	80	126 ^(a)
RSD		6	5	2
TC-5 Upper Replicate 1	C	58	70	107
TC-5 Upper Replicate 2	C	55	65	102
TC-5 Upper Replicate 3	C	59	74	118
RSD		4	6	8
R-BF Replicate 1	A	62	71	109
R-BF Replicate 2	A	43	55	98
R-BF Replicate 3	A	41	48	74
RSD		24	20	19

(a) Recovery outside quality control range of (40%-120%).

(b) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

(c) Surrogate spikes for sample were inadvertently not added during extraction process.

**TABLE C.7. Sediment Chlorinated Pesticide Results (alphabetical, Aldrin - DDT),
Richmond Harbor Program**

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)									
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Alpha Chlor-dane	Gamma Chlor-dane	4,4' DDD	4,4' DDE	4,4' DDT
Target DL ^(a)		2	2	2	2	2	2	2	2	2	2
Achieved DL		2	2	2	2	2	2	2	2.0-10.0	2	2.0-10.0
COMP I	C	2 U ^(b)	2 U	2 U	2 U	2 U	2 U	2 U	8	3	1 J ^(c)
C-1	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	9	2	1 J
C-3	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	9	2	1 J
C-5	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	6	2	1 J
C-6	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	6	3	1 J
C-8 ^(d)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	3	10 U
C-10	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	15	5	3
COMP II	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4
C-11	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10	4	14
C-16	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	9	3	1 J
C-18	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	44	5	4
C-19	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	5	1 J	0.5 J
C-20	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	27	4	5
C-23	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	8	2	1 J
COMP III	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	3	0.8 J	0.5 J
TC-1 Upper	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	3	0.6 J	0.3 J
TC-2 Upper	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	16	3	1 J
TC-3 Upper	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-4 Upper	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-5 Upper Comp	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	21	6	3
TC-5 Upper Replicate 1	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	13	5	2
TC-5 Upper Replicate 2	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	14	5	2
TC-5 Upper Replicate 3	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	13	5	2
TC-5 Special Sample	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 J
COMP IV	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-1 Lower	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-2 Lower	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	9	2	1 J
TC-3 Lower	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-4 Lower	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-5 Lower	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

TABLE C.7. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)									
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Alpha Chlor-dane	Gamma Chlor-dane	4,4' DDD	4,4' DDE	4,4' DDT
COMP V	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	76	9	41
C-24	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
C-26	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	79	10	9
C-30	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	66	9	5
C-33	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	70	8	8
C-35	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	53	5	12
C-37	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	54	5	24
COMP VI	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	88	10	129
C-25	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20	4	3
C-29	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	16	3	4
C-32	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	23	3	2
C-36	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	151	14	71
C-38	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	171	12	65
TC-6 (1) ^(e)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	7	1 J	0.5 J
TC-6 (2)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-6 (3)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-6 (4)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-7 (1) ^(e)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-7 (2)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-7 (3)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TC-7 (4)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
R-AC	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.4 J	2 U
R-AM Replicate 1	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
R-AM Replicate 2	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 J
R-AM Replicate 3	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
R-BF Replicate 1	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4	2	2
R-BF Replicate 2 ^(d)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	1 J	10 U
R-BF Replicate 3 ^(d)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	10 U
R-OS	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 J	2 U
R-PF	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

TABLE C.7. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Alpha Chlor-dane	Gamma Chlor-dane	4,4' DDD	4,4' DDE
C-SB	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
C-WB	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
C-NE	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

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

(d) Elevated detection limits due to matrix spike interference.

(e) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

**TABLE C.8. Sediment Chlorinated Pesticide Results (alphabetical, Dieldrin - Toxaphene),
Richmond Harbor Program**

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								
		Dieldrin	Endo Sulfan I	Endo Sulfan II	Endo Sulfan Sulfate	Endrin	Endrin Alde- hyde	Hepta- chlor	Hepta- chlor epoxide	Toxa- phene
Target DL (a)		2	2	2	2	2	2	2	2	30
Achieved DL		2	2	2.0-10.0	2.0-10.0	2.0-10.0	2.0-10.0	2	2	20
COMP I	C	2 U ^(b)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-1	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-3	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-5	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-6 ^(c)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-8 ^(c)	A	2 U	2 U	10 U	10 U	10 U	10 U	2 U	2 U	20 U
C-10	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP II	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-11	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-16	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-18	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-19	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-20	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-23	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP III	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-1 Upper	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-2 Upper	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-3 Upper	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-4 Upper	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Upper Comp	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Upper Replicate 1	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Upper Replicate 2	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Upper Replicate 3	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Special Sample	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP IV	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-1 Lower	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-2 Lower	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-3 Lower	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-4 Lower	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Lower	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U

TABLE C.8. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
		Dieldrin	Endo Sulfan I	Endo Sulfan II	Endo Sulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor epoxide	Toxaphene
COMP V	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-24	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-26	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-30	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-33	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-35	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-37	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP VI	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-25	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-29	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-32	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-36	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-38	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-6 (1) ^(d)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-6 (2)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-6 (3)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-6 (4)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-7 (1) ^(d)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-7 (2)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-7 (3)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-7 (4)	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-AC	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-AM Replicate 1	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-AM Replicate 2	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-AM Replicate 3	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-BF Replicate 1 ^(c)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-BF Replicate 2 ^(c)	A	2 U	2 U	10 U	10 U	10 U	10 U	2 U	2 U	20 U
R-BF Replicate 3 ^(c)	A	2 U	2 U	10 U	10 U	10 U	10 U	2 U	2 U	20 U
R-OS	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-PF	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U

TABLE C.8. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
		Dieldrin	Endo Sulfan I	Endo Sulfan II	Endo Sulfan Sulfate	Endrin	Endrin Alde- hyde	Hepta- chlor	Hepta- chlor epoxide	Toxa- phene
C-SB	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-WB	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
C-NE	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

(c) Elevated detection limits due to matrix interference.

(d) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.9. Quality Control Data for Sediment Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4' DDT), Richmond Harbor Program

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)									
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Alpha Chlor-dane	Gamma Chlor-dane	4,4' DDD	4,4' DDE	4,4' DDT
Method Blanks											
Blank 1	A	2 U ^(a)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Blank 2	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Blank 3	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Blank 4	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.6 J ^(b)
Blank 5	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Blank 6R ^(c)	D	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Matrix Spikes											
COMP I	C	2 U	2 U	2 U	2 U	2 U	2 U ^(d)	2 U	8	3	1 J
COMP I MS	C	30	33	26	31	39	NA	NA	41	29	35
Concentration Recovered		30	33	26	31	39	NA	NA	33	26	33
Amount Spiked		36	36	36	36	36	NS ^(e)	NS	36	36	36
Percent Recovery		84%	92%	73%	86%	109%	NA	NA	94%	73%	94%
COMP I	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	8	3	1 J
COMP I MSD	C	41	45	37	44	58	NA	NA	59	40	47
Concentration Recovered		41	45	37	44	58	NA	NA	52	37	46
Amount Spiked		39	39	39	39	39	NS	NS	39 ^(f)	39	39
Percent Recovery		104%	116%	95%	112%	148% ^(f)	NA	NA	131% ^(f)	95%	118%
MS/MSD RPD	C	21%	23%	26%	27%	31% ^(g)	NA	NA	34% ^(g)	26%	23%
MS/MSD I-STAT	C	0.10	0.11	0.13	0.13	0.15	NA	NA	0.17	0.13	0.11
COMP III	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	3	0.8 J	0.5 J
COMP III MS	B	68	77	61	76	96	NA	NA	85	65	76
Concentration Recovered		68	77	61	76	96	NA	NA	85	65	76
Amount Spiked		44	44	44	44	44	NS	NS	44 ^(f)	44	44
Percent Recovery		156% ^(f)	175% ^(f)	139% ^(f)	175% ^(f)	219% ^(f)	NA	NA	194% ^(f)	149% ^(f)	174% ^(f)

TABLE C.9. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)									
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Alpha Chlor-dane	Gamma Chlor-dane	4,4' DDD	4,4' DDE	4,4' DDT
COMP III	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	3	0.8 J	0.5 J
COMP III MSD	B	64	72	54	68	82	NA	NA	73	57	65
Concentration Recovered		64	72	54	68	82	NA	NA	70	57	65
Amount Spiked		44	44	44	44	44	NS	NS	44	44	44
Percent Recovery		146%(f)	164%(f)	123%(f)	156%(f)	188%(f)	NA	NA	160%(f)	131%(f)	150%(f)
MS/MSD RPD	B	7%	7%	12%	11%	15%	NA	NA	19%	12%	15%
MS/MSD I-STAT	B	0.03	0.03	0.06	0.06	0.07	NA	NA	0.10	0.06	0.08
COMP IV	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
COMP IV MS(h)	A	28	36	29	35	40	2 U	2 U	30	27	50
Concentration Recovered		28	36	29	35	40	2 U	2 U	30	27	50
Amount Spiked		28.9	28.9	28.9	28.9	28.9	NS	NS	28.9	28.9	28.9
Percent Recovery(i)		98%	126%(f)	100%	121%(f)	139%(f)	NA	NA	105%	93%	172%(f)
<u>Standard Reference Material</u>											
Non Certified Value		NC(j)	NC	NC	NC	NC	2.06 ± 0.05	NC	10.3 ± 0.1	9.71 ± 0.17	1.11 ± 0.05
SRM 1 (NIST 1941)(k)	A	NA	NA	NA	NA	NA	2 U	NA	4	5	14
SRM 2 (NIST 1941)	B	NA	NA	NA	NA	NA	2 U	NA	22	16	18
SRM 3 (NIST 1941)	B	NA	NA	NA	NA	NA	2 U	NA	17	14	14
SRM 4 (NIST 1941)	C	NA	NA	NA	NA	NA	2 U	NA	24	16	17
<u>Analytical Replicates</u>											
TC-5 Upper Replicate 1	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	13	5	2
TC-5 Upper Replicate 2	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	14	5	2
TC-5 Upper Replicate 3	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	13	5	2
RSD		NA	NA	NA	NA	NA	NA	NA	5%	NA	NA
R-AM Replicate 1	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
R-AM Replicate 2	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 J
R-AM Replicate 3	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE C.9. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)									
		Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Alpha Chlor-dane	Gamma Chlor-dane	4,4' DDD	4,4' DDE	4,4' DDT
R-BF Replicate 1	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4	2	2
R-BF Replicate 2 ^(k)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	1 J	10 U
R-BF Replicate 3 ^(k)	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	10 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) U The analyte was not present above the level of the associated value.

(b) J Analyte detected below method detection limit (MDL) but above instrument detection limit (IDL).

(c) R Sample was reanalyzed.

(d) NA Not applicable.

(e) NS Not spiked.

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

(g) Value exceeds relative precision range of 30%.

(h) Matrix spike duplicate was lost during processing.

(i) Recoveries outside of range are attributed to probable response factor errors caused by using calibration standards from a different source than that used for the spiking solution.

(j) NC Not certified.

(k) Elevated detection limits due to matrix interference.

TABLE C.10. Quality Control Data for Sediment Chlorinated Pesticide Analysis (alphabetical, Dieldrin-Toxaphene), Richmond Harbor Program

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								
		Dieldrin	Endo Sulfan I	Endo Sulfan II	Endo Sulfan Sulfate	Endrin ^(a)	Endrin Aldehyde	Heptachlor	Heptachlor epoxide	Toxaphene
Method Blanks										
Blank 1	A	2 U ^(b)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
Blank 2	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
Blank 3	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
Blank 4	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
Blank 5	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
Blank 6 ^(c)	D	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
Matrix Spikes										
COMP I	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP I MS	C	29	28	28	29	143	18	28	27	NA ^(d)
Concentration Recovered		29	28	28	29	143	18	28	27	NA
Amount Spiked		36	36	36	36	36	36	36	36	NS ^(e)
Percent Recovery		82%	79%	78%	80%	401% ^(f)	51%	79%	75%	NA
COMP I	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP I MSD	C	43	39	41	41	215	24	39	38	NA
Concentration Recovered		43	39	41	41	215	24	39	38	NA
Amount Spiked		39	39	39	39	39	39	39	39	NS
Percent Recovery		108%	100%	103%	105%	548% ^(f)	62%	99%	96%	NA
MS/MSD RPD	C	27%	23%	28%	27%	31% ^(g)	20%	22%	24%	NA
MS/MSD I-STAT	C	0.14	0.12	0.14	0.13	0.15	0.10	0.11	0.12	NA
COMP III	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP III MS	B	68	60	62	62	126	39	57	59	NA
Concentration Recovered		68	60	62	62	126	39	57	59	NA
Amount Spiked		44	44	44	44	44	44	44	44	NS
Percent Recovery		156% ^(f)	138% ^(f)	141% ^(f)	143% ^(f)	289% ^(f)	89%	130% ^(f)	135% ^(f)	NA

TABLE C.10. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg}$ dry weight)								Toxa- phene
		Dieldrin	Endo Sulfan I	Endo Sulfan II	Endo Sulfan Sulfate	Endrin ^(a)	Endrin Alde- hyde	Hepta- chlor	Hepta- chlor epoxide	
COMP III	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP III MSD	B	60	54	55	55	112	35	53	53	NA
Concentration Recovered		60	54	55	55	112	35	53	53	NA
Amount Spiked		44	44	44	44	44	44	44	44	NS
Percent Recovery		137%(f)	123%(f)	126%(f)	126%(f)	257%(f)	79%	121%(f)	122%(f)	NA
MS/MSD RPD	B	13%	11%	12%	12%	12%	11%	7%	11%	NA
MS/MSD I-STAT	B	0.06	0.06	0.06	0.06	0.06	0.05	0.04	0.05	NA
COMP IV	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
COMP IV MS ^(h)	A	29	27	28	29	133	16	34	27	20 U
Concentration Recovered		29	27	28	29	133	16	34	27	NA
Amount Spiked		28.9	28.9	28.9	28.96	28.9	28.9	28.9	28.9	NS
Percent Recovery ⁽ⁱ⁾		100%	93%	96%	99%	459%(f)	57%	117%	94%	NA
<u>Standard Reference Material</u>										
Non Certified Value		0.63 ± 0.03	NC ^(j)	NC	NC	NC	NC	NC	0.23 ± 0.02	NC
SRM 1 (NIST 1941) ^(k)	A	2 U	NA	NA	NA	NA	NA	NA	100 U	NA
SRM 2 (NIST 1941)	B	2 U	NA	NA	NA	NA	NA	NA	2 U	NA
SRM 3 (NIST 1941)	B	2 U	NA	NA	NA	NA	NA	NA	2 U	NA
SRM 4 (NIST 1941)	C	2 U	NA	NA	NA	NA	NA	NA	2 U	NA
<u>Analytical Replicates</u>										
TC-5 Upper Replicate 1	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Upper Replicate 2	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
TC-5 Upper Replicate 3	C	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-AM Replicate 2	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-AM Replicate 3	B	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE C.10. (contd)

Sediment Treatment	Analytical Batch	Pesticides ($\mu\text{g/kg dry weight}$)								
			Endo	Endo	Endo		Endrin		Hepta-	
		<u>Dieldrin</u>	<u>Sulfan</u> <u>I</u>	<u>Sulfan</u> <u>II</u>	<u>Sulfan</u> <u>Sulfate</u>	<u>Endrin</u> ^(a)	<u>Alde-</u> <u>hyde</u>	<u>hepta-</u> <u>chlor</u>	<u>chlor</u> <u>epoxide</u>	<u>Toxa-</u> <u>phene</u>
R-BF Replicate 1	A	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U
R-BF Replicate 2 ^(k)	A	2 U	2 U	10 U	10 U	10 U	10 U	2 U	2 U	20 U
R-BF Replicate 3 ^(k)	A	2 U	2 U	10 U	10 U	10 U	10 U	2 U	2 U	20 U
RSD		NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) Analyte amount in standard mixture is believed to be incorrect.

(b) U The analyte was not present above the level of the associated value.

(c) R Sample was reanalyzed.

(d) NA Not applicable.

(e) NS Not spiked.

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

(g) Value exceeds relative precision range of 30%.

(h) Matrix spike duplicate was lost during processing.

(i) Recoveries outside of range are attributed to probable response factor errors caused by using calibration standards from a different source than that used for the spiking solution.

(j) NC Not certified.

(k) Elevated detection limits due to Matrix interference.

TABLE C.11. Sediment Polychlorinated Biphenyls (PCBs) Results,
Richmond Harbor Program

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		20	20	20	20
COMP I	C	20 U ^(b)	20 U	17 J ^(c)	20 U
C-1	A	20 U	20 U	12 J	20 U
C-3	A	20 U	20 U	9 J	20 U
C-5	A	20 U	20 U	16 J	20 U
C-6	A	20 U	20 U	14 J	20 U
C-8	A	20 U	20 U	17 J	20 U
C-10	B	20 U	20 U	35	20 U
COMP II	A	20 U	20 U	37.1	20 U
C-11	B	20 U	20 U	22	20 U
C-16	B	20 U	20 U	21	20 U
C-18	B	20 U	20 U	37	20 U
C-19	B	20 U	20 U	8 J	20 U
C-20	B	20 U	20 U	27	20 U
C-23	B	20 U	20 U	11 J	20 U
COMP III	B	20 U	20 U	13 J	20 U
TC-1 Upper	B	20 U	20 U	7 J	20 U
TC-2 Upper	B	20 U	20 U	22	20 U
TC-3 Upper	C	20 U	20 U	20 U	20 U
TC-4 Upper	B	20 U	20 U	20 U	20 U
TC-5 Upper Comp	C	20 U	20 U	62	20 U
TC-5 Upper	C	20 U	20 U	49	20 U
TC-5 Upper	C	20 U	20 U	47	20 U
TC-5 Upper	C	20 U	20 U	50	20 U
TC-5 Special Sample	C	20 U	20 U	23	20 U
COMP IV	A	20 U	20 U	20 U	20 U
TC-1 Lower	B	20 U	20 U	20 U	20 U
TC-2 Lower	B	20 U	20 U	12 J	20 U
TC-3 Lower	C	20 U	20 U	20 U	20 U
TC-4 Lower	C	20 U	20 U	20 U	20 U
TC-5 Lower	B	20 U	20 U	20 U	20 U
COMP V	A	20 U	20 U	58	20 U
C-24	B	20 U	20 U	20 U	20 U
C-26	B	20 U	20 U	55	20 U
C-30	C	20 U	20 U	57	20 U
C-33	C	20 U	20 U	48	20 U
C-35	A	20 U	20 U	43	20 U
C-37	A	20 U	20 U	51	20 U

TABLE C.11. (contd)

Sediment Treatment	Analytical Batch	PCBs ($\mu\text{g/kg}$ dry weight)			
		Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
COMP VI	A	20 U	20 U	57	20 U
C-25	B	20 U	20 U	28	20 U
C-29	A	20 U	20 U	32	20 U
C-32	A	20 U	20 U	19 J	20 U
C-36	B	20 U	20 U	54	20 U
C-38	B	20 U	20 U	33	20 U
TC-6 (1) ^(d)	C	20 U	20 U	11 J	20 U
TC-6 (2)	C	20 U	20 U	20 U	20 U
TC-6 (3)	C	20 U	20 U	20 U	20 U
TC-6 (4)	C	20 U	20 U	20 U	20 U
TC-7 (1) ^(d)	C	20 U	20 U	20 U	20 U
TC-7 (2)	C	20 U	20 U	20 U	20 U
TC-7 (3)	C	20 U	20 U	20 U	20 U
TC-7 (4)	C	20 U	20 U	64	20 U
R-AC	A	20 U	20 U	6 J	20 U
R-AM Replicate 1	B	20 U	20 U	14 J	20 U
R-AM Replicate 2	B	20 U	20 U	21	20 U
R-AM Replicate 3	B	20 U	20 U	10 J	20 U
R-BF Replicate 1	A	20 U	20 U	23	20 U
R-BF Replicate 2	A	20 U	20 U	19 J	20 U
R-BF Replicate 3	A	20 U	20 U	26	20 U
R-OS	A	20 U	20 U	20 U	20 U
R-PF	A	20 U	20 U	20 U	20 U
C-SB	A	20 U	20 U	20 U	20 U
C-WB	A	20 U	20 U	20 U	20 U
C-NE	A	20 U	20 U	20 U	20 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

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

(d) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.12. Quality Control Data for Polychlorinated Biphenyl (PCB) Results,
Richmond Harbor Program

Sediment Treatment	Analytical Batch	PCBs ($\mu\text{g/kg}$ dry weight)			
		Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<u>Method Blanks</u>					
Blank 1	A	20 U ^(a)	20 U	20 U	20 U
Blank 2	A	20 U	20 U	20 U	20 U
Blank 3	B	20 U	20 U	20 U	20 U
Blank 4	C	20 U	20 U	20 U	20 U
Blank 5	C	20 U	20 U	20 U	20 U
Blank 6R ^(b)	D	20 U	20 U	20 U	20 U
<u>Matrix Spikes</u>					
COMP I	C	20 U	20 U	17 J ^(c)	20 U
COMP I MS	C	NA ^(d)	168	NA	NA
Concentration Recovered		NA	168	NA	NA
Amount Spiked		NS ^(e)	226	NS	NS
Percent Recovery		NA	74%	NA	NA
COMP I	C	20 U	20 U	17 J	20 U
COMP I MSD	C	NA	114	NA	NA
Concentration Recovered		NA	114	NA	NA
Amount Spiked		NS	123	NS	NS
Percent Recovery		NA	93%	NA	NA
MS/MSD RPD	B	NA	22%	NA	NA
MS/MSD I-STAT	B	NA	0.11	NA	NA
COMP III	B	20 U	20 U	13	20 U
COMP III MS	B	NA	244	NA	NA
Concentration Recovered		NA	244	NA	NA
Amount Spiked		NS	207	NS	NS
Percent Recovery		NA	118%	NA	NA
COMP III	B	20 U	20 U	13 J	20 U
COMP III MSD	B	NA	263	NA	NA
Concentration Recovered		NA	263	NA	NA
Amount Spiked		NS	229	NS	NS
Percent Recovery		NA	115%	NA	NA
MS/MSD RPD	B	NA	2%	NA	NA
MS/MSD I-STAT	B	NA	0.01	NA	NA

TABLE C.12. (contd)

Sediment Treatment	Analytical Batch	PCBs ($\mu\text{g/kg}$ dry weight)			
		Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
COMP IV	A	20 U	20 U	20 U	20 U
COMP IV MS	A	NA	155	NA	NA
Concentration Recovered		NA	155	NA	NA
Amount Spiked		NS	130	NS	NS
Percent Recovery		NA	120%	NA	NA
COMP IV	A	20 U	20 U	20 U	20 U
COMP IV MSD	A	NA	198	NA	NA
Concentration Recovered		NA	198	NA	NA
Amount Spiked		NS	158	NS	NS
Percent Recovery		NA	125% ^(f)	NA	NA
MS/MSD RPD	A	NA	4%	NA	NA
MS/MSD I-STAT	A	NA	0.02	NA	NA

Standard Reference Material

No certified values provided for PCBs

Analytical Replicates

TC-5 Upper	C	20 U	20 U	49	20 U
TC-5 Upper	C	20 U	20 U	47	20 U
TC-5 Upper	C	20 U	20 U	50	20 U
RSD		NA	NA	4%	NA
R-AM Replicate 1	B	20 U	20 U	14 J	20 U
R-AM Replicate 2	B	20 U	20 U	21	20 U
R-AM Replicate 3	B	20 U	20 U	10 J	20 U
RSD		NA	NA	37% ^(g)	NA
R-BF Replicate 1	A	20 U	20 U	23	20 U
R-BF Replicate 2	A	20 U	20 U	19 J	20 U
R-BF Replicate 3	A	20 U	20 U	26	20 U
RSD		NA	NA	15%	NA

- (a) U The analyte was not present above the level of the associated value.
 (b) R Sample was reanalyzed.
 (c) J Analyte detected below method detection limit (MDL) but above instrument detection limits (IDL).
 (d) NA Not applicable.
 (e) NS Not spiked.
 (f) Recovery outside quality control range (40%-120%).
 (g) Value exceeds relative precision range of 30%.

TABLE C.13. Surrogate Recoveries for Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs) in Sediment, Richmond Harbor Program

Sediment Treatment	Analytical Batch	Surrogate Percent Recovery	
		TCX	OCN
COMP I	C	92.0	93.9
C-1	A	97.6	109.4
C-3	A	62.2	65.2
C-5	A	84.4	85.3
C-6	A	80.7	86.7
C-8	A	61.7	67.8
C-10	B	94.2	93.1
COMP II	A	99.1	107.5
C-11	B	90.5	75.1
C-16	B	104.2	92.8
C-18	B	94.8	89.2
C-19	B	97.3	95.2
C-20	B	89.1	89.5
C-23	B	97.7	100.9
COMP III	B	97.5	96.3
TC-1 Upper	B	113.2	99.5
TC-2 Upper	B	92.8	80.2
TC-3 Upper	C	83.9	87.9
TC-4 Upper	B	110.0	78.7
TC-5 Upper Comp	C	91.1	97.3
TC-5 Upper	C	88.5	99.9
TC-5 Upper	C	84.9	93.7
TC-5 Upper	C	92.3	101.0
TC-5 Special Sample	C	77.2	82.2
COMP IV	A	93.6	104.9
TC-1 Lower	B	86.6	87.2
TC-2 Lower	B	100.8	96.1
TC-3 Lower	C	82.2	88.7
TC-4 Lower	C	89.8	101.2
TC-5 Lower	B	105.2	100.3
COMP V	A	91.3	99.8
C-24	B	105.2	104.7
C-26	B	89.7	89.5
C-30	C	85.2	92.1
C-33	C	82.6	87.3
C-35	A	73.4	76.6
C-37	A	70.1	74.9

TABLE C.13. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Surrogate Percent Recovery</u>	
		<u>TCX</u>	<u>OCN</u>
COMP VI	A	94.8	106.4
C-25	B	92.8	90.8
C-29	A	73.4	84.3
C-32	A	49.4	51.8
C-36	B	86.2	81.8
C-38	B	102.3	89.7
TC-6 (1) ^(a)	C	98.0	97.3
TC-6 (2)	C	97.0	99.8
TC-6 (3)	C	69.3	67.5
TC-6 (4)	C	94.5	95.2
TC-7 (1) ^(a)	C	30.5 ^(b)	24.9 ^(b)
TC-7 (2)	C	83.8	82.5
TC-7 (3)	C	67.3	75.6
TC-7 (4)	C	87.2	91.5
R-AC	A	89.4	92.1
R-AM Replicate 1	B	86.1	94.4
R-AM Replicate 2	B	88.6	115.2
R-AM Replicate 3	B	86.0	102.1
R-BF Replicate 1	A	85.9	92.9
R-BF Replicate 2	A	75.9	91.6
R-BF Replicate 3	A	67.7	71.4
R-OS	A	84.4	100.0
R-PF	A	79.6	82.2
C-SB	A	94.6	98.5
C-WB	A	70.9	85.6
C-NE	A	77.6	86.9

Quality Control DataMethod Blanks

Blank 1	A	NS ^(c)	NS
Blank 2	A	NS	NS
Blank 3	B	82.7	94.0
Blank 4	C	129.0 ^(b)	77.5
Blank 5	C	81.6	87.1
Blank 6-R ^(d)	D	90.4	118.5

TABLE C.13. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Surrogate Percent Recovery</u>	
		<u>TCX</u>	<u>OCN</u>
<u>Matrix Spikes</u>			
COMP I MS	C	62.5	61.2
COMP I MSD	C	76.9	74.9
MS/MSD RPD		20.7	20.1
MS/MSD I-STAT		.1	.1
COMP III MS	B	99.7	101.6
COMP III MSD	B	82.5	92.4
MS/MSD RPD		19	9
MS/MSD I-STAT		.09	.05
COMP IV MS	A	98.1	109.0
COMP IV MSD	A	98.1	109.0
MS/MSD RPD		0	0
MS/MSD I-STAT		0	0
<u>Standard Reference Material</u>			
No certified values provided for PCBs			
<u>Analytical Replicates</u>			
TC-5 Upper	C	88.5	99.9
TC-5 Upper	C	84.9	93.7
TC-5 Upper	C	92.3	101.0
RSD		4	4
R-AM Replicate 1	B	86.1	94.4
R-AM Replicate 2	B	88.6	115.2
R-AM Replicate 3	B	86.0	102.1
RSD		2	10

TABLE C.13. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Surrogate Percent Recovery</u>	
		<u>TCX</u>	<u>OCN</u>
R-BF Replicate 1	A	85.9	92.9
R-BF Replicate 2	A	75.9	91.6
R-BF Replicate 3	A	67.7	71.4
RSD		12	14

-
- (a) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.
- (b) Recovery outside quality control range (40%-120%).
- (c) NS Not spiked; sample inadvertently not spiked.
- (d) R Sample was reanalyzed.

TABLE C.14. Sediment Metals Results, Richmond Harbor Program

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL ^(a)		1.000	1.00	0.100	1.0	1.0	0.02	1.0	1.0	0.50	1.0
Achieved DL		0.019	1.00	0.012	1.0	1.0	0.0003	1.0	1.0	0.50	1.0
COMP I	C	0.362	13.10	0.351	181.0	55.9	0.323	114.8	30.5	0.80 U ^(b)	133.1
C-1	A	0.280	11.80	0.333	211.0	51.1	0.221	112.1	23.1	0.79 U	119.9
C-3	A	0.338	13.30	0.342	238.0	59.0	0.288	120.8	27.6	0.93	132.6
C-5	A	0.383	14.90	0.278	195.0	59.8	0.333	113.3	29.7	0.84 U	137.3
C-6	A	0.400	14.20	0.323	188.0	63.6	0.357	115.4	31.9	1.14	143.6
C-8	A	0.458	16.60	0.361	207.0	70.4	0.375	127.7	34.2	0.82 U	154.9
C-10	B	0.492	12.50	0.368	205.0	61.7	0.399	112.0	38.9	0.82 U	150.0
COMP II	A	0.314	14.00	0.380	197.0	57.4	0.358	105.5	24.9	0.82 U	124.5
C-11	B	0.448	14.50	0.306	202.0	71.3	0.439	120.6	36.0	0.93	159.4
C-16	B	0.293	13.20	0.257	315.0	50.8	0.293	99.4	25.9	0.77 U	114.3
C-18	B	0.389	12.90	0.396	240.0	59.4	0.356	115.6	33.9	0.81 U	139.3
C-19	B	0.195	10.20	0.308	156.0	42.0	0.140	91.3	20.1	0.80 U	90.0
C-20	B	0.337	11.90	0.311	196.0	55.1	0.357	94.1	31.5	0.80 U	129.1
C-23	B	0.251	11.60	0.268	196.0	57.2	0.230	115.4	21.6	0.78 U	119.7
COMP III	B	0.160	10.84	0.342	203.0	38.5	0.175	87.1	16.6	0.79 U	92.3
TC-1 Upper	B	0.172	11.90	0.338	194.0	46.3	0.144	109.1	14.6	0.79 U	109.4
TC-2 Upper	B	0.369	14.60	0.238	205.0	55.4	0.408	105.3	29.4	0.81 U	137.4
TC-3 Upper	C	0.111	12.60	0.290	241.0	37.6	0.058	95.8	10.4	0.81 U	88.4
TC-4 Upper	B	0.114	12.14	0.309	253.0	31.4	0.066	92.7	11.1	0.78 U	83.1
TC-5 Upper Comp	A	0.769	18.20	0.799	230.0	81.2	1.048	110.4	60.0	1.44	220.0
TC-5 Upper Replicate 1	C	0.856	19.50	1.209	207.0	81.1	1.081	108.9	56.2	0.83 U	220.0
TC-5 Upper Replicate 2	C	0.880	21.00	0.835	194.0	82.7	1.110	105.0	53.8	0.82 U	214.0
TC-5 Upper Replicate 3	C	0.840	19.40	0.871	218.0	80.4	1.047	110.7	57.2	0.85	214.0
TC-5 Special Sample	C	1.299	24.80	1.294	206.0	96.4	1.431	111.2	62.1	0.84 U	260.0
COMP IV	A	0.110	10.27	0.362	184.0	36.5	0.101	84.6	11.1	0.77 U	76.1
TC-1 Lower	B	0.103	9.58	0.211	320.0	40.1	0.119	93.1	11.5	0.98	84.4
TC-2 Lower	B	0.121	10.25	0.276	253.0	40.2	0.103	91.8	11.3	0.79 U	87.1
TC-3 Lower	C	0.159	9.22	0.347	229.0	33.2	0.077	83.5	10.0	0.75 U	65.9
TC-4 Lower	C	0.107	10.86	0.237	269.0	32.3	0.116	89.5	10.8	0.81 U	66.0
TC-5 Lower	B	0.075	7.85	0.217	248.0	26.5	0.105	57.2	13.1	0.78 U	55.2
COMP V	A	0.448	14.50	0.556	196.0	74.4	0.562	123.5	46.4	0.83 U	179.3
C-24	B	0.279	13.80	0.291	223.0	64.3	0.295	117.1	24.1	0.83	130.8
C-26	B	0.500	14.60	0.379	205.0	72.4	0.486	117.0	47.6	0.82	172.0
C-30	C	0.527	14.20	0.428	184.0	79.0	0.529	121.1	52.1	0.82 U	178.0
C-33	C	0.483	15.40	0.655	217.0	71.5	0.437	130.9	44.1	0.84 U	173.5

TABLE C.14. (contd)

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
C-35	A	0.440	12.70	0.544	204.0	69.7	0.453	116.4	44.8	0.82 U	160.6
C-37	A	0.343	9.14	0.431	261.0	55.2	0.321	102.3	31.6	1.04	131.9
COMP VI	A	0.471	12.50	0.428	211.0	72.8	0.535	123.4	48.3	0.84 U	172.9
C-25	B	0.304	9.82	0.290	209.0	53.2	0.271	101.0	30.2	0.78 U	120.7
C-29	A	0.307	10.70	0.457	181.0	49.0	0.243	102.6	27.8	0.84 U	126.5
C-32	A	0.340	12.10	0.456	189.0	59.6	0.303	112.6	32.9	1.32	137.2
C-36	B	0.450	13.40	0.609	210.0	64.5	0.423	111.6	44.8	0.81 U	158.7
C-38	B	0.339	7.72	1.232	189.0	56.5	0.292	103.9	33.9	2.01	137.4
TC-6 (1) ^(c)	C	0.182	12.90	0.350	207.0	38.1	0.276	102.2	22.5	0.82 U	103.1
TC-6 (2)	C	0.117	12.04	0.328	209.0	37.6	0.054	103.7	9.4	0.80 U	95.0
TC-6 (3)	C	0.078	6.13	0.105	226.0	16.2	0.088	46.1	8.3	0.73 U	35.2
TC-6 (4)	C	0.128	10.26	0.222	211.0	44.7	0.060	102.8	11.9	0.78 U	86.8
TC-7 (1) ^(c)	C	0.107	9.83	0.303	197.0	39.6	0.052	100.5	12.0	0.83 U	94.5
TC-7 (2)	C	0.121	12.40	0.309	242.0	46.5	0.063	112.8	10.8	1.12	99.6
TC-7 (3)	C	0.082	5.91	0.125	286.0	21.5	0.078	53.2	9.4	0.76 U	41.8
TC-7 (4)	C	0.118	10.95	0.237	204.0	45.5	0.062	101.5	9.0	0.80 U	87.3
R-AC	A	0.166	10.25	0.215	438.0	27.1	0.130	68.8	20.4	0.79 U	74.0
R-AM Replicate 1	B	0.047	7.18	0.046	251.0	11.6	0.041	43.3	16.6	0.73 U	36.0
R-AM Replicate 2	B	0.021	7.23	0.053	294.0	10.6	0.031	46.4	14.7	0.74 U	34.9
R-AM Replicate 3	B	0.032	6.19	0.066	307.0	10.0	0.019	45.9	16.2	0.70 U	34.3
R-BF Replicate 1	A	0.478	8.70	0.217	218.0	55.2	0.571	117.2	36.1	0.84 U	137.5
R-BF Replicate 2	A	0.462	9.60	0.202	206.0	55.8	0.346	112.1	37.6	0.80 U	139.2
R-BF Replicate 3	A	0.466	8.80	0.204	261.0	57.4	0.365	120.0	35.4	0.83 U	140.5
R-OS	A	0.501	4.01	0.616	172.0	30.7	0.146	82.8	9.2	2.57	91.0
R-PF	A	0.054	5.47	2.297	411.0	13.6	0.062	50.0	7.1	0.75 U	53.7
C-SB	A	0.267	12.60	1.203	132.0	39.7	0.146	52.2	13.1	0.87 U	98.6
C-WB	A	0.019 U	3.67	0.104	399.0	11.9	0.0003 U	50.5	4.9	0.73 U	51.8
C-NE	A	0.019 U	4.34	0.112	114.0	8.2	0.045	24.6	5.1	0.66 U	20.9

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

(c) TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.15. Quality Control Data for Sediment Metals Analyses, Richmond Harbor Program

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Method Blanks											
Blank 1	A	0.019 U ^(a)	NM ^(b)	0.012	NM	NM	0.00004	NM	NM	NM	NM
Blank 1 Duplicate	A	NM	NM	NM	NM	NM	0.00003	NM	NM	NM	NM
Blank 2	B	0.019 U	NM	0.013	NM	NM	0.00001	NM	NM	NM	NM
Blank 2 Duplicate	B	NM	NM	NM	NM	NM	0.00003	NM	NM	NM	NM
Blank 3	C	NM	NM	NM	NM	NM	0.00003	NM	NM	NM	NM
Blank 3 Duplicate	C	NM	NM	NM	NM	NM	0.00002	NM	NM	NM	NM
Matrix Spikes											
COMP I	C	0.362	NA ^(c)	0.351	NA	NA	0.323	NA	NA	NA	NA
COMP I MS	C	2.439	NA	2.254	NA	NA	1.223	NA	NA	NA	NA
Concentration Recovered		2.077	NA	1.903	NA	NA	0.900	NA	NA	NA	NA
Spike Amount		2.000	NS ^(d)	2.000	NS	NS	0.998	NS	NS	NS	NS
Percent Recovery		104%	NA	95%	NA	NA	90%	NA	NA	NA	NA
COMP I	C	0.362	NA	0.351	NA	NA	0.323	NA	NA	NA	NA
COMP I MSD	C	2.539	NA	2.357	NA	NA	1.230	NA	NA	NA	NA
Concentration Recovered		2.177	NA	2.006	NA	NA	0.907	NA	NA	NA	NA
Spike Amount		2.000	NS	2.000	NS	NS	0.998	NS	NS	NS	NS
Percent Recovery		109%	NA	100%	NA	NA	91%	NA	NA	NA	NA
MS/MSD RPD		5%	NA	5%	NA	NA	1%	NA	NA	NA	NA
MS/MSD I-Stat		0.02	NA	0.03	NA	NA	0.00	NA	NA	NA	NA
COMP III	B	0.160	NA	0.342	NA	NA	0.175	NA	NA	NA	NA
COMP III MS	B	2.250	NA	2.296	NA	NA	1.062	NA	NA	NA	NA
Concentration Recovered		2.090	NA	1.954	NA	NA	0.887	NA	NA	NA	NA
Spike Amount		2.000	NS	2.000	NS	NS	1.002	NS	NS	NS	NS
Percent Recovery		105%	NA	98%	NA	NA	89%	NA	NA	NA	NA
COMP III	B	0.160	NA	0.342	NA	NA	0.175	NA	NA	NA	NA
COMP III MSD	B	2.383	NA	2.235	NA	NA	0.971	NA	NA	NA	NA
Concentration Recovered		2.223	NA	1.893	NA	NA	0.796	NA	NA	NA	NA
Spike Amount		2.000	NS	2.000	NS	NS	0.992	NS	NS	NS	NS
Percent Recovery		111%	NA	95%	NA	NA	80%	NA	NA	NA	NA
MS/MSD RPD		6%	NA	3%	NA	NA	10%	NA	NA	NA	NA
MS/MSD I-Stat		0.03	NA	0.02	NA	NA	0.05	NA	NA	NA	NA

TABLE C.15. (contd)

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP IV	A	0.110	NA	0.362	NA	NA	0.101	NA	NA	NA	NA
COMP IV MS	A	2.307	NA	2.441	NA	NA	0.951	NA	NA	NA	NA
Concentration Recovered		2.197	NA	2.079	NA	NA	0.850	NA	NA	NA	NA
Spike Amount		2.000	NS	2.000	NS	NS	0.988	NS	NS	NS	NS
Percent Recovery		110%	NA	104%	NA	NA	86%	NA	NA	NA	NA
COMP IV	A	0.110	NA	0.362	NA	NA	0.101	NA	NA	NA	NA
COMP IV MSD	A	2.239	NA	2.497	NA	NA	0.891	NA	NA	NA	NA
Concentration Recovered		2.129	NA	2.135	NA	NA	0.790	NA	NA	NA	NA
Spike Amount		2.000	NS	2.000	NS	NS	0.990	NS	NS	NS	NS
Percent Recovery		106%	NA	107%	NA	NA	80%	NA	NA	NA	NA
MS/MSD RPD		3%	NA	3%	NA	NA	8%	NA	NA	NA	NA
MS/MSD I-Stat		0.02	NA	0.01	NA	NA	0.04	NA	NA	NA	NA
<u>Standard Reference Material</u>											
Certified Value 1646		NC ^(e)	11.6 ±1.3	0.36 ±0.07	76.0 ±3.0	18.0 ±3.0	0.063 ±0.012	32.0 ±3.0	28.2 ±1.8	NC	138.0 ±6.0
SRM 1646 Replicate 1	A	NA	10.5	0.604	87.0	21.3	0.067	37.6	31.7	NA	134.0
SRM 1646 Duplicate	A	NA	NM	NM	NM	NM	0.064	NM	NM	NA	NM
SRM 1646 Replicate 2	B	NA	11.8	0.404	88.0	20.6	0.066	38.1	29.5	NA	135.6
SRM 1646 Replicate 3	C	NA	11.7	0.395	90.0	21.3	0.063	37.3	30.5	NA	135.9
Certified Value BEST-1		NC	NC	NC	NC	NC	0.092 ±0.009	NC	NC	NC	NC
BEST-1 Replicate 1	A	NA	NA	NA	NA	NA	0.079	NA	NA	NA	NA
BEST-1 Duplicate	A	NA	NA	NA	NA	NA	0.079	NA	NA	NA	NA
BEST-1 Replicate 2	B	NA	NA	NA	NA	NA	0.082	NA	NA	NA	NA
BEST-1 Replicate 3	C	NA	NA	NA	NA	NA	0.081	NA	NA	NA	NA
<u>Analytical Duplicates</u>											
TC-5 Upper Comp	A	NA	NA	NA	NA	NA	1.048	NA	NA	NA	NA
TC-5 Upper Comp Duplicate	A	NA	NA	NA	NA	NA	1.075	NA	NA	NA	NA
RPD		NA	NA	NA	NA	NA	3%	NA	NA	NA	NA
I-Stat		NA	NA	NA	NA	NA	0.01	NA	NA	NA	NA

TABLE C.15. (contd)

Sediment Treatment	Analytical Batch	Metals (mg/kg dry weight)									
		Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
TC-5 Special Sample	C	NA	NA	NA	NA	NA	1.431	NA	NA	NA	NA
TC-5 Special Duplicate	C	NA	NA	NA	NA	NA	1.412	NA	NA	NA	NA
RPD		NA	NA	NA	NA	NA	1%	NA	NA	NA	NA
I-Stat		NA	NA	NA	NA	NA	0.01	NA	NA	NA	NA
TC-1 Lower	B	NA	NA	NA	NA	NA	0.119	NA	NA	NA	NA
TC-1 Lower Duplicate	B	NA	NA	NA	NA	NA	0.120	NA	NA	NA	NA
RPD		NA	NA	NA	NA	NA	1%	NA	NA	NA	NA
I-Stat		NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA
COMP VI	A	NA	NA	NA	NA	NA	0.535	NA	NA	NA	NA
COMP VI Duplicate	A	NA	NA	NA	NA	NA	0.544	NA	NA	NA	NA
RPD		NA	NA	NA	NA	NA	2%	NA	NA	NA	NA
I-Stat		NA	NA	NA	NA	NA	0.01	NA	NA	NA	NA
<u>Analytical Replicates</u>											
TC-5 Upper Replicate 1	C	0.856	19.50	1.209	207.0	81.1	1.081	108.9	56.2	0.83 U	220.0
TC-5 Upper Replicate 2	C	0.880	21.00	0.835	194.0	82.7	1.110	105.0	53.8	0.82 U	214.0
TC-5 Upper Replicate 3	C	0.840	19.40	0.871 (f)	218.0	80.4	1.047	110.7	57.2	0.85	214.0
RSD		2%	4%	21% (f)	6%	1%	3%	3%	3%	NA	2%
R-AM Replicate 1	B	0.047	7.18	0.046	251.0	11.6	0.041	43.3	16.6	0.73 U	36.0
R-AM Replicate 2	B	0.021	7.23	0.053	294.0	10.6	0.031	46.4	14.7	0.74 U	34.9
R-AM Replicate 3	B	0.032 (f)	6.19	0.066	307.0	10.0	0.019	45.9	16.2	0.70 U	34.3
RSD		39% (f)	9%	18%	10%	8%	36% (f)	4%	6%	NA	2%
R-BF Replicate 1	A	0.478	8.70	0.217	218.0	55.2	0.571	117.2	36.1	0.84 U	137.5
R-BF Replicate 2	A	0.462	9.60	0.202	206.0	55.8	0.346	112.1	37.6	0.80 U	139.2
R-BF Replicate 3	A	0.466	8.80	0.204	261.0	57.4	0.365 (f)	120.0	35.4	0.83 U	140.5
RSD		2%	5%	4%	13%	2%	29% (f)	3%	3%	NA	1%

(a) U The analyte was not present above the level of the associated value.

(b) NM Not measured, no blank or duplicate data available; samples were analyzed by XRF.

(c) NA Not applicable.

(d) NS Not spiked.

(e) NC Not certified, but previous analysis has determined 0.1 mg/kg to be a good estimate.

(f) Value exceeds relative precision range of 20%.

TABLE C.16. Sediment Total Organic Carbon (TOC) and Total Volatile Solids (TVS) Results, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>TOC (percent dry weight)</u>	<u>TVS (percent dry weight)</u>
Target DL ^(a)		0.1	0.1
Achieved DL		0.006	0.0013
COMP I	C	0.99	6.10
C-1	A	0.80	4.75
C-3	A	0.93	5.52
C-5	A	1.01	5.68
C-6	A	1.09	6.12
C-8	A	1.18	6.55
C-10	B	1.08	5.90
COMP II	A	0.73	5.49
C-11	B	1.14	6.46
C-16	B	0.59	3.98
C-18	B	0.81	4.73
C-19	B	0.28	3.38
C-20	B	0.67	4.66
C-23	B	0.74	4.54
COMP III	B	0.68	3.65
TC-1 Upper	B	0.79	3.96
TC-2 Upper	B	0.90	5.19
TC-3 Upper	C	0.59	3.03
TC-4 Upper	B	0.54	2.87
TC-5 Upper Comp	A	0.91	5.00
TC-5 Upper Replicate 1	C	0.93	5.14
TC-5 Upper Replicate 2	C	0.94	5.09
TC-5 Upper Replicate 3	C	0.96	5.09
TC-5 Special Sample	C	1.07	5.65
COMP IV	A	0.39	3.32
TC-1 Lower	B	0.43	3.00
TC-1 Lower Duplicate	B	0.42	NM ^(b)
TC-2 Lower	B	0.60	3.45
TC-3 Lower	C	0.26	2.07
TC-3 Lower Duplicate	C	0.28	NM
TC-4 Lower	C	0.25	2.22
TC-5 Lower	B	0.41	2.50

TABLE C.16. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>TOC (percent dry weight)</u>	<u>TVS (percent dry weight)</u>
COMP V	A	1.08	6.38
C-24	B	0.79	4.96
C-26	B	1.01	5.93
C-30	C	1.06	6.26
C-30 Duplicate	C	1.06	NM
C-33	C	0.92	6.06
C-35	A	0.84	5.52
C-37	A	0.60	4.77
COMP VI	A	1.03	6.52
C-25	B	0.49	4.06
C-29	A	0.57	4.61
C-29 Duplicate	A	0.59	NM
C-32	A	0.60	4.74
C-32 Duplicate	A	0.60	NM
C-36	B	0.89	5.62
C-38	B	0.59	4.65
TC-6 (1) ^(c)	C	0.79	4.48
TC-6 (2)	C	0.71	3.56
TC-6 (3)	C	0.15	1.53
TC-6 (4)	C	0.56	3.50
TC-7 (1) ^(c)	C	0.81	3.63
TC-7 (2)	C	0.72	3.62
TC-7 (3)	C	0.23	1.68
TC-7 (4)	C	0.54	3.33
R-AC	A	0.38	2.95
R-AM Replicate 1	B	0.06	0.98
R-AM Replicate 2	B	0.06	1.02
R-AM Replicate 3	B	0.06	0.98
R-BF Replicate 1	A	1.00	6.28
R-BF Replicate 2	A	1.04	6.09
R-BF Replicate 3	A	0.96	5.86
R-OS	A	1.39	5.74
R-OS Duplicate	A	1.49	NM
R-PF	A	0.41	2.08

TABLE C.16. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>TOC (percent dry weight)</u>	<u>TVS (percent dry weight)</u>
C-SB	A	2.15	7.81
C-WB	A	0.06	0.69
C-WB Duplicate	A	0.06	NM
C-NE	A	0.06	0.87

-
- (a) DL Detection limit.
 (b) NM Not measured; duplicate analysis performed by ARI for TOC only; TVS was analyzed by the MSL.
 (c) TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.17. Quality Control Data Total Organic Carbons (TOC) and Total Volatile Solids (TVS) Analyses, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>TOC (percent dry weight)</u>	<u>TVS (percent dry weight)</u>
<u>Method Blanks</u>			
Blank 1	A	0.007	0.0013
Blank 2	B	0.006	0.0014
Blank 3	C	0.009	NM ^(a)
<u>Standard Reference Materials</u>			
Estimated value		2.3 ^(b)	NC ^(c)
MESS-1 Replicate 1		2.29	NA ^(d)
MESS-1 Replicate 2		2.28	NA
MESS-1 Replicate 3		2.33	NA
<u>Analytical Duplicates</u>			
TC-1 Lower	B	0.43	NM
TC-1 Lower Duplicate	B	0.42	NM
RPD		2%	NM
I-Stat		0.01	NM
TC-3 Lower	C	0.26	NM
TC-3 Lower Duplicate	C	0.28	NM
RPD		7%	NM
I-Stat		0.04	NM
C-30	C	1.06	NM
C-30 Duplicate	C	1.06	NM
RPD		0%	NM
I-Stat		0.00	NM
C-29	A	0.57	NM
C-29 Duplicate	A	0.59	NM
RPD		3%	NM
I-Stat		0.02	NM
C-32	A	0.60	NM
C-32 Duplicate	A	0.60	NM
RPD		0%	NM
I-Stat		0.00	NM
R-OS	A	1.39	NM
R-OS Duplicate	A	1.49	NM
RPD		7%	NM
I-Stat		0.03	NM

TABLE C.17. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>TOC (percent dry weight)</u>	<u>TVS (percent dry weight)</u>
C-WB	A	0.06	NM
C-WB Duplicate	A	0.06	NM
RPD		0%	NM
I-Stat		0.00	NM
<u>Analytical Replicates</u>			
TC-5 Upper Replicate 1	C	0.93	5.14
TC-5 Upper Replicate 2	C	0.94	5.09
TC-5 Upper Replicate 3	C	0.98	5.09
RSD		3%	1%
R-AM Replicate 1	B	0.06	0.98
R-AM Replicate 2	B	0.06	1.02
R-AM Replicate 3	B	0.06	0.98
RSD		0%	2%
R-BF Replicate 1	A	1.00	6.28
R-BF Replicate 2	A	1.04	6.09
R-BF Replicate 3	A	0.96	5.86
RSD		4%	3%

-
- (a) NM Not measured; TVS analyzed in two batches.
 (b) MESS-1 is not certified for TOC, but frequent analyses at MSL indicate an estimated value of 2.3%.
 (c) NC Not certified.
 (d) NA Not applicable.

TABLE C.18. Sediment Oil and Grease and Total Petroleum Hydrocarbons (TPHs) Results, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>TPHs (mg/kg dry weight)</u>	<u>Petroleum Fraction (%)</u>
Target DL ^(a)		20.00	20.00	
Achieved DL Low		0.5	0.5	
Achieved DL High		1.29	1.29	
COMP I	B	63.22	41.39	65
C-1	A	91.26	68.41	75
C-3	A	89.17	65.03	73
C-5	A	144.92	92.66	64
C-6	A	108.89	88.21	81
C-8	A	132.45	104.76	79
C-10	B	151.75	115.92	76
COMP II	A	118.30	91.00	77
C-11	B	99.86	76.06	76
C-16	B	93.04	74.71	80
C-18	B	124.58	95.91	77
C-19	B	42.91	27.30	64
C-20	B	103.58	78.82	76
C-23	B	68.91	46.08	67
COMP III	B	44.06	26.74	61
TC-1 Upper	B	90.29	34.60	38
TC-2 Upper	B	132.78	79.16	60
TC-3 Upper	C	37.83	19.54	52
TC-4 Upper	B	73.52	16.77	23
TC-5 Upper Comp	C	311.19	281.16	90
TC-5 Upper Replicate 1	C	297.24	256.11	86
TC-5 Upper Replicate 2	C	230.74	189.60	82
TC-5 Upper Replicate 3	C	418.34	350.10	84
TC-5 Special Sample	C	18.83	10.99	58
COMP IV	A	19.06	10.50	55
TC-1 Lower	B	9.80	5.67	58
TC-2 Lower	B	24.30	13.27	55
TC-3 Lower	C	13.03	8.58	66
TC-4 Lower	C	14.14	8.10	57
TC-5 Lower	B	24.65	7.79	32
COMP V	A	186.23	141.25	76
C-24	B	76.55	54.99	72
C-26	B	138.15	107.13	78
C-30	C	218.95	174.70	80
C-33	C	100.39	83.05	83
C-35	A	151.47	119.79	79
C-37	A	263.31	150.44	57
COMP VI	A	252.06	185.70	74
C-25	B	76.89	63.25	82
C-29	A	91.93	72.97	79
C-32	A	167.80	140.78	84
C-36	B	223.76	180.06	80
C-38	B	118.09	101.70	86
TC-6 (1) ^(b)	C	37.60	25.13	67
TC-6 (2)	C	27.74	14.43	52
TC-6 (3)	C	5.64	2.63	47
TC-6 (4)	C	15.57	9.01	58

TABLE C.18. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>TPHs (mg/kg dry weight)</u>	<u>Petroleum Fraction (%)</u>
TC-7 (1) ^(b)	C	27.50	24.48	89
TC-7 (2)	C	62.33	20.42	33
TC-7 (3)	C	6.50	5.68	87
TC-7 (4)	C	16.87	15.21	90
R-AC	A	59.07	27.81	47
R-AM Replicate 1	B	12.97	6.79	52
R-AM Replicate 2	B	11.92	6.77	57
R-AM Replicate 3	B	9.99	5.77	58
R-BF Replicate 1	A	73.70	50.64	69
R-BF Replicate 2	A	101.51	73.76	73
R-BF Replicate 3	A	134.35	126.51	94
R-OS	A	39.26	17.09	44
R-PF	A	37.61	3.72	10
C-SB	A	172.93	47.89	28
C-WB	A	30.75	6.96	23
C-NE	A	13.58	4.90	36

(a) DL Detection limit.

(b) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.19. Quality Control Data for Sediment Oil and Grease and Total Petroleum Hydrocarbons (TPHs) Analyses, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>Total Petroleum Hydrocarbons (mg/kg dry weight)</u>	<u>Petroleum Fraction (%)</u>
<u>Method Blanks</u>				
Blank 1	A	7.14	NH ^(a)	0
Blank 2	B	6.57	5.34	81
Blank 3	C	3.31	0.47	14
<u>Blank Spikes</u>				
Blank	A	0.00 U ^(b)	0.00 U	0
Blank MS	A	24.65	21.31	86
Concentration Recovered		24.65	21.31	NA ^(c)
Amount Spiked		24.00	24.00	NA
Percent Recovery		103%	89%	NA
Blank	B	0.00 U	0.00 U	0
Blank MS	B	27.72	23.62	85
Concentration Recovered		27.72	23.62	NA
Amount Spiked		26.00	26.00	NA
Percent Recovery		107%	91%	NA
Blank	C	0.00 U	0.00 U	0
Blank MS	C	35.94	36.79	102
Concentration Recovered		35.94	36.79	NA
Amount Spiked		23.90	23.90	NA
Percent Recovery		150%	154% ^(d)	NA
<u>Matrix Spikes</u>				
COMP I	B	63.22	41.39	65
COMP I MS	B	162.47	138.05	85
Concentration Recovered		99.25	96.66	NA
Amount Spiked		75.70	75.70	NA
Percent Recovery		131%	128%	NA
COMP I	B	63.22	41.39	65
COMP I MSD	B	144.02	125.89	B7
Concentration Recovered		80.80	84.50	NA
Amount Spiked		77.80	77.80	NA
Percent Recovery		104%	109%	NA
MS/MSD RPD		23% ^(e)	16%	NA
MS/MSD I-STAT		0.12	0.08	NA
COMP III	B	44.06	26.74	61
COMP III MS	B	90.79	73.35	81
Concentration Recovered		46.73	46.61	NA
Amount Spiked		59.60	59.60	NA
Percent Recovery		78%	78%	NA
COMP III	B	44.06	26.74	61
COMP III MSD	B	71.67	56.49	79
Concentration Recovered		27.61	29.75	NA
Amount Spiked		51.40	51.40	NA
Percent Recovery		54%	58%	NA
MS/MSD RPD		37% ^(e)	30% ^(e)	NA
MS/MSD I-STAT		0.19	0.15	NA

TABLE C.19. (contd)

<u>Sediment Treatment</u>	<u>Analytical Batch</u>	<u>Oil and Grease (mg/kg dry weight)</u>	<u>Total Petroleum Hydrocarbons (mg/kg dry weight)</u>	<u>Petroleum Fraction (%)</u>
COMP IV	A	19.06	10.50	55
COMP IV MS	A	39.18	32.07	82
Concentration Recovered		20.12	21.57	NA
Amount Spiked		64.60	64.60	NA
Percent Recovery		31%(d)	33%(d)	NA
COMP IV	A	19.06	10.50	55
COMP IV MSO	A	61.75	50.27	81
Concentration Recovered		42.69	39.77	NA
Amount Spiked		55.40	55.40	NA
Percent Recovery		77%	72%	NA
MS/MSD RPD		85%(e)	73%(e)	NA
MS/MSD I-STAT		0.42	0.37	NA
<u>Analytical Replicates</u>				
R-BF Replicate 1	A	73.70	50.64	69
R-BF Replicate 2	A	101.51	73.76	73
R-BF Replicate 3	A	134.35	126.51	94
RSD		29%(e)	46%(e)	17%
R-AM Replicate 1	B	12.97	6.79	52
R-AM Replicate 2	B	11.92	6.77	57
R-AM Replicate 3	B	9.99	5.77	58
RSD		13%	9%	5%
TC-5 Upper Replicate 1	C	297.24	256.11	86
TC-5 Upper Replicate 2	C	230.74	189.60	82
TC-5 Upper Replicate 3	C	418.34	350.10	84
RSD		30%(e)	30%(e)	2%

(a) NM Not measured; septa put on column upside down, no blank information available.

(b) U The analyte was not present above the level of the associated value.

(c) NA Not applicable.

(d) Recovery outside quality control range (50%-150%).

(e) Value exceeds relative precision range of 20%.

TABLE C.20. Sediment Butyltin Results, Richmond Harbor Program

Sediment Treatment	Analytical Batch	Triphenyltin Surrogate Recovery (%)	Butyltin Species ($\mu\text{g/kg}$ dry weight)			
			Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
Target DL ^(a)			10.0	10.0	10.0	10.0
Achieved OL			2.4	2.5	2.4	5.1
COMP I	D	97.43	1.2 J ^(b)	3.1	3.3	5.1 U ^(c)
C-1	A	78.14	2.4 U	0.8 J	0.8 J	5.1 U
C-3	A	84.84	2.4 U	1.4 J	1.2 J	5.1 U
C-5	A	78.14	2.4 U	2.6	2.1 J	5.1 U
C-6	A	79.04	2.4 U	1.5 J	1.3 J	5.1 U
C-8	A	79.47	2.4 U	1.3 J	1.7 J	5.1 U
C-10	B	82.12	2.4 U	2.5 U	2.4 U	5.1 U
COMP II	A	66.68	2.4 U	1.0 J	1.6 J	5.1 U
C-11	B	93.41	2.4 U	1.5 J	2.4 U	5.1 U
C-16	B	73.04	2.4 U	23.5	7.8	5.1 U
C-18	B	83.48	2.4 U	0.9 J	2.4 U	5.1 U
C-19	B	134.27 ^(d)	2.4 U	0.8 J	1.2 J	5.1 U
C-20	B	86.98	2.4 U	4.1	2.8	5.1 U
C-23	B	66.67	2.4 U	0.7 J	0.5 J	5.1 U
COMP III	D	79.17	0.4 J	1.6 J	1.3 J	5.1 U
TC-1 Upper	B	70.96	2.4 U	0.5 J	2.4 U	5.1 U
TC-2 Upper	B	73.62	2.4 U	2.5 U	2.6 U	5.1 U
TC-3 Upper	C	78.40	2.4 U	2.5 U	0.4 J	5.1 U
TC-4 Upper	B	69.40	2.4 U	0.3 J	2.4 U	5.1 U
TC-5 Upper Comp	E	87.25	2.0 U	2.3	1.9 J	4.2 U
TC-5 Upper Replicate 1	D	91.54	2.4 U	2.5 U	9.3	5.1 U
TC-5 Upper Replicate 2	D	91.65	2.4 U	2.5 U	3.7	5.1 U
TC-5 Upper Replicate 3	D	75.52	2.4 U	2.5 U	11.4	4.0 J
TC-5 Special sample ^(e)	E	58.72	2.4 U	2.5 U	2.4 U	19.0
COMP IV	D	88.44	0.4 J	0.4 J	1.6 J	5.1 U
TC-1 Lower	B	68.41	2.4 U	2.5 U	0.3 J	5.1 U
TC-2 Lower	B	65.01	2.4 U	2.5 U	2.4 U	5.1 U
TC-3 Lower	C	85.01	2.4 U	2.5 U	2.4 U	5.1 U
TC-4 Lower	C	74.79	2.4 U	2.5 U	0.3 J	5.1 U
TC-5 Lower	B	63.31	2.4 U	2.5 U	2.4 U	5.1 U
COMP V	A	74.51	2.4 U	3.4	3.6	5.1 U
C-24	B	67.03	2.4 U	1.3 J	0.9 J	5.1 U
C-26	B	74.40	2.4 U	2.5 U	2.4 U	5.1 U
C-30	C	102.40	2.4 U	2.4 J	3.6	5.1 U
C-33	C	89.50	2.4 U	2.5 J	3.5	5.1 U
C-35	A	79.32	2.4 U	3.2	3.2	5.1 U
C-37	A	99.98	2.4 U	3.9	2.4 U	5.1 U
COMP VI	A	75.77	2.4 U	4.7	2.4 U	5.1 U
C-25	B	74.61	2.4 U	2.5 U	2.4 U	5.1 U
C-29	B	63.67	2.4 U	2.5 U	2.4 U	5.1 U
C-32	A	94.12	2.4 U	1.6 J	2.4	5.1 U
C-36	B	72.50	2.4 U	2.5 U	2.4 U	5.1 U
C-38	B	69.47	0.3 J	1.6 J	2.7	5.1 U
TC-6 (1) ^(f)	C	70.85	2.4 U	0.6 J	1.2 J	5.1 U
TC-6 (2)	C	74.26	2.4 U	2.5 U	2.4 U	5.1 U
TC-6 (3)	C	53.38	2.4 U	2.5 U	2.4 U	5.1 U
TC-6 (4)	C	82.91	2.4 U	2.5 U	2.4 U	5.1 U

TABLE C.20. (contd)

Sediment Treatment	Analytical Batch	Triphenyltin Surrogate Recovery (%)	Butyltin Species ($\mu\text{g/kg}$ dry weight)			
			Tetra- butyltin	Tri- butyltin	Di- butyltin	Mono- butyltin
TC-7 (1) ^(f)	C	93.95	2.4 U	2.5 U	2.4 U	5.1 U
TC-7 (2)	C	83.80	2.4 U	2.5 U	2.4 U	5.1 U
TC-7 (3)	C	79.93	2.4 U	0.5 J	0.3 J	5.1 U
TC-7 (4)	C	79.14	2.4 U	2.5 U	2.4 U	5.1 U
R-AC	A	87.27	0.7 J	16.2	5.4	5.1 U
R-AM Replicate 1 ^(g)	D	56.93	0.3 J	2.5 U	0.7 J	5.1 U
R-AM Replicate 2	B	71.09	2.4 U	2.5 U	2.4 U	5.1 U
R-AM Replicate 3	B	66.38	2.4 U	2.5 U	2.4 U	5.1 U
R-BF Replicate 1	A	70.65	2.4 U	1.9 J	1.3 J	5.1 U
R-BF Replicate 2	A	71.92	2.4 U	1.9 J	1.6 J	5.1 U
R-BF Replicate 3	A	69.45	2.4 U	1.9 J	1.6 J	5.1 U
R-OS	A	70.23	2.4 U	2.5 U	0.5 J	5.1 U
R-PF	A	63.68	2.4 U	2.5 U	2.4 U	5.1 U
C-SB	E	87.08	2.1 U	2.2	2.8	4.4 U
C-WB	A	59.98	2.4 U	2.5 U	2.4 U	5.1 U
C-NE	A	63.68	2.4 U	2.5 U	0.2 J	5.1 U

(a) DL Detection limit.

(b) J Analyte detected below method detection limit (MDL) but above instrument detection limit (IDL).

(c) U The analyte was not present above the level of the associated value.

(d) Recovery outside quality control range (40%-120%).

(e) Sample had interference in the chromatogram; the internal standard was altered to give approximate numbers for this sample.

(f) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

(g) Replicate 1 broke during extraction as noted by analyst, sample was then re-extracted and rerun with Batch D.

TABLE C.21. Quality Control Data for Sediment Butyltin Analysis, Richmond Harbor Program

Sediment Treatment	Analytical Batch	Triphenyltin Surrogate Recovery (%)	Butyltin Species ($\mu\text{g/kg}$ dry weight)			
			Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
Method Blanks						
Blank 1	A	43.04	2.4 U ^(a)	2.5 U	2.4 U	5.1 U
Blank 2	B	58.04	2.4 U	2.5 U	2.4 U	5.1 U
Blank 3	C	69.35	2.4 U	2.5 U	2.4 U	5.1 U
Blank 4	D	74.94	2.4 U	2.5 U	3.4	5.1 U
Blank 5	E	50.35	2.1 U	2.1 U	2.1 U	4.4 U
Matrix Spikes						
COMP I ^(b)	D	97.43	1.2 J ^(c)	3.1	3.3	5.1 U
COMP I MS-R ^(d)	D	86.41	94.9	140.9	165	57.3
Concentration Recovered		NA ^(e)	93.7	137.8	161.7	57.3
Amount Spiked		NS ^(f)	203.2	203.3	203.3	203.2
Percent Recovery		NA	46%	68%	80%	28% ^(g)
COMP I	D	97.43	1.2 J	3.1	3.3	5.1 U
COMP I MSD	D	146.71	98.1	186.6	245.1	82.2
Concentration Recovered		NA	96.9	183.5	241.8	82.2
Amount Spiked		NS	200.8	200.8	200.8	200.8
Percent Recovery		NA	48%	91%	120%	41%
MS/MSD RPD		NA	5%	30%	41% ^(h)	37% ^(h)
MS/MSD I-Stat		NA	0.02	0.15	0.20	0.18
COMP III	D	79.17	0.4 J	1.6 J	1.3 J	5.1 U
COMP III MS	D	85.19	60.5	105.7	145.7	60.2
Concentration Recovered		NA	60.1	104.1	144.4	60.2
Amount Spiked		NS	172.1	172.1	172.1	172.1
Percent Recovery		NA	35% ^(g)	60%	84%	35% ^(g)
COMP III	D	79.17	0.4 J	1.6 J	1.3 J	5.1 U
COMP III MSD	D	75.06	70.0	101.0	120.0	42.5
Concentration Recovered		NA	69.6	99.4	118.7	42.5
Amount Spiked		NS	164.2	164.2	164.2	164.2
Percent Recovery		NA	42%	61%	72%	26% ^(g)
MS/MSD RPD		NA	19%	0%	15%	30%
MS/MSD I-Stat		NA	0.10	0.00	0.07	0.15
COMP IV	D	88.44	0.4 J	0.4 J	1.6 J	5.1 U
COMP IV MS	D	83.99	57.2	90.1	126.6	43.8
Concentration Recovered		NA	56.8	89.7	125.0	43.8
Amount Spiked		NS	146.8	146.8	146.8	146.8
Percent Recovery		NA	39% ^(g)	61%	85%	30% ^(g)
COMP IV	D	88.44	0.4 J	0.4 J	1.6 J	5.1 U
COMP IV MSD	D	80.81	43.1	83.7	125.4	42.8
Concentration Recovered		NA	42.7	83.3	123.8	42.8
Amount Spiked		NS	154.3	154.3	154.3	154.3
Percent Recovery		NA	28% ^(g)	54%	80%	28% ^(g)
MS/MSD RPD		NA	33% ^(h)	12%	6%	7%
MS/MSD I-Stat		NA	0.17	0.06	0.03	0.04

TABLE C.21. (contd)

Sediment Treatment	Analytical Batch	Triptyltn Surrogate Recovery (%)	Butyltn Species ($\mu\text{g/kg}$ dry weight)			
			Tetra-butyltn	Tri-butyltn	Di-butyltn	Mono-butyltn
TC-5 Upper Comp	E	87.25	2.0 U	2.3	1.9 J	4.2 U
TC-5 Upper Comp MS	E	92.14	15.1	18.8	15.9	9.7
Concentration Recovered		NA	15.1	16.5	14.0	9.7
Amount Spiked		NS	19.0	19.0	19.0	19.0
Percent Recovery		NA	80%	87%	74%	51%
<u>Standard Reference Material</u>						
Certified Value		NC ⁽ⁱ⁾	NC	1270 ± 220	1160 ± 180	280 ± 17
PACS(j)	B	NA	NA	1287.9	1124.7	395.6
PACS(j)	C	NA	NA	1912.6	2017.9	456.1
PACS(j)	D	NA	NA	1089.7	133.3	246.3
PACS(j)	E	NA	NA	1059.9	848.3	56.7
<u>Analytical Replicates</u>						
TC-5 Upper Replicate 1	D	91.54	2.4 U	2.5 U	9.3	5.1 U
TC-5 Upper Replicate 2	D	91.65	2.4 U	2.5 U	3.7	5.1 U
TC-5 Upper Replicate 3	D	75.52	2.4 U	2.5 U	11.4 ^(h)	4.0 J
RSD		11%	NA	NA	49%	NA
R-AM Replicate 1 ^(k)	D	96.72	0.3 J	2.5 U	0.7 J	5.1 U
R-AM Replicate 2	B	71.09	2.4 U	2.5 U	2.4 U	5.1 U
R-AM Replicate 3	B	66.38	2.4 U	2.5 U	2.4 U	5.1 U
RSD		21%	NA	NA	NA	NA
R-BF Replicate 1	A	70.65	2.4 U	1.9 J	1.3 J	5.1 U
R-BF Replicate 2	A	71.92	2.4 U	1.9 J	1.6 J	5.1 U
R-BF Replicate 3	A	69.45	2.4 U	1.9 J	1.6 J	5.1 U
RSD		2%	NA	0%	12%	NA

NOTE: There is no SRM for Batch A. Surrogate was out of range; therefore, rerun with Batch D.

- (a) U The analyte was not present above the level of the associated value.
 (b) Original spikes lost during extraction; new set rerun with Batch D.
 (c) J Analyte detected below method detection limit (MDL) but above instrument detection limit (IDL).
 (d) R Matrix spike and matrix spike duplicate had surrogates out of range, spikes were re-extracted and rerun with Batch D.
 (e) NA Not applicable.
 (f) NS Not spiked.
 (g) Recovery outside quality control range (40%-120%).
 (h) Value exceeds relative precision range of 30%.
 (i) NC Not certified.
 (j) Standard reference materials detected and certified values are corrected for surrogate propyltn recovery.
 (k) Replicate 1 broke during extraction as noted by analyst, sample was then re-extracted and run with Batch D.

TABLE C.22. Summary of Sediment Grain Size Including Quality Control Data, Richmond Harbor Program

Sediment Treatment	Analytical Batch	Total Percent			
		Gravel >2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay <3.9 μm
COMP I	C	0	9	45	46
C-1	A	0	23	42	35
C-3	A	0	12	44	44
C-5	A	0	5	51	44
C-6	A	0	4	46	50
C-8	A	0	1	41	58
C-10	B	0	4	45	51
COMP II	A	0	8	44	48
C-11	B	0	1	41	58
C-16	B	0	25	34	41
C-18	B	3	13	39	45
C-19	B	0	20	49	31
C-20	B	7	28	29	36
C-23	B	0	3	45	52
COMP III	B	2	11	54	33
TC-1 Upper	B	0	3	57	40
TC-2 Upper	B	0	8	49	43
TC-3 Upper	C	0	6	65	29
TC-4 Upper	B	5	12	57	26
TC-5 Upper Comp	A	0	10	43	47
TC-5 Upper Replicate 1	C	0	8	45	47
TC-5 Upper Replicate 2	C	0	8	44	48
TC-5 Upper Replicate 3	C	0	8	43	49
TC-5 Special Sample	C	0	5	45	50
COMP IV	A	3	26	43	28
TC-1 Lower	B	7	21	39	33
TC-2 Lower	B	3	9	47	41
TC-3 Lower	C	12	48	22	18
TC-4 Lower	C	3	30	40	27
TC-5 Lower	B	3	30	39	28
COMP V	A	1	2	34	63
C-24	B	0	2	39	59
C-26	B	1	6	37	56
C-30	C	0	3	38	59
C-33	C	0	3	37	60
C-35	A	0	5	41	54
C-37	A	0	16	41	43

TABLE C.22. (contd)

Sediment Treatment	Analytical Batch	Total Percent			
		Gravel >2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay <3.9 μm
COMP VI	A	0	3	36	61
C-25	B	0	16	41	43
C-29	A	0	6	51	43
C-32	A	0	2	54	44
C-36	B	0	5	40	55
C-38	B	1	6	45	48
TC-6 (1) ^(a)	C	2	11	50	37
TC-6 (2)	C	0	3	61	36
TC-6 (3)	C	1	77	11	11
TC-6 (4)	C	0	10	45	45
TC-7 (1) ^(a)	C	0	3	60	37
TC-7 (2)	C	0	2	59	39
TC-7 (3)	C	0	67	18	15
TC-7 (4)	C	0	14	45	41
R-AC	A	0	65	17	18
R-AM Replicate 1	B	0	95	2	3
R-AM Replicate 2	B	0	95	2	3
R-AM Replicate 3	B	0	95	2	3
R-BF Replicate 1	A	0	12	35	53
R-BF Replicate 2	A	0	12	34	54
R-BF Replicate 3	A	0	12	34	54
R-OS	A	0	16	62	22
R-PF	A	0	57	37	6
C-SB	A	0	9	60	31
C-WB	A	0	99	0	1
C-NE	A	0	98	1	1

Quality Control DataAnalytical Replicates

TC-5 Upper Replicate 1	C	0	8	45	47
TC-5 Upper Replicate 2	C	0	8	44	48
TC-5 Upper Replicate 3	C	0	8	43	49
RSD		0%	0%	2%	2%
R-BF Replicate 1	A	0	12	35	53
R-BF Replicate 2	A	0	12	34	54
R-BF Replicate 3	A	0	12	34	54
RSD		0%	0%	2%	1%

TABLE C.22. (contd)

Sediment Treatment	Analytical Batch	Total Percent			
		Gravel >2000 μm	Sand 62.5- 2000 μm	Silt 3.9- 62.5 μm	Clay <3.9 μm
R-AM Replicate 1	B	0	95	2	3
R-AM Replicate 2	B	0	95	2	3
R-AM Replicate 3	B	0	95	2	3
RSD		0%	0%	0%	0%

- (a) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.23. Sediment Grain Size Results (percent dry weight), Richmond Harbor Program

Sediment Treatment	Analytical Batch	phi µm >4750	Percent at Size Fraction															
			4750- 2000	2000- 850	850- 425	425- 250	250- 149	149- 75	75- 62.5	62.5- 48.0	48.0- 31.2	31.2- 23.0	23.0- 15.6	15.6- 7.8	7.8- 3.9	3.9- 1.9	1.9- 0.9	10
COMP I	C	0	0	0	0	0	1	6	2	6	9	6	6	9	9	9	9	28
C-1	A	0	0	0	0	1	3	14	5	9	10	5	4	7	7	7	6	22
C-3	A	0	0	0	0	1	0	8	3	9	8	6	5	8	8	8	10	26
C-5	A	0	0	0	0	0	0	3	2	8	10	9	6	10	8	6	10	28
C-6	A	0	0	0	0	0	1	2	1	5	6	8	6	10	11	9	10	31
C-8	A	0	0	0	0	0	0	1	0	3	4	6	6	10	12	11	12	35
C-10	B	0	0	0	0	0	1	2	1	2	7	7	6	12	11	10	10	31
COMP II	A	0	0	0	0	1	1	4	2	3	7	6	6	12	10	11	7	30
C-11	B	0	0	0	0	0	0	0	1	3	4	7	4	12	11	12	11	35
C-16	B	0	0	0	2	6	6	9	2	6	4	4	5	7	8	7	8	26
C-18	B	0	3	1	1	1	2	6	2	7	5	4	4	10	9	8	9	28
C-19	B	0	0	0	1	0	2	13	4	8	7	8	6	11	9	7	6	18
C-20	B	7	0	1	3	7	8	7	2	3	2	4	3	9	8	7	8	21
C-23	B	0	0	0	0	0	0	1	2	5	5	6	6	11	12	9	9	34
COMP III	B	2	0	1	0	0	1	4	5	9	13	9	6	10	7	5	4	24
TC-1 Upper	B	0	0	0	0	1	0	1	1	7	10	10	9	12	9	8	4	28
TC-2 Upper	B	0	0	0	0	1	0	4	3	11	8	7	5	9	9	7	8	28
TC-3 Upper	C	0	0	0	1	0	0	2	3	16	12	11	9	10	7	5	5	19
TC-4 Upper	B	3	2	0	0	1	1	4	6	16	13	10	5	8	5	4	3	19
TC-5 Upper Comp	A	0	0	1	0	0	1	4	4	7	6	6	5	10	9	7	10	30
TC-5 Upper Replicate 1	C	0	0	0	0	0	1	3	4	8	6	6	5	10	10	8	9	30
TC-5 Upper Replicate 2	C	0	0	0	0	0	1	3	4	8	6	6	5	9	10	8	10	30
TC-5 Upper Replicate 3	C	0	0	0	0	0	1	3	4	9	4	5	5	10	10	9	8	32
TC-5 Special Sample	C	0	0	0	0	0	1	2	2	6	6	5	6	11	11	7	11	32
COMP IV	A	0	3	4	3	6	4	6	3	13	5	1	6	11	7	6	4	18
TC-1 Lower	B	2	5	3	3	4	4	5	2	5	6	7	5	9	7	5	5	23
TC-2 Lower	B	2	1	0	1	1	1	4	2	6	9	7	7	9	9	7	5	29
TC-3 Lower	C	4	8	7	8	11	11	8	3	4	3	3	3	5	4	6	1	11
TC-4 Lower	C	2	1	4	4	6	5	8	3	8	9	7	5	7	4	5	2	20
TC-5 Lower	B	1	2	3	3	4	5	11	4	7	6	7	5	8	6	3	2	23

TABLE C.23. (contd)

Sediment Treatment	Analytical Batch	Percent at Size Fraction																
		phi	4750-	2000-	850-	425-	250-	149-	75-	62.5-	48.0-	31.2-	23.0-	15.6-	7.8-	3.9-	1.9-	10
		μm	>4750	2000	850	425	250	149	75	62.5	48.0	31.2	23.0	15.6	7.8	3.9	1.9	<0.9
COMP V	A	0	1	0	0	0	0	1	1	1	2	5	4	10	12	13	10	40
C-24	B	0	0	0	0	1	0	0	1	3	1	5	5	13	12	11	11	37
C-26	B	0	1	1	0	1	1	1	2	0	7	4	5	9	12	10	11	35
C-30	C	0	0	0	0	1	0	1	1	3	2	6	5	10	12	13	10	36
C-33	C	0	0	0	0	1	0	1	1	2	4	4	4	11	12	14	11	35
C-35	A	0	0	0	1	0	1	2	1	4	3	5	6	12	11	11	11	32
C-37	A	0	0	0	0	1	1	11	3	7	4	5	5	10	10	9	10	24
COMP VI	A	0	0	0	0	0	1	1	1	2	2	5	8	9	10	13	10	38
C-25	B	0	0	0	1	1	4	7	3	2	6	6	5	12	10	8	8	27
C-29	A	0	0	1	0	0	1	2	2	4	6	7	8	14	12	9	9	25
C-32	A	0	0	0	0	0	1	1	0	4	7	4	14	13	12	10	8	26
C-36	B	0	0	0	1	0	1	2	1	2	4	6	4	12	12	11	11	33
C-38	B	1	0	1	0	0	1	2	2	3	2	7	6	15	12	11	9	28
TC-6 (1) ^(a)	C	1	1	2	1	1	1	3	3	6	12	9	6	10	7	7	4	26
TC-6 (2)	C	0	0	0	0	1	0	1	1	7	14	11	8	12	9	6	5	25
TC-6 (3)	C	0	1	1	5	18	29	21	3	2	1	1	2	3	2	2	0	9
TC-6 (4)	C	0	0	0	0	1	0	5	4	7	8	7	4	8	11	9	6	30
TC-7 (1) ^(a)	C	0	0	0	1	0	0	1	1	9	12	11	10	11	7	7	5	25
TC-7 (2)	C	0	0	0	0	0	1	0	1	3	9	11	9	15	12	5	7	27
TC-7 (3)	C	0	0	1	4	12	17	27	6	3	3	2	2	4	4	2	3	10
TC-7 (4)	C	0	0	0	0	0	1	7	6	8	6	6	4	11	10	7	8	26
R-AC	A	0	0	1	20	28	12	3	1	2	3	3	2	4	3	4	3	11
R-AM Replicate 1	B	0	0	1	21	53	18	2	0	0	1	0	0	1	0	0	0	3
R-AM Replicate 2	B	0	0	1	20	54	18	2	0	0	1	0	0	1	0	0	1	2
R-AM Replicate 3	B	0	0	1	20	51	21	2	0	1	0	0	0	1	0	0	1	2
R-BF Replicate 1	A	0	0	0	1	3	5	3	0	4	3	5	5	8	10	13	10	30
R-BF Replicate 2	A	0	0	0	1	3	4	3	1	3	3	5	4	9	10	12	11	31
R-BF Replicate 3	A	0	0	0	1	3	4	3	1	2	3	4	6	9	10	12	11	31
R-OS	A	0	0	0	0	1	0	7	8	33	7	6	3	7	6	5	5	12
R-PF	A	0	0	0	0	0	1	41	15	26	6	2	1	1	1	1	1	4

TABLE C.23. (contd)

Sediment Treatment	Analytical Batch	Percent at Size Fraction																
		phi	4750-	2000-	850-	425-	250-	149-	75-	62.5-	48.0-	31.2-	23.0-	15.6-	7.8-	3.9-	1.9-	10
		μm 4750	2000	850	425	250	149	75	62.5	48.0	31.2	23.0	15.6	7.8	3.9	1.9	0.9	<0.9
C-SB	A	0	0	0	0	1	2	5	1	5	6	13	11	16	9	9	8	14
C-WB	A	0	0	0	3	29	55	12	0	0	0	0	0	0	0	1	0	0
C-NE	A	0	0	0	2	24	65	7	0	1	0	0	0	0	0	0	1	0

(a) Stations TC-6 and TC-7 were split into four separate core sections which were composited, subsampled for chemistry, and used for geologic descriptions.

TABLE C.24. Quality Control Data for Sediment Grain Size, Richmond Harbor Program

		Percent at Size Fraction																
Sediment Treatment	Analytical Batch	phi	4750-	2000-	850-	425-	250-	149-	75-	62.5-	48.0-	31.2-	23.0-	15.6-	7.8-	3.9-	1.9-	10
		<u>µm</u> <u>>4750</u>	<u>2000</u>	<u>850</u>	<u>425</u>	<u>250</u>	<u>149</u>	<u>75</u>	<u>62.5</u>	<u>48.0</u>	<u>31.2</u>	<u>23.0</u>	<u>15.6</u>	<u>7.8</u>	<u>3.9</u>	<u>1.9</u>	<u>0.9</u>	<u><0.9</u>
<u>Analytical Replicates</u>																		
TC-5 Upper Replicate 1	C	0	0	0	0	0	1	3	4	8	6	6	5	10	10	8	9	30
TC-5 Upper Replicate 2	C	0	0	0	0	0	1	3	4	8	6	6	5	9	10	8	10	30
TC-5 Upper Replicate 3	C	0	0	0	0	0	1	3	4	9	4	5	5	10	10	9	8	32
RSD		0%	0%	0%	0%	0%	0%	0%	0%	7%	22%	10%	0%	6%	0%	7%	11%	4%
R-AM Replicate 1	B	0	0	1	21	53	18	2	0	0	1	0	0	1	0	0	0	3
R-AM Replicate 2	B	0	0	1	20	54	18	2	0	0	1	0	0	1	0	0	1	2
R-AM Replicate 3	B	0	0	1	20	51	21	2	0	1	0	0	0	1	0	0	1	2
RSD		0%	0%	0%	3%	3%	9%	0%	0%	173%	87%	0%	0%	0%	0%	0%	87%	25%
R-BF Replicate 1	A	0	0	0	1	3	5	3	0	4	3	5	5	8	10	13	10	30
R-BF Replicate 2	A	0	0	0	1	3	4	3	1	3	3	5	4	9	10	12	11	31
R-BF Replicate 3	A	0	0	0	1	3	4	3	1	2	3	4	6	9	10	12	11	31
RSD		0%	0%	0%	0%	0%	13%	0%	87%	33%	0%	12%	20%	7%	0%	5%	5%	2%

APPENDIX D

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

TABLE D.1. Test Results for 10-Day *M. nasuta* Solid-Phase Test,
Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>M. nasuta</i></u>		<u>Mean Proportion Surviving</u>
		<u>Live^(a)</u>	<u>Dead or Missing</u>	
COMP I	1	20	0	1.00
COMP I	2	20	0	
COMP I	3	20	0	
COMP I	4	20	0	
COMP I	5	20	0	
COMP II	1	20	0	0.96
COMP II	2	20	0	
COMP II	3	16	4	
COMP II	4	20	0	
COMP II	5	20	0	
COMP III	1	20	0	0.99
COMP III	2	19	1	
COMP III	3	20	0	
COMP III	4	20	0	
COMP III	5	20	0	
TC-5 Upper Comp	1	20	0	1.00
TC-5 Upper Comp	2	20	0	
TC-5 Upper Comp	3	20	0	
TC-5 Upper Comp	4	20	0	
TC-5 Upper Comp	5	20	0	
COMP IV	1	19	1	0.97
COMP IV	2	20	0	
COMP IV	3	20	0	
COMP IV	4	20	0	
COMP IV	5	18	2	
COMP V	1	20	0	1.00
COMP V	2	20	0	
COMP V	3	20	0	
COMP V	4	20	0	
COMP V	5	20	0	
COMP VI	1	20	0	0.99
COMP VI	2	20	0	
COMP VI	3	20	0	
COMP VI	4	20	0	
COMP VI	5	19	1	

TABLE D.1. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
R-AC	1	20	0	0.99
R-AC	2	20	0	
R-AC	3	19	1	
R-AC	4	20	0	
R-AC	5	20	0	
R-AM	1	20	0	0.98
R-AM	2	19	1	
R-AM	3	20	0	
R-AM	4	19	1	
R-AM	5	20	0	
R-BF	1	19	1	0.98
R-BF	2	20	0	
R-BF	3	20	0	
R-BF	4	19	1	
R-BF	5	20	0	
R-OS	1	20	0	0.99
R-OS	2	20	0	
R-OS	3	20	0	
R-OS	4	20	0	
R-OS	5	19	1	
R-PF	1	19	1	0.98
R-PF	2	20	0	
R-PF	3	20	0	
R-PF	4	20	0	
R-PF	5	19	1	
C-SB	1	20	0	1.00
C-SB	2	20	0	
C-SB	3	20	0	
C-SB	4	20	0	
C-SB	5	20	0	
C-NE	1	20	0	0.99
C-NE	2	20	0	
C-NE	3	19	1	
C-NE	4	20	0	
C-NE	5	20	0	

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

TABLE D.2. Rank Order Based on Mean Proportion Surviving for 10-Day
M. nasuta Solid-Phase Test, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP II	0.96
COMP IV	0.97
R-BF	0.98
R-AM	0.98
R-PF	0.98
R-AC	0.99
R-OS	0.99
COMP VI	0.99
COMP III	0.99
C-NE	0.99
COMP V	1.00
TC-5 Upper Comp	1.00
C-SB	1.00
COMP I	1.00

TABLE D.3. Daily Observation of *M. nasuta* on Sediment Surface During 10-Day Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>M. nasuta</i> on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	3	2	2	1	1	2	2	2	2	2
COMP I	2	0	0	0	0	0	0	0	0	0	0
COMP I	3	2	2	2	0	1	2	2	1	2	0
COMP I	4	2	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	0	0	0	0	0	0	0	0
COMP II	1	7	3	2	2	2	2	1	2	2	2
COMP II	2	0	0	0	0	0	0	0	0	0	1
COMP II	3	5	7	4	3	3	3	3	2	2	2
COMP II	4	4	2	2	2	1	1	0	0	1	1
COMP II	5	1	1	1	1	0	0	0	0	0	0
COMP III	1	2	3	1	1	2	2	2	2	2	2
COMP III	2	1	2	1	1	1	1	1	1	1	0
COMP III	3	5	3	4	3	2	3	2	2	2	3
COMP III	4	4	2	3	1	1	1	1	1	1	1
COMP III	5	3	3	3	3	4	3	3	2	3	2
TC-5 Upper Comp	1	2	2	3	3	3	3	2	0	1	2
TC-5 Upper Comp	2	1	0	1	1	2	1	0	0	0	0
TC-5 Upper Comp	3	4	3	2	0	2	1	1	1	1	2
TC-5 Upper Comp	4	3	0	1	1	2	2	1	1	1	1
TC-5 Upper Comp	5	5	2	2	2	1	0	0	0	0	0
COMP IV	1	4	2	1	1	1	1	0	0	0	0
COMP IV	2	4	4	3	2	3	2	2	0	1	1
COMP IV	3	9	4	0	1	1	0	0	0	0	1
COMP IV	4	5	2	3	3	1	2	3	1	3	2
COMP IV	5	3	1	1	2	2	1	1	0	1	2
COMP V	1	0	0	0	0	0	0	0	0	0	1
COMP V	2	0	0	0	1	1	1	0	0	0	0
COMP V	3	2	2	0	1	1	1	1	1	1	1
COMP V	4	0	0	1	1	1	0	0	0	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	0	0	0	0	0	0	0	0
COMP VI	2	3	2	2	2	1	2	2	0	1	1
COMP VI	3	1	0	1	1	0	1	1	0	0	0
COMP VI	4	4	4	3	4	3	5	6	6	5	2
COMP VI	5	1	2	2	2	3	2	1	2	3	2

TABLE D.3. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AC	1	2	1	1	1	1	1	2	2	0	0
R-AC	2	1	1	1	1	1	1	0	0	0	0
R-AC	3	0	0	0	0	1	0	0	0	0	0
R-AC	4	1	0	0	0	0	0	0	0	0	0
R-AC	5	0	0	0	0	0	0	0	0	1	0
R-AM	1	0	0	0	0	0	1	0	0	2	2
R-AM	2	1	2	2	1	3	2	2	2	5	5
R-AM	3	1	1	0	0	2	2	1	2	2	1
R-AM	4	2	0	2	1	1	1	0	1	2	1
R-AM	5	0	0	0	1	2	3	3	3	6	6
R-BF	1	2	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	1	0	0	1	1
R-BF	4	2	2	1	1	1	1	1	0	0	0
R-BF	5	0	0	0	0	0	0	0	0	1	1
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	1	0	0	0	0	0	0	0	0	1
R-OS	4	2	0	0	0	0	0	0	0	0	0
R-OS	5	3	1	1	2	2	2	1	0	0	0
R-PF	1	1	1	1	1	1	2	1	1	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	2	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	0	0
R-PF	5	0	0	0	1	0	0	0	0	0	0
C-SB	1	0	0	1	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	1	0	1	1	1	0	0	0	0	0
C-SB	5	0	0	1	1	0	1	0	0	1	1
C-NE	1	1	1	1	2	1	1	2	0	1	2
C-NE	2	1	1	0	1	1	2	2	2	1	4
C-NE	3	1	1	0	2	2	2	4	4	5	6
C-NE	4	2	2	0	0	1	3	2	1	2	2
C-NE	5	1	1	1	0	2	2	1	0	1	2

TABLE D.4. Daily Observations of *M. nasuta* Siphons Exposed During 10-Day Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>M. nasuta</i> Siphons Exposed Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	21	8	8	6	7	7	4	4	4	6
COMP I	2	11	7	2	5	2	2	2	1	2	2
COMP I	3	12	6	8	7	7	10	3	2	4	4
COMP I	4	5	5	3	3	5	8	3	3	3	1
COMP I	5	10	6	6	4	5	6	2	1	0	1
COMP II	1	13	19	13	11	14	10	9	8	8	9
COMP II	2	7	7	6	8	9	12	4	1	2	3
COMP II	3	23	21	13	14	11	13	10	4	3	3
COMP II	4	13	12	13	11	9	11	9	10	6	7
COMP II	5	14	8	7	4	6	3	1	3	2	4
COMP III	1	21	12	8	7	10	11	6	0	3	2
COMP III	2	23	14	12	3	5	7	0	2	3	2
COMP III	3	31	22	19	11	14	14	8	8	5	7
COMP III	4	20	15	15	8	9	4	6	5	2	4
COMP III	5	19	14	16	17	21	20	15	10	6	3
TC-5 Upper Comp	1	13	11	11	9	12	9	9	5	6	5
TC-5 Upper Comp	2	12	8	11	7	4	10	3	7	7	8
TC-5 Upper Comp	3	20	22	13	9	7	10	7	7	7	5
TC-5 Upper Comp	4	14	12	11	10	10	7	3	5	3	4
TC-5 Upper Comp	5	18	13	13	8	9	7	2	3	3	2
COMP IV	1	24	16	18	21	11	5	5	5	5	3
COMP IV	2	21	10	14	13	11	6	2	2	3	3
COMP IV	3	15	18	17	9	6	9	5	2	1	3
COMP IV	4	26	16	15	12	9	12	6	11	5	7
COMP IV	5	22	12	17	12	10	9	4	7	5	6
COMP V	1	8	12	5	7	5	3	0	3	0	3
COMP V	2	13	6	7	8	5	6	0	0	3	2
COMP V	3	12	7	9	7	6	6	1	2	3	2
COMP V	4	7	9	8	9	6	7	2	2	3	3
COMP V	5	2	2	3	2	1	1	0	2	0	1
COMP VI	1	11	10	12	9	7	4	4	3	4	2
COMP VI	2	7	4	4	4	5	4	1	2	3	3
COMP VI	3	10	6	10	8	5	7	4	3	1	3
COMP VI	4	11	7	9	8	9	7	8	6	6	7
COMP VI	5	9	6	10	8	6	7	5	4	5	6

TABLE D.4. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> Siphons Exposed Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AC	1	12	11	9	10	7	5	1	3	5	2
R-AC	2	6	6	4	7	4	7	5	11	1	9
R-AC	3	8	9	6	14	8	7	2	1	2	2
R-AC	4	9	11	4	9	6	5	4	3	2	4
R-AC	5	14	10	10	9	5	8	1	4	3	4
R-AM	1	5	3	1	4	3	4	0	0	1	3
R-AM	2	14	10	15	12	14	10	8	8	13	10
R-AM	3	12	5	8	3	5	5	1	6	2	4
R-AM	4	7	4	4	3	1	2	2	2	4	2
R-AM	5	15	8	11	8	5	12	14	10	15	16
R-BF	1	9	7	5	12	6	3	1	2	1	2
R-BF	2	6	5	7	4	3	4	1	1	2	1
R-BF	3	12	3	5	6	5	6	3	4	2	4
R-BF	4	7	10	11	6	6	5	6	1	1	2
R-BF	5	9	5	7	5	6	4	3	4	4	3
R-OS	1	8	6	6	8	10	5	4	3	5	3
R-OS	2	10	2	3	4	4	6	6	3	2	1
R-OS	3	2	3	5	4	3	4	2	0	1	4
R-OS	4	9	9	5	7	4	8	3	4	4	3
R-OS	5	18	15	9	9	10	7	3	4	3	4
R-PF	1	10	7	6	6	6	6	3	3	0	4
R-PF	2	7	2	7	2	4	2	3	2	4	3
R-PF	3	10	10	8	5	4	3	1	2	3	5
R-PF	4	5	5	1	2	2	3	5	1	6	3
R-PF	5	6	5	3	5	3	7	1	3	0	5
C-SB	1	6	9	6	8	8	3	3	3	1	3
C-SB	2	2	1	5	3	3	5	2	1	2	1
C-SB	3	1	2	3	1	3	2	2	0	1	1
C-SB	4	9	2	4	3	4	6	1	1	0	3
C-SB	5	5	3	4	3	5	6	3	5	0	4
C-NE	1	6	0	3	5	4	6	4	5	3	3
C-NE	2	9	6	8	8	6	7	6	10	6	8
C-NE	3	7	8	8	6	11	12	5	7	11	8
C-NE	4	11	10	5	2	8	8	8	2	2	3
C-NE	5	4	3	5	2	3	5	2	3	3	8

TABLE D.5. Daily Observations of *M. nasuta* Dead and Removed During 10-Day Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>M. nasuta</i> Dead and Removed Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	0	0	0	0	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	0	0	0	0
COMP I	3	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	0	0	0	0	0	0	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	1	0	0	0	0	0	0	1
COMP II	4	0	0	0	0	0	0	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	0	0	0	0	0	0	0
COMP III	2	0	0	0	0	0	0	0	0	1	0
COMP III	3	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	0	0	0	0	0	0	0	0	0
COMP III	5	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	1	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	2	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	3	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	4	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	5	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	1	0	0	0	0
COMP IV	2	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	0	0	0	0	0	0	0	0	0
COMP IV	4	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	1
COMP V	1	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	0	0	0	0	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	0	0	0	0	0	0	0
COMP VI	5	0	0	0	0	0	0	0	0	0	0

TABLE D.5. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> Dead and Removed Test Days 1 through 10									
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
R-AC	1	0	0	0	0	0	0	0	0	0	0
R-AC	2	0	0	0	0	0	0	0	0	0	0
R-AC	3	0	0	0	0	0	0	0	1	0	0
R-AC	4	0	0	0	0	0	0	0	0	0	0
R-AC	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	1	0	0	0	0	0
R-AM	3	0	0	0	0	0	0	0	0	0	0
R-AM	4	0	0	0	1	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	1	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
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	0	0	0	0	0	0	0	0	0
R-OS	4	0	0	0	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	1	0	0	0
R-PF	1	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	0	0
R-PF	5	0	0	0	1	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
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	1	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

TABLE D.6. Water Quality Summary for 10-Day *M. nasuta*/*N. caecoides* Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Flow Rates (mL/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.41	8.41	4.0	NA ^(a)	29.9	33.9	115	135
COMP I	15.0	15.7	7.63	8.09	6.5	8.7	31.0	32.5	116	132
COMP II	14.8	15.8	7.63	8.15	7.2	8.8	31.0	32.5	116	132
COMP III	15.0	15.8	7.62	8.10	7.0	8.7	31.0	32.5	116	132
TC-S Upper Comp	14.7	15.6	7.55	8.09	7.2	8.8	31.0	32.5	116	132
COMP IV	15.0	16.1	7.50	8.12	5.6	8.8	30.5	32.0	116	132
COMP V	15.0	15.7	7.62	8.09	7.3	8.7	30.5	32.5	116	132
COMP VI	15.0	15.7	7.61	8.08	7.3	9.0	31.0	32.5	116	132
R-AC	15.0	15.6	7.64	8.09	7.4	8.7	31.0	33.0	116	132
R-AM	15.1	15.7	7.62	8.10	7.1	9.0	31.0	32.5	116	132
R-BF	14.9	15.8	7.64	8.15	7.2	8.7	31.0	32.5	116	132
R-OS	15.0	15.9	7.74	8.11	7.2	8.9	31.0	32.5	116	132
R-PF	15.0	15.9	7.55	8.11	7.2	8.6	31.0	32.5	108 ^(b)	132
C-SB	15.0	16.0	7.14 ^(b)	8.10	6.8	8.5	31.0	32.5	116	132
C-NE	15.0	15.8	7.48	8.11	6.8	8.8	31.0	32.5	116	132

(a) Not applicable.

(b) Data point out of range.

TABLE D.7. Test Results for 10-Day *N. caecoides* Solid-Phase Test, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>N. caecoides</i></u>		<u>Mean Proportion Surviving</u>
		<u>Live^(a)</u>	<u>Dead or Missing</u>	
COMP I	1	19	1	0.91
COMP I	2	17	3	
COMP I	3	16	4	
COMP I	4	19	1	
COMP I	5	20	0	
COMP II	1	17	3	0.89
COMP II	2	18	2	
COMP II	3	18	2	
COMP II	4	17	3	
COMP II	5	19	1	
COMP III	1	18	2	0.79
COMP III	2	18	2	
COMP III	3	18	2	
COMP III	4	16	4	
COMP III	5	9	11	
TC-5 Upper Comp	1	14	6	0.79
TC-5 Upper Comp	2	15	5	
TC-5 Upper Comp	3	14	6	
TC-5 Upper Comp	4	18	2	
TC-5 Upper Comp	5	18	2	
COMP IV	1	17	3	0.73
COMP IV	2	15	5	
COMP IV	3	13	7	
COMP IV	4	12	8	
COMP IV	5	16	4	
COMP V	1	19	1	0.93
COMP V	2	18	2	
COMP V	3	18	2	
COMP V	4	19	1	
COMP V	5	19	1	
COMP VI	1	17	3	0.91
COMP VI	2	19	1	
COMP VI	3	20	0	
COMP VI	4	17	3	
COMP VI	5	18	2	

TABLE D.7. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
R-AC	1	19	1	0.91
R-AC	2	18	2	
R-AC	3	17	3	
R-AC	4	19	1	
R-AC	5	18	2	
R-AM	1	19	1	0.93
R-AM	2	18	2	
R-AM	3	18	2	
R-AM	4	19	1	
R-AM	5	19	1	
R-BF	1	17	3	0.92
R-BF	2	17	3	
R-BF	3	19	1	
R-BF	4	19	1	
R-BF	5	20	0	
R-OS	1	20	0	0.95
R-OS	2	20	0	
R-OS	3	19	1	
R-OS	4	17	3	
R-OS	5	19	1	
R-PF	1	19	1	0.97
R-PF	2	29 ^(b)	1	
R-PF	3	19	1	
R-PF	4	20	0	
R-PF	5	20	0	
C-SB	1	20	0	1.00
C-SB	2	20	0	
C-SB	3	20	0	
C-SB	4	20	0	
C-SB	5	20	0	
C-NE	1	18	2	0.95
C-NE	2	19	1	
C-NE	3	20	0	
C-NE	4	18	2	
C-NE	5	20	0	

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

(b) Based on exposure of 30 individuals.

TABLE D.8. Rank Order Based on Mean Proportion Surviving for 10-Day *N. caecoides* Solid-Phase Test, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP IV	0.73
COMP III	0.79
TC-5 Upper Comp	0.79
COMP II	0.89
R-AC	0.91
COMP I	0.91
COMP VI	0.91
R-BF	0.92
R-AM	0.93
COMP V	0.93
R-OS	0.95
C-NE	0.95
R-PF	0.97
C-SB	1.00

TABLE D.9. Daily Observations of *N. caecoides* on Sediment Surface During 10-Day Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>N. caecoides</i> on Sediment Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	1	1	0	0	0	0	0	0	0
COMP I	2	1	0	0	0	0	0	0	0	0	0
COMP I	3	1	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	0	0	0	0	0	0	0
COMP I	5	1	1	0	0	0	0	0	0	0	0
COMP II	1	0	1	1	1	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	0	0	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	0	0	0	0	0
COMP II	5	1	2	2	0	0	0	0	0	0	0
COMP III	1	0	1	1	1	1	0	1	0	1	0
COMP III	2	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	1	0	0	0	1	0	0	0	0
COMP III	4	0	1	1	0	0	0	0	0	0	0
COMP III	5	0	0	0	0	1	0	0	0	0	0
TC-5 Upper Comp	1	2	1	0	0	0	0	0	0	0	0
TC-5 Upper Comp	2	1	2	3	1	0	0	0	0	0	0
TC-5 Upper Comp	3	0	0	1	0	0	0	0	1	1	0
TC-5 Upper Comp	4	1	4	1	0	0	0	0	0	0	0
TC-5 Upper Comp	5	2	1	2	0	0	0	0	0	0	0
COMP IV	1	0	1	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	2	0	0	0	1	1	0	0	0
COMP IV	4	1	0	1	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0
COMP V	1	1	0	1	0	0	0	0	0	0	0
COMP V	2	0	0	0	1	0	0	0	0	0	0
COMP V	3	0	0	0	1	0	0	0	0	0	0
COMP V	4	0	0	1	0	0	0	0	0	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	2	1	0	0	0	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	1	0	0	0	0	0	0
COMP VI	4	0	1	2	1	0	0	0	0	0	0
COMP VI	5	1	1	2	2	1	1	1	0	0	0

TABLE D.9. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i> on Sediment Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AC	1	0	0	0	0	1	0	0	0	0	0
R-AC	2	0	0	0	0	0	0	0	0	0	0
R-AC	3	0	0	0	0	1	0	0	0	0	0
R-AC	4	0	1	1	0	0	0	0	0	0	0
R-AC	5	0	1	1	0	0	0	0	0	1	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	0
R-AM	3	0	0	0	1	0	0	0	0	0	0
R-AM	4	0	0	0	0	0	0	0	0	0	0
R-AM	5	0	1	0	1	0	0	0	0	0	0
R-BF	1	0	2	1	0	0	0	0	0	0	0
R-BF	2	1	1	1	1	2	2	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
R-OS	1	0	0	0	0	2	0	0	0	0	0
R-OS	2	0	0	0	0	0	0	0	0	0	0
R-OS	3	0	0	1	0	0	0	0	0	0	0
R-OS	4	2	1	1	1	0	0	0	0	0	0
R-OS	5	1	0	0	0	0	0	0	0	0	0
R-PF	1	1	0	1	0	0	1	0	0	0	0
R-PF	2	2	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	1	0	0	0	0	0	0	0
R-PF	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	1	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	1	0	0	0	0	0	0	0	0
C-SB	5	1	1	0	0	0	0	0	0	0	0
C-NE	1	0	0	0	1	0	0	0	0	0	0
C-NE	2	0	1	0	1	0	1	0	0	0	0
C-NE	3	0	0	0	0	0	0	0	0	0	0
C-NE	4	1	1	1	0	1	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0

TABLE D.10. Daily Observations of *N. caecoides* Dead and Removed During 10-Day Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>N. caecoides</i> Dead and Removed Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	0	0	1	0	0	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	0	0	0	0
COMP I	3	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	0	0	0	0	0	0	0	0
COMP II	1	0	0	0	0	0	0	0	0	0	0
COMP II	2	0	0	0	0	0	0	0	0	0	0
COMP II	3	0	0	0	0	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	0	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	0	0	0	1	0	0	0
COMP III	2	0	0	0	0	0	0	0	0	0	0
COMP III	3	0	0	0	0	0	0	0	0	0	0
COMP III	4	0	0	1	0	0	0	0	0	0	0
COMP III	5	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	1	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	2	0	0	1	0	0	0	0	0	0	0
TC-5 Upper Comp	3	0	0	0	0	0	0	0	1	0	0
TC-5 Upper Comp	4	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	5	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	0	0	0	0	0	0
COMP IV	3	0	0	0	0	0	0	1	0	0	0
COMP IV	4	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0
COMP V	1	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	0	0	0	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	0
COMP VI	1	0	0	1	0	0	0	0	0	0	0
COMP VI	2	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	0	0	0	0	0	0	0	0
COMP VI	5	0	0	1	0	0	0	1	0	0	0

TABLE D.10. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i> Dead and Removed Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AC	1	0	0	0	0	0	0	0	0	0	0
R-AC	2	0	0	0	0	0	0	0	0	0	0
R-AC	3	0	0	0	0	0	0	0	0	0	0
R-AC	4	0	0	1	0	0	0	0	0	0	0
R-AC	5	0	0	1	0	0	0	0	0	1	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	0
R-AM	3	0	0	0	1	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	1	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	2	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
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	1	0	0	0	0	0	0	0
R-OS	4	0	0	1	0	0	0	0	0	0	0
R-OS	5	0	0	0	0	0	0	0	0	0	0
R-PF	1	0	0	1	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	0	0	0	0	0	0
R-PF	4	0	0	0	0	0	0	0	0	0	0
R-PF	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
C-NE	1	0	0	0	1	0	0	0	0	0	0
C-NE	2	0	0	0	1	0	0	0	0	0	0
C-NE	3	0	0	0	0	0	0	0	0	0	0
C-NE	4	0	0	1	0	1	0	0	0	0	0
C-NE	5	0	0	0	0	0	0	0	0	0	0

APPENDIX E

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

TABLE E.1. Test Results for 28-Day *M. nasuta* Solid-Phase Test,
Richmond Harbor Program

Sediment Treatment	Replicate	<i>M. nasuta</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
COMP I	1	24	1	0.92
COMP I	2	25	0	
COMP I	3	22	3	
COMP I	4	22	3	
COMP I	5	22	3	
COMP II	1	22	3	0.90
COMP II	2	22	3	
COMP II	3	23	2	
COMP II	4	23	2	
COMP II	5	22	3	
COMP III	1	25	0	0.93
COMP III	2	22	3	
COMP III	3	24	1	
COMP III	4	23	2	
COMP III	5	22	3	
TC-5 Upper Comp	1	22	3	0.84
TC-5 Upper Comp	2	21	4	
TC-5 Upper Comp	3	24	1	
TC-5 Upper Comp	4	17	8	
TC-5 Upper Comp	5	21	4	
COMP IV	1	19	6	0.85
COMP IV	2	19	6	
COMP IV	3	24	1	
COMP IV	4	20	5	
COMP IV	5	24	1	
COMP V	1	24	1	0.90
COMP V	2	19	6	
COMP V	3	22	3	
COMP V	4	23	2	
COMP V	5	25	0	
COMP VI	1	20	5	0.87
COMP VI	2	23	2	
COMP VI	3	21	4	
COMP VI	4	21	4	
COMP VI	5	24	1	

TABLE E.1. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>M. nasuta</u>		<u>Mean Proportion Surviving</u>
		<u>Live^(a)</u>	<u>Dead or Missing</u>	
R-AC	1	22	3	0.91
R-AC	2	20	5	
R-AC	3	24	1	
R-AC	4	24	1	
R-AC	5	24	1	
R-AM	1	21	4	0.90
R-AM	2	24	1	
R-AM	3	21	4	
R-AM	4	22	3	
R-AM	5	24	1	
R-BF	1	20	5	0.89
R-BF	2	23	2	
R-BF	3	25	0	
R-BF	4	23	2	
R-BF	5	20	5	
R-OS	1	22	3	0.91
R-OS	2	23	2	
R-OS	3	24	1	
R-OS	4	23	2	
R-OS	5	22	3	
R-PF	1	21	4	0.90
R-PF	2	24	1	
R-PF	3	22	3	
R-PF	4	24	1	
R-PF	5	21	4	
C-SB	1	25	0	0.95
C-SB	2	24	1	
C-SB	3	24	1	
C-SB	4	22	3	
C-SB	5	24	1	
C-NE	1	25	0	0.90
C-NE	2	19	6	
C-NE	3	23	2	
C-NE	4	23	2	
C-NE	5	22	3	

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

TABLE E.2. Rank Order Based on Mean Proportion Surviving 28-Day *M. nasuta* Solid-Phase Test, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
TC-5 Upper Comp	0.84
COMP IV	0.85
COMP VI	0.87
R-BF	0.89
COMP II	0.90
C-NE	0.90
R-AM	0.90
R-PF	0.90
COMP V	0.90
R-AC	0.91
R-OS	0.91
COMP I	0.92
COMP III	0.93
C-SB	0.95

TABLE E.3. Daily Observations of *M. nasuta* on Sediment Surface During 28-Day Solid-Phase Test, Richmond Harbor Program

Sediment		<i>M. nasuta</i> on Sediment Test Days 1 through 28																												
Treatment	Replicate	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	28	
COMP I	1	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
COMP I	2	1	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	
COMP I	3	2	3	2	2	1	1	1	1	0	0	0	0	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	0	
COMP I	4	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	1	0	0	
COMP I	5	3	4	1	2	2	2	1	2	2	3	2	2	3	2	1	1	0	1	1	1	1	1	1	0	0	0	0	2	0
COMP II	1	6	5	2	2	3	3	3	3	4	2	2	2	2	1	1	1	1	1	0	2	1	1	1	0	0	0	0	0	0
COMP II	2	3	3	1	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	1	1
COMP II	3	3	4	1	1	0	1	0	1	1	1	1	1	1	2	1	0	1	0	0	2	0	1	0	0	1	1	1	0	0
COMP II	4	3	3	1	1	2	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0
COMP II	5	1	3	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	1	0	2	1	2	0	0
COMP III	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	1	0	0	0
COMP III	2	6	7	5	3	5	3	4	4	3	2	1	1	1	2	1	1	1	1	1	3	0	0	0	0	1	0	0	0	0
COMP III	3	4	2	2	2	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	4	7	4	3	1	1	2	2	2	2	0	0	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0
COMP III	5	0	2	2	2	1	2	2	2	1	1	2	2	2	4	2	2	2	1	1	6	1	2	1	0	2	1	1	0	0
TC-5 Upper Comp	1	7	10	5	3	3	2	2	2	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	2	4	2	2	1	1	1	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
TC-5 Upper Comp	3	2	3	0	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	4	17	14	8	3	3	3	1	3	2	3	3	3	2	3	3	2	0	2	1	2	1	1	0	0	0	1	1	0	0
TC-5 Upper Comp	5	14	11	6	4	2	2	1	0	1	2	1	1	1	4	1	0	0	0	1	2	0	1	0	0	0	0	0	0	1
COMP IV	1	1	3	2	1	1	0	1	1	2	1	0	2	1	5	2	0	1	0	0	3	0	T ^(a)	1	0	2	2	2	0	0
COMP IV	2	10	10	7	3	4	4	1	2	0	2	1	1	0	2	1	0	1	0	0	2	0	0	1	0	1	2	1	0	0
COMP IV	3	3	3	3	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	1	0	0	0	0	2	3	0	0	0
COMP IV	4	7	3	2	2	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
COMP IV	5	7	7	2	2	0	1	0	1	0	0	2	2	0	3	0	0	T	0	0	0	0	0	0	0	3	1	3	1	1
COMP V	1	1	4	1	0	0	0	0	0	0	0	0	1	0	3	1	1	0	0	1	2	0	1	1	0	3	1	1	1	1
COMP V	2	1	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
COMP V	3	6	4	2	2	2	2	1	0	2	2	2	2	2	3	2	1	0	0	1	2	1	1	1	1	1	1	2	1	1
COMP V	4	2	2	2	2	2	2	2	0	0	0	0	0	0	1	0	0	2	0	0	1	0	1	1	0	1	1	1	1	0
COMP V	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

TABLE E.3. (contd)

Sediment		<i>M. nasuta</i> on Sediment Test Days 1 through 28																											
Treatment	Replicate	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	28
COMP VI	1	5	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
COMP VI	2	2	3	1	1	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	3	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	2	0	0	0	0	1	1	1	0
COMP VI	4	3	4	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	1	0	0	0
COMP VI	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-AC	1	0	2	1	1	0	0	0	0	0	0	0	0	0	4	2	0	1	1	1	0	0	1	0	0	0	1	1	1
R-AC	2	11	8	6	1	2	2	0	0	0	2	2	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0
R-AC	3	3	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	1	0	0	0
R-AC	5	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
R-AM	1	1	3	1	2	2	4	5	5	4	5	7	6	8	6	5	5	4	5	4	5	3	5	5	4	6	2	3	2
R-AM	2	2	5	3	3	4	4	3	4	6	6	6	6	6	6	5	7	5	4	4	8	2	5	4	4	4	2	4	3
R-AM	3	0	0	0	1	0	2	4	4	3	1	1	2	0	3	2	0	1	0	0	3	3	4	3	4	4	3	3	1
R-AM	4	11	2	1	1	3	5	3	4	3	3	3	2	2	3	2	0	2	1	1	2	0	1	1	2	3	7	4	4
R-AM	5	2	4	2	2	5	6	3	3	2	1	4	3	2	3	3	1	3	4	3	3	3	3	2	2	2	2	0	2
R-BF	1	8	11	3	4	1	2	1	0	1	1	1	1	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	2	2	2	1	1	1	1	1	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	3	4	3	0	3	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	1	2	0	1	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	0	1	1	1	1
R-BF	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
R-OS	1	4	4	2	1	2	1	2	0	1	0	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	0	0	0
R-OS	2	2	2	0	1	1	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-OS	3	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
R-OS	4	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0
R-OS	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	1	0	0
R-PF	1	0	2	0	0	0	1	1	0	0	0	1	2	2	2	2	0	2	2	0	5	1	3	2	2	3	1	1	1
R-PF	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	2	0
R-PF	3	1	1	1	0	0	0	0	0	0	1	2	2	1	3	1	1	2	1	1	2	1	1	2	2	2	0	1	0
R-PF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	1	1	1	0	0	0	0	0
R-PF	5	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0	2	1	4	1
C-SB	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
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	1	0	1	0	0	0
C-SB	3	1	1	0	1	0	1	0	0	0	4	0	0	0	1	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	5	1	0	1	1	0	3	0	0	0	0	1	2	0	0
C-SB	5	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0

TABLE E.3. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> on Sediment Test Days 1 through 28																											
		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	28
C-NE	1	1	0	1	0	1	2	1	1	2	0	1	1	0	0	0	0	0	0	0	3	0	0	1	0	0	0	1	0
C-NE	2	0	6	5	1	2	4	4	7	6	5	6	4	4	8	5	5	4	7	6	7	3	3	3	5	5	5	3	4
C-NE	3	1	3	3	3	2	2	2	2	3	1	5	2	3	3	3	3	3	4	3	2	3	2	2	3	4	4	4	5
C-NE	4	0	1	1	1	0	2	0	3	3	1	2	1	0	4	5	3	1	0	3	4	3	2	3	2	3	4	5	3
C-NE	5	1	4	2	3	4	4	4	3	3	6	3	4	2	6	5	4	4	4	4	4	3	4	4	2	3	1	4	1

(a) T Too turbid to make accurate observation.

TABLE E.4. Daily Observations of *M. nasuta* Siphons Exposed During 28-Day Solid-Phase Test, Richmond Harbor Program

Sediment		<i>M. nasuta</i> Siphons Exposed Test Days 1 through 28																												
Treatment	Replicate	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	28	
COMP I	1	12	5	4	7	5	7	3	5	1	0	4	1	1	0	0	1	3	0	0	0	0	0	0	2	0	0	0	1	
COMP I	2	5	3	2	6	2	2	1	2	1	1	0	5	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	
COMP I	3	6	3	4	7	4	4	6	3	2	2	3	3	5	0	1	1	4	2	1	2	2	5	3	1	1	0	0	1	
COMP I	4	9	4	2	5	2	4	1	3	1	4	6	5	2	0	0	1	0	0	0	0	0	3	0	1	0	1	1	3	
COMP I	5	9	11	1	5	7	4	0	3	5	6	4	5	4	4	3	1	2	1	1	1	0	0	0	0	0	0	0	1	
COMP II	1	7	9	6	10	7	8	7	8	7	6	7	4	5	2	2	4	4	3	1	1	3	2	2	0	0	0	0	0	
COMP II	2	8	6	4	3	2	2	1	1	0	1	2	2	1	0	1	0	1	0	1	1	1	1	1	0	0	0	0	2	
COMP II	3	4	10	4	7	5	11	6	4	2	3	3	4	4	1	2	2	1	1	1	1	1	1	0	0	0	0	0	1	
COMP II	4	10	7	2	5	4	4	3	2	2	2	3	2	1	1	1	2	2	0	0	0	0	1	1	0	0	0	0	1	
COMP II	5	7	5	7	4	1	5	1	3	1	2	3	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1	
COMP III	1	6	5	5	12	10	3	2	2	2	1	2	0	2	0	0	0	0	0	2	0	0	2	0	1	0	1	0	1	
COMP III	2	16	14	7	12	9	6	5	6	4	3	4	7	3	1	1	4	2	1	2	1	0	1	2	0	0	0	1	1	
COMP III	3	8	3	7	9	6	9	3	9	3	4	2	2	3	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	
COMP III	4	17	16	13	9	9	9	3	9	6	3	8	3	6	2	5	4	1	1	1	0	1	1	2	0	0	0	0	0	
COMP III	5	1	9	3	8	5	7	4	4	6	5	8	4	3	4	2	2	7	1	5	0	2	2	0	1	1	3	0	1	
TC-5 Upper Comp	1	9	16	16	13	11	11	4	9	6	5	8	5	5	3	4	3	3	1	1	0	3	2	1	2	1	0	0	2	
TC-5 Upper Comp	2	20	13	13	13	11	8	7	7	7	8	4	3	1	0	1	3	2	0	0	0	2	1	2	1	1	0	1	0	
TC-5 Upper Comp	3	16	5	5	8	5	5	3	5	0	0	3	2	0	1	0	2	2	0	0	0	0	1	2	1	0	0	0	0	
TC-5 Upper Comp	4	26	17	16	22	19	13	13	16	11	12	10	13	10	10	7	10	13	7	3	2	5	4	4	2	0	0	3	1	
TC-5 Upper Comp	5	26	20	14	18	13	9	10	11	7	5	5	6	3	5	4	3	6	6	7	6	5	6	4	1	2	0	0	1	
COMP IV	1	7	6	4	12	10	5	7	8	3	3	6	6	6	4	1	1	4	2	4	0	2	T ^(a)		2	2	1	0	2	0
COMP IV	2	20	10	15	19	16	12	5	14	4	4	8	9	9	2	2	2	2	1	1	0	2	0	2	0	2	0	0	0	
COMP IV	3	8	10	5	8	6	6	4	5	1	5	10	7	2	5	6	4	6	1	1	0	2	4	7	0	0	0	0	2	
COMP IV	4	14	11	11	10	6	7	4	4	3	6	3	5	6	1	0	2	1	2	1	0	0	1	0	0	0	0	0	0	
COMP IV	5	28	20	13	17	9	11	4	9	7	10	14	10	4	8	9	1	7	3	3	1	9	2	2	0	3	0	2	3	
COMP V	1	7	5	6	6	3	6	2	6	3	4	3	4	1	2	3	0	5	2	2	3	7	3	2	4	2	2	2	1	
COMP V	2	6	8	5	10	6	8	5	1	3	0	2	4	0	0	1	0	0	2	1	0	1	1	1	0	0	0	0	0	
COMP V	3	12	11	13	6	6	7	3	6	3	5	6	2	4	3	3	2	3	4	5	2	3	3	3	2	1	1	0	2	
COMP V	4	10	8	8	11	12	6	3	2	3	4	3	4	2	0	1	0	4	0	0	0	1	2	1	0	1	0	1	3	
COMP V	5	8	4	3	5	2	3	1	0	3	0	2	4	0	0	0	0	1	0	0	0	1	1	2	1	0	0	0	4	

TABLE E.4. (contd)

Sediment Treatment	Replicate	<i>M. nasuta</i> Siphons Exposed Test Days 1 through 28																											
		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	28
COMP VI	1	9	4	6	9	5	4	2	5	0	2	1	0	1	0	0	3	7	0	2	0	0	3	1	1	0	0	1	0
COMP VI	2	16	5	4	6	6	6	2	2	3	2	5	6	2	5	2	2	4	1	1	1	2	4	1	1	1	0	1	0
COMP VI	3	3	4	7	8	4	4	0	1	2	1	2	4	2	0	0	0	4	2	0	0	2	2	1	0	0	0	0	0
COMP VI	4	14	9	4	3	0	1	1	1	4	3	4	4	1	5	2	2	1	1	0	0	1	2	0	0	0	0	0	0
COMP VI	5	10	6	5	6	3	5	2	2	2	1	4	3	2	1	2	2	2	0	0	0	0	1	0	0	0	1	0	0
R-AC	1	8	10	6	11	4	4	7	3	3	4	7	3	5	0	2	1	4	2	1	0	0	5	1	7	0	0	1	4
R-AC	2	28	13	11	10	6	9	2	8	8	3	9	2	4	1	4	6	3	4	3	0	0	2	0	0	0	0	0	0
R-AC	3	10	4	6	9	5	6	2	2	2	7	7	2	6	2	3	3	2	7	0	0	0	2	0	0	0	1	0	0
R-AC	4	4	4	3	8	7	8	8	5	5	5	6	5	1	1	1	4	1	2	0	1	2	2	0	0	0	0	0	0
R-AC	5	8	7	11	13	9	5	2	2	1	1	3	4	2	0	3	6	1	2	3	1	0	1	2	0	0	0	0	0
R-AM	1	9	7	6	6	5	5	6	9	9	15	12	15	12	9	6	5	11	10	7	6	14	9	5	6	2	2	1	5
R-AM	2	5	8	3	9	8	12	13	8	8	12	12	13	12	10	7	11	5	5	6	4	4	6	5	7	4	2	4	3
R-AM	3	1	0	7	1	1	6	5	5	3	2	13	4	1	4	2	2	3	3	2	0	1	3	2	1	0	0	0	2
R-AM	4	20	2	4	7	4	7	3	6	2	3	6	6	7	4	4	1	0	1	1	0	0	2	1	0	0	5	1	4
R-AM	5	9	7	9	8	6	7	3	3	8	4	12	6	5	7	4	2	5	3	3	2	4	6	4	4	1	1	0	2
R-BF	1	14	14	5	9	6	8	3	2	1	2	2	4	3	1	4	4	5	0	1	1	0	1	1	0	0	0	0	0
R-BF	2	4	5	3	4	1	2	1	0	2	4	2	2	0	0	0	1	2	0	0	0	0	2	0	0	0	0	1	0
R-BF	3	10	0	1	11	1	3	0	0	0	1	2	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
R-BF	4	5	2	1	2	1	3	1	1	2	3	2	1	0	0	1	1	2	1	2	0	3	2	1	2	0	1	3	4
R-BF	5	2	0	1	2	0	3	1	1	2	2	3	3	3	0	1	0	6	1	0	0	0	0	0	1	0	0	0	0
R-OS	1	8	6	7	5	5	6	2	1	2	3	4	8	3	3	5	5	2	5	3	2	1	4	3	1	0	0	0	2
R-OS	2	4	6	3	4	3	3	1	1	0	0	1	2	0	0	0	0	1	0	0	0	0	1	1	0	2	1	0	2
R-OS	3	9	2	3	3	3	6	0	2	2	1	2	3	2	1	2	0	2	0	2	1	1	0	0	0	0	0	0	0
R-OS	4	7	5	2	4	3	3	1	2	2	0	2	1	0	1	1	2	0	0	0	0	3	0	0	0	0	0	0	0
R-OS	5	7	7	2	4	1	2	1	1	0	2	2	3	2	1	1	0	0	0	0	1	1	0	3	0	0	2	0	0
R-PF	1	2	4	6	3	2	3	2	7	2	1	7	6	2	4	2	2	2	5	2	0	0	2	3	1	3	0	0	0
R-PF	2	4	5	1	3	0	1	1	5	0	0	3	1	0	0	1	8	3	0	0	0	0	0	2	0	0	0	0	0
R-PF	3	6	1	11	2	3	6	0	1	0	2	4	6	5	3	1	3	6	1	1	1	4	3	4	2	1	0	0	1
R-PF	4	5	5	3	8	4	4	0	2	2	3	4	4	4	1	1	3	5	2	1	1	4	3	3	0	0	0	0	0
R-PF	5	5	6	1	5	5	6	4	4	6	11	8	4	4	3	2	1	2	2	0	0	0	2	2	0	0	1	1	4
C-SB	1	13	1	1	6	2	3	2	2	3	2	2	2	2	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	6	2	2	5	4	2	0	7	1	0	1	0	0	0	1	2	2	1	1	1	0	0	1	0	0	0	0	0
C-SB	3	2	2	0	4	4	2	1	0	1	5	1	3	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0
C-SB	4	4	3	3	5	2	3	2	2	4	5	5	2	2	0	1	2	5	2	3	3	2	3	2	4	0	1	1	3
C-SB	5	2	4	3	4	2	1	0	0	1	1	2	1	2	0	0	3	0	0	0	0	0	1	1	0	0	0	1	0

TABLE E.4. (contd)

Sediment		<i>M. nasuta</i> Siphons Exposed Test Days 1 through 28																											
Treatment	Replicate	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	28
C-NE	1	1	2	3	2	1	4	3	1	2	0	1	3	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	
C-NE	2	5	8	6	10	6	9	7	12	10	10	10	8	11	5	7	3	11	4	2	6	3	0	0	0	1	1	3	2
C-NE	3	1	3	7	9	2	8	4	3	5	3	7	8	2	4	4	1	3	4	6	1	6	3	3	4	3	2	0	2
C-NE	4	4	0	8	2	5	4	5	3	7	6	6	7	0	6	8	4	2	3	6	5	4	4	0	2	4	5	3	1
C-NE	5	4	3	6	6	7	7	7	7	5	7	12	11	4	3	3	3	5	7	5	1	8	8	3	3	2	2	2	2

(a) T Too turbid to make accurate observation.

TABLE E.5. Daily Observations of *M. nasuta* Dead and Removed During 28-Day Solid-Phase Test, Richmond Harbor Program

Sediment		<i>M. nasuta</i> Dead and Removed Test Days 1 through 28																											
Treatment	Replicate	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	28
COMP I	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	0	0	0	0
COMP I	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 I	3	0	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	0
COMP I	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	1	0	0
COMP I	5	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	0
COMP II	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
COMP II	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	1
COMP II	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
COMP II	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
COMP II	5	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	0	0
COMP III	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 III	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
COMP III	3	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 III	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
COMP III	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0
TC-5 Upper Comp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
TC-5 Upper Comp	2	0	0	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	1
TC-5 Upper Comp	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	1
TC-5 Upper Comp	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	1	1	0
TC-5 Upper Comp	5	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	T ^(a)	1	0	0	0	0	0
COMP IV	2	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
COMP IV	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0
COMP IV	4	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
COMP IV	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0
COMP V	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 V	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	1	0	0	0
COMP V	3	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	0	1	0
COMP V	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
COMP V	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 E.5. (contd)

Sediment		<i>M. nasuta</i> Dead and Removed Test Days 1 through 28																												
Treatment	Replicate	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	28	
COMP VI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	
COMP VI	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
COMP VI	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	
COMP VI	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	
COMP VI	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	1	
R-AC	1	0	0	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	1	
R-AC	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	
R-AC	3	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	0	0	
R-AC	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	1	0	0	0	
R-AC	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	1	0	0	0	0	3	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	1	0	0	0	
R-AM	3	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	1	0	
R-AM	4	0	0	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	
R-AM	5	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	0	
R-BF	1	0	0	1	2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	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	1	0	0	0	
R-BF	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	
R-BF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	
R-BF	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
R-OS	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	
R-OS	2	0	0	0	0	0	1	0	0	1	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	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
R-OS	4	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	0	0	0	
R-OS	5	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	1	0	1	
R-PF	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	2	0	0	1	
R-PF	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-PF	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	
R-PF	4	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	
R-PF	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	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	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	0	0	0	0	0	1	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	1	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	1	0	0	0	0	1	0	0	0	0	
C-SB	5	0	0	1	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	

TABLE E.5. (contd)

Sediment		<i>M. nasuta</i> Dead and Removed Test Days 1 through 28																											
Treatment	Replicate	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	28
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
C-NE	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	1	0	0	0
C-NE	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0

(a) T Too turbid to make accurate observation.

TABLE E.6. Water Quality Summary for 28-Day *M. nasuta*/*N. caecoides* Solid-Phase Test, Richmond Harbor Program

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)		Flow Rates (ml/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.51	8.51	4.0	NA ^(a)	29.6	33.6	115	135
COMP I	15.1	16.0	7.67	8.27	7.3	8.8	30.0	32.5	116	133
COMP II	14.8	16.3	7.66	8.26	7.0	8.7	30.5	32.5	116	134
COMP III	14.9	16.4	7.67	8.30	7.2	8.9	30.5	33.0	116	133
TC-5 Upper Comp	14.9	15.9	7.60	8.28	5.4	8.9	30.5	32.5	116	140 ^(b)
COMP IV	15.0	16.0	7.67	8.32	7.0	8.6	30.0	32.5	116 ^(b)	132 ^(b)
COMP V	15.0	16.0	7.66	8.30	7.0	8.8	30.0	32.5	112 ^(b)	140 ^(b)
COMP VI	14.9	16.5	7.66	8.27	7.2	8.7	30.0	32.5	116	133
R-AC	14.9	16.4	7.71	8.29	7.0	8.6	30.0	32.5	116	133
R-AM	14.9	15.9	7.69	8.30	6.8	9.0	30.0	32.5	116	132
R-BF	14.9	16.0	7.66	8.29	6.0	8.7	30.0	32.5	116	132
R-OS	15.0	16.2	7.71	8.31	6.8	8.8	30.0	32.5	116	132
R-PF	14.9	16.3	7.59	8.29	7.0	8.9	30.0	32.5	116	133
C-SB	15.0	16.4	7.68	8.33	6.8	8.9	30.0	32.5	116	133
C-NE	14.8	15.9	7.70	8.29	7.2	8.9	30.0	32.5	116	144 ^(b)

(a) NA Not applicable.

(b) Data point out of range.

TABLE E.7. Test Results for 28-Day *N. caecoides* Solid-Phase Test,
Richmond Harbor Program

Sediment Treatment	Replicate	<i>N. caecoides</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
COMP I	1	34	6	0.89
COMP I	2	38	2	
COMP I	3	40	0	
COMP I	4	31	9	
COMP I	5	35	5	
COMP II	1	37	3	0.94
COMP II	2	36	4	
COMP II	3	39	1	
COMP II	4	35	5	
COMP II	5	40	0	
COMP III	1	35	5	0.89
COMP III	2	39	1	
COMP III	3	34	6	
COMP III	4	35	5	
COMP III	5	34	6	
TC-5 Upper Comp	1	29	11	0.85
TC-5 Upper Comp	2	32	8	
TC-5 Upper Comp	3	36	4	
TC-5 Upper Comp	4	36	4	
TC-5 Upper Comp	5	37	3	
COMP IV	1	34	6	0.77
COMP IV	2	32	8	
COMP IV	3	30	10	
COMP IV	4	28	12	
COMP IV	5	30	10	
COMP V	1	33	7	0.91
COMP V	2	37	3	
COMP V	3	36	4	
COMP V	4	38	2	
COMP V	5	37	3	
COMP VI	1	36	4	0.87
COMP VI	2	33	7	
COMP VI	3	35	5	
COMP VI	4	37	3	
COMP VI	5	32	8	

TABLE E.7. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
R-AC	1	37	3	0.92
R-AC	2	38	2	
R-AC	3	33	7	
R-AC	4	38	2	
R-AC	5	38	2	
R-AM	1	37	3	0.95
R-AM	2	40	0	
R-AM	3	40	0	
R-AM	4	35	5	
R-AM	5	37	3	
R-BF	1	34	6	0.83
R-BF	2	30	10	
R-BF	3	34	6	
R-BF	4	30	10	
R-BF	5	37	3	
R-OS	1	39	1	0.98
R-OS	2	38	2	
R-OS	3	40	0	
R-OS	4	39	1	
R-OS	5	39	1	
R-PF	1	38	2	0.98
R-PF	2	40	0	
R-PF	3	39	1	
R-PF	4	40	0	
R-PF	5	38	2	
C-SB	1	38	2	0.95
C-SB	2	39	1	
C-SB	3	37	3	
C-SB	4	40	0	
C-SB	5	36	4	
C-NE	1	38	2	0.95
C-NE	2	38	2	
C-NE	3	38	2	
C-NE	4	39	1	
C-NE	5	37	3	

(a) Survival based on initial exposure of 40 individuals per replicate.

TABLE E.8. Rank Order Based on Mean Proportion Surviving 28-Day *N. caecoides* Solid-Phase Test, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP IV	0.77
R-BF	0.83
TC-5 Upper Comp	0.85
COMP VI	0.87
COMP III	0.89
COMP I	0.89
COMP V	0.91
R-AC	0.92
COMP II	0.94
R-AM	0.95
C-NE	0.95
C-SB	0.95
R-PF	0.98
R-OS	0.98

TABLE E.9. Daily Observations of *N. caecoides* on Sediment Surface During 28-Day Solid-Phase Test, Richmond Harbor Program

Sediment		<i>N. caecoides</i> on Sediment Test Days 1 through 28																											
Treatment	Replicate	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	28
COMP I	1	0	2	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
COMP I	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 I	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 I	4	0	3	3	3	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	1	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
COMP II	1	1	1	1	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP II	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 II	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 II	4	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
COMP II	5	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 III	1	1	2	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	2	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP III	3	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	0	0
COMP III	4	0	3	4	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
COMP III	5	1	2	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
TC-5 Upper Comp	1	2	3	0	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
TC-5 Upper Comp	2	5	2	5	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	3	1	2	2	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
TC-5 Upper Comp	4	2	3	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	5	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T ^(a)	0	0	0	0	0	0
COMP IV	2	2	1	2	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
COMP IV	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0
COMP IV	4	0	1	1	1	2	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0
COMP V	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	2	0	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 V	3	0	1	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	1	1	1	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	2	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP VI	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0
COMP VI	2	0	2	4	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
COMP VI	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 VI	4	1	1	1	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
COMP VI	5	0	2	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

TABLE E.9. (contd)

Sediment Treatment	Replicate	<i>N. caecoides</i> on Sediment Test Days 1 through 28																											
		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	28
R-AC	1	3	1	0	1	1	0	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0
R-AC	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-AC	3	0	2	3	0	0	0	0	0	T	T	T	0	T	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0
R-AC	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-AC	5	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	0	0	0
R-AM	1	3	0	1	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
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	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-AM	4	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	0	0	0
R-AM	5	0	1	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	1	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
R-BF	2	3	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-BF	3	0	2	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
R-BF	4	1	2	1	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
R-BF	5	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
R-OS	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-OS	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
R-OS	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
R-OS	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-OS	5	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
R-PF	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
R-PF	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-PF	3	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
R-PF	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
R-PF	5	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	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	0	0	0	0	0	0
C-SB	2	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
C-SB	3	0	1	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
C-SB	4	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
C-SB	5	1	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

TABLE E.9. (contd)

Sediment		<i>N. caecoides</i> on Sediment Test Days 1 through 28																											
Treatment	Replicate	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	28
C-NE	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
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	0	0	0	0	0	0
C-NE	3	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	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	2	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

(a) T Too turbid to make accurate observation.

TABLE E.10. Daily Observations of *N. caecoides* Dead and Removed During 28-Day Solid-Phase Test, Richmond Harbor Program

Sediment		<i>N. caecoides</i> Dead and Removed During Test Days 1 through 28																											
Treatment	Replicate	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	28
COMP I	1	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
COMP I	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 I	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 I	4	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP I	5	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	0	0
COMP II	1	0	0	1	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
COMP II	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 II	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 II	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 II	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 III	1	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	0
COMP III	2	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	0	0
COMP III	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 III	4	0	0	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
COMP III	5	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
TC-5 Upper Comp	1	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
TC-5 Upper Comp	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
TC-5 Upper Comp	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
TC-5 Upper Comp	4	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
TC-5 Upper Comp	5	0	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
COMP IV	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T ^(a)	0	0	0	0	0	0
COMP IV	2	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
COMP IV	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0
COMP IV	4	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMP IV	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0
COMP V	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
COMP V	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 V	3	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	0	0
COMP V	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 V	5	0	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
COMP VI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0	0
COMP VI	2	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
COMP VI	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 VI	4	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 VI	5	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

TABLE E.10. (contd)

Sediment		<i>N. caecoides</i> Dead and Removed During Test Days 1 through 28																											
Treatment	Replicate	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	28
R-AC	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	0
R-AC	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-AC	3	0	0	3	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R-AC	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-AC	5	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
R-AM	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	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	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-AM	4	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
R-AM	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-BF	1	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
R-BF	2	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	0	0
R-BF	3	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
R-BF	4	0	1	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
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
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	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
R-OS	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
R-OS	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-OS	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-PF	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
R-PF	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-PF	3	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
R-PF	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-PF	5	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
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	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	0	0	0	0	0	0	0	0	0	0	0
C-SB	3	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	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	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

TABLE E.10. (contd)

Sediment		<i>N. caecoides</i> Dead and Removed During Test Days 1 through 28																											
Treatment	Replicate	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	28
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
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	0	0	0	0	0	0
C-NE	3	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
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	1	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

(a) T Too turbid to make accurate observation.

APPENDIX F

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

TABLE F.1. Test Results for 10-Day *R. abronius* Solid-Phase Static Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>R. abronius</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
COMP I	1	13	7	0.77
COMP I	2	14	6	
COMP I	3	17	3	
COMP I	4	19	1	
COMP I	5	14	6	
COMP II	1	19	1	0.80
COMP II	2	14	6	
COMP II	3	16	4	
COMP II	4	18	2	
COMP II	5	13	7	
COMP III	1	9	11	0.58
COMP III	2	17	3	
COMP III	3	13	7	
COMP III	4	12	8	
COMP III	5	7	13	
TC-5 Upper Comp	1	18	2	0.82
TC-5 Upper Comp	2	17	3	
TC-5 Upper Comp	3	13	7	
TC-5 Upper Comp	4	15	5	
TC-5 Upper Comp	5	19	1	
COMP IV	1	16	4	0.76
COMP IV	2	15	5	
COMP IV	3	18	2	
COMP IV	4	14	6	
COMP IV	5	13	7	
COMP V	1	18	2	0.87
COMP V	2	18	2	
COMP V	3	18	2	
COMP V	4	17	3	
COMP V	5	16	4	
COMP VI	1	16	4	0.83
COMP VI	2	16	4	
COMP VI	3	16	4	
COMP VI	4	16	4	
COMP VI	5	19	1	

TABLE F.1. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>R. abronius</i></u>		<u>Mean Proportion Surviving</u>
		<u>Live^(a)</u>	<u>Dead or Missing</u>	
R-AC	1	12	8	0.75
R-AC	2	14	6	
R-AC	3	17	3	
R-AC	4	17	3	
R-AC	5	15	5	
R-AM	1	19	1	0.90
R-AM	2	20	0	
R-AM	3	16	4	
R-AM	4	17	3	
R-AM	5	18	2	
R-BF	1	18	2	0.88
R-BF	2	19	1	
R-BF	3	16	4	
R-BF	4	17	3	
R-BF	5	18	2	
R-OS	1	15	5	0.66
R-OS	2	18	2	
R-OS	3	15	5	
R-OS	4	4	16	
R-OS	5	14	6	
R-PF	1	18	2	0.82
R-PF	2	19	1	
R-PF	3	14	6	
R-PF	4	16	4	
R-PF	5	15	5	
C-SB	1	18	2	0.88
C-SB	2	19	1	
C-SB	3	14	6	
C-SB	4	18	2	
C-SB	5	19	1	
C-WB	1	20	0	1.00
C-WB	2	20	0	
C-WB	3	20	0	
C-WB	4	20	0	
C-WB	5	20	0	

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

TABLE F.2. Rank Order Based on Mean Proportion Surviving 10-Day
R. abronius Solid-Phase Static Test, Richmond Harbor
 Program

<u>Sediment Treatment</u>	<u>Mean Proportion Surviving</u>
COMP III	0.58
R-OS	0.66
R-AC	0.75
COMP IV	0.76
COMP I	0.77
COMP II	0.80
TC-5 Upper Comp	0.82
R-PF	0.82
COMP VI	0.83
COMP V	0.87
R-BF	0.88
C-SB	0.88
R-AM	0.90
C-WB	1.00

TABLE F.3. Water Quality Summary for 10-Day *R. abronius* Solid-Phase Static Test, Richmond Harbor Program

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	7.64	8.64	4.0	NA ^(a)	29.8	33.8
CDMP I	14.9	15.4	7.86	8.34	7.3	7.9	31.5	32.5
CDMP II	14.9	15.4	7.81	8.30	7.2	7.9	31.5	32.5
CDMP III	14.8	15.4	7.78	8.26	7.3	8.0	30.0	32.0
TC-5 Upper Comp	14.9	15.4	8.00	8.46	7.3	7.9	31.0	32.0
CDMP IV	14.9	15.6	7.72	8.25	7.2	8.0	30.0	32.0
CDMP V	14.8	15.4	7.67	8.33	7.1	7.9	31.5	33.0
CDMP VI	14.8	15.6	7.77	8.33	7.3	7.9	31.5	32.5
R-AC	14.8	15.4	7.73	8.24	7.4	8.0	32.0	33.0
R-AH	14.8	15.4	7.73	8.21	7.4	8.1	31.5	32.5
R-BF	15.0	15.4	7.73	8.23	7.1	7.9	31.5	32.5
R-OS	14.9	15.5	7.81	8.29	7.3	8.0	32.0	33.0
R-PF	14.8	15.7	7.73	8.19	7.1	8.0	32.0	32.5
C-SB	14.8	15.3	8.01	8.88 ^(b)	7.4	7.9	32.0	32.5
C-WB	14.8	15.5	7.88	8.46	7.0	8.1	31.5	32.5

(a) NA Not applicable.

(b) Data point out of range.

TABLE F.4. Daily Observations of *R. abronius* on Sediment Surface During 10-Day Solid-Phase Static Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>R. abronius</i> on Sediment for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
COMP I	1	1	1	1	0	1	0	0	0	0	0
COMP I	2	0	0	0	0	0	0	2	2	1	1
COMP I	3	0	0	0	0	0	0	0	0	0	0
COMP I	4	0	0	0	0	0	0	0	0	0	0
COMP I	5	0	0	2	2	3	3	2	0	0	0
COMP II	1	0	0	0	0	0	1	1	1	1	0
COMP II	2	1	2	1	0	1	0	0	1	1	1
COMP II	3	0	0	0	0	0	1	1	1	1	1
COMP II	4	0	0	0	0	0	0	0	0	0	0
COMP II	5	0	0	0	0	0	0	0	0	0	0
COMP III	1	0	0	0	0	0	0	0	0	0	0
COMP III	2	0	0	0	0	0	0	0	0	0	0
COMP III	3	1	0	1	1	0	1	1	1	1	1
COMP III	4	1	0	1	1	1	1	1	1	1	0
COMP III	5	0	0	0	0	2	0	0	1	0	1
TC-5 Upper Comp	1	1	0	0	0	0	1	1	1	2	2
TC-5 Upper Comp	2	0	0	0	0	0	0	0	0	0	0
TC-5 Upper Comp	3	0	1	0	1	1	0	1	0	0	1
TC-5 Upper Comp	4	0	0	0	0	0	0	0	0	0	1
TC-5 Upper Comp	5	0	0	0	0	0	0	0	0	0	0
COMP IV	1	0	0	0	0	0	0	0	0	0	0
COMP IV	2	0	0	0	0	0	1	0	0	0	0
COMP IV	3	0	0	0	0	1	0	0	0	0	2
COMP IV	4	0	0	0	0	0	1	0	1	0	0
COMP IV	5	0	0	0	0	0	0	0	2	0	0
COMP V	1	0	1	0	0	0	0	0	0	0	0
COMP V	2	0	0	0	2	1	1	0	0	0	0
COMP V	3	0	0	0	0	0	0	0	0	0	0
COMP V	4	0	0	0	0	0	0	0	0	0	0
COMP V	5	0	0	0	0	0	0	0	0	0	1
COMP VI	1	0	0	2	1	1	2	0	0	0	0
COMP VI	2	1	0	0	0	0	0	0	0	0	0
COMP VI	3	0	0	0	0	0	0	0	0	0	0
COMP VI	4	0	0	1	1	1	2	1	1	0	0
COMP VI	5	0	0	0	0	0	0	0	0	0	0

TABLE F.4. (contd)

Sediment Treatment	Replicate	<i>R. abronius</i> on Sediment for Test Days 1 through 10									
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
R-AC	1	0	0	0	1	2	3	3	3	2	4
R-AC	2	0	0	0	1	1	1	1	1	0	0
R-AC	3	0	0	1	0	2	1	0	1	0	0
R-AC	4	0	0	0	0	1	0	1	0	0	0
R-AC	5	0	0	1	0	0	0	0	0	0	0
R-AM	1	0	2	2	1	1	1	1	1	1	1
R-AM	2	0	0	0	0	0	0	1	1	1	1
R-AM	3	0	0	0	0	0	0	2	3	3	4
R-AM	4	1	2	2	2	3	3	3	3	2	2
R-AM	5	0	0	0	0	0	0	0	1	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	2	1	0	0	0	0	0	0	0
R-BF	4	1	0	0	1	1	1	1	1	1	0
R-BF	5	0	0	0	0	0	0	0	0	0	0
R-OS	1	1	1	1	1	1	0	1	0	0	0
R-OS	2	0	0	0	1	0	0	0	1	1	1
R-OS	3	0	0	1	0	0	0	0	0	0	0
R-OS	4	1	0	2	4	3	5	6	7	7	6
R-OS	5	0	0	0	0	0	0	0	0	0	0
R-PF	1	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	0	0	0
R-PF	3	0	0	0	0	1	1	1	1	1	2
R-PF	4	0	0	2	2	0	0	0	0	0	0
R-PF	5	2	3	3	2	4	3	2	2	2	3
C-SB	1	0	0	0	0	0	0	0	0	0	0
C-SB	2	1	0	0	1	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	1	1	1	0	0	0
C-SB	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	1
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	0	0	0	0	0	0	0	0	0	0

TABLE F.5. Daily Observations of *R. abronius* Floating on Surface During 10-Day Solid Phase Static Test, Richmond Harbor Program

Sediment Treatment	Replicate	<i>R. abronius</i> Floating for Test Days 1 through 10									
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
COMP I	1	0	0	1	0	2	0	0	0	3	3
COMP I	2	2	6	2	2	4	1	0	0	4	1
COMP I	3	1	0	1	3	1	0	1	0	3	2
COMP I	4	2	1	1	4	2	0	1	1	3	3
COMP I	5	0	1	0	2	1	0	0	0	2	1
COMP II	1	0	1	2	2	1	0	1	0	5	3
COMP II	2	0	1	0	2	1	1	0	0	3	4
COMP II	3	1	1	2	4	4	1	0	1	2	4
COMP II	4	0	1	1	1	3	0	0	1	4	3
COMP II	5	0	2	1	3	2	0	0	0	1	4
COMP III	1	0	0	1	0	2	0	0	0	2	1
COMP III	2	0	1	1	0	1	0	0	0	4	4
COMP III	3	0	0	1	1	2	0	0	0	4	4
COMP III	4	0	2	1	2	0	0	0	1	3	3
COMP III	5	0	0	1	1	0	0	0	0	1	0
TC-5 Upper Comp	1	0	1	1	2	1	0	0	0	1	2
TC-5 Upper Comp	2	1	4	4	5	2	0	1	1	3	4
TC-5 Upper Comp	3	0	1	1	1	1	0	1	0	6	3
TC-5 Upper Comp	4	2	3	2	2	1	1	2	1	1	3
TC-5 Upper Comp	5	2	6	2	4	4	0	0	0	4	3
COMP IV	1	0	0	4	1	0	0	0	1	4	4
COMP IV	2	2	0	3	4	4	0	0	0	2	3
COMP IV	3	1	0	0	0	1	0	0	1	6	2
COMP IV	4	1	2	3	4	4	0	0	0	6	1
COMP IV	5	2	2	2	5	4	0	0	0	9	5
COMP V	1	0	1	0	3	0	0	1	2	4	3
COMP V	2	0	2	1	2	2	0	0	0	3	4
COMP V	3	2	3	3	2	3	0	0	0	2	5
COMP V	4	1	1	1	3	2	0	0	0	3	1
COMP V	5	2	0	3	2	2	0	0	0	1	2
COMP VI	1	0	1	0	0	0	0	0	0	1	1
COMP VI	2	0	1	3	2	4	0	0	1	2	1
COMP VI	3	0	0	2	3	5	0	0	0	6	4
COMP VI	4	0	1	0	0	2	0	0	0	1	2
COMP VI	5	0	0	1	2	0	1	0	0	2	2

TABLE F.5. (contd)

Sediment Treatment	Replicate	<i>R. abronius</i> Floating for Test Days 1 through 10									
		1	2	3	4	5	6	7	8	9	10
R-AC	1	0	1	1	0	1	0	0	0	1	3
R-AC	2	1	0	0	0	2	0	0	0	3	1
R-AC	3	0	1	2	3	0	0	0	0	1	2
R-AC	4	1	1	2	1	1	0	0	0	0	0
R-AC	5	0	0	1	2	2	0	0	0	3	3
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	0
R-AM	3	0	1	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	1	1	1	0	1	0	4	1
R-BF	2	0	0	2	1	0	0	0	0	1	2
R-BF	3	0	0	1	0	1	0	0	0	2	0
R-BF	4	0	0	1	0	0	0	1	0	0	1
R-BF	5	1	2	1	2	1	0	0	0	2	3
R-OS	1	0	0	1	0	0	0	0	1	0	0
R-OS	2	0	0	1	0	0	0	0	0	0	0
R-OS	3	0	0	0	0	0	0	0	0	2	1
R-OS	4	1	0	2	2	2	1	3	0	2	1
R-OS	5	0	0	1	0	0	0	0	0	2	1
R-PF	1	0	0	0	0	0	0	0	0	0	0
R-PF	2	0	0	0	0	0	0	0	1	0	0
R-PF	3	1	0	1	0	0	0	0	0	0	0
R-PF	4	0	0	0	1	0	0	0	0	0	0
R-PF	5	0	0	0	1	0	0	0	0	0	0
C-SB	1	1	1	0	0	1	0	0	0	1	0
C-SB	2	0	1	1	2	0	0	0	0	0	0
C-SB	3	0	2	0	0	1	0	0	0	1	1
C-SB	4	0	1	0	2	1	0	0	0	2	1
C-SB	5	2	0	0	1	0	0	0	0	0	2
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	0	0	0	0	0
C-WB	4	0	0	0	0	0	0	0	0	0	0
C-WB	5	0	0	0	0	0	0	0	0	0	0

TABLE F.6. Test Result for 4-Day *R. abronius* Reference Toxicant Test, Richmond Harbor Program

Cadmium Concentration (mg/L)	Replicate	<i>R. abronius</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
0	1	17	3	0.85
0	2	18	2	
0	3	16	4	
0.5	1	14	6	0.72
0.5	2	15	6	
0.5	3	14	6	
1.00	1	12	8	0.48
1.00	2	9	11	
1.00	3	8	12	
2.00	1	6	14	0.17
2.00	2	2	18	
2.00	3	2	18	
4.00	1	0	20	0.02
4.00	2	1	19	
4.00	3	0	20	

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

TABLE F.7. Rank Order Based on Mean Proportion Surviving 4-Day
R. abronius Reference Toxicant Test, Richmond Harbor
 Program

<u>Cadmium Concentration (mg/L)</u>	<u>Mean Proportion Surviving</u>
4.00	0.02
2.00	0.17
1.00	0.48
0.50	0.72
0.00	0.85

TABLE F.8. Water Quality Summary for 4-Day *R. abronius* Reference Toxicant Test, Richmond Harbor Program

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	7.53	8.53	4.0	NA ^(a)	30.2	34.2
0.00	14.9	15.3	7.81	8.24	7.6	7.9	32.0	32.5
0.50	14.9	15.4	7.81	8.20	7.3	8.0	32.0	32.5
1.00	14.9	15.8	7.78	8.18	7.5	7.9	32.0	32.5
2.00	14.8	15.4	7.70	8.14	7.6	8.1	32.0	32.5
4.00	15.0	15.7	7.68	8.03	7.4	8.0	32.0	32.5

(a) NA Not applicable.

TABLE F.9. Daily Observations of *R. abronius* Floating on Surface During 4-Day Reference Toxicant Test, Richmond Harbor Program

Cadmium Concentration (mg/L)	Replicate	<i>R. abronius</i> Test Days 1 through 4			
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
0.00	1	1	0	2	1
0.00	2	0	1	4	3
0.00	3	0	0	0	3
0.50	1	1	1	2	0
0.50	2	1	2	4	1
0.50	3	4	2	2	0
1.00	1	2	1	4	3
1.00	2	0	4	2	0
1.00	3	3	1	0	0
2.00	1	1	0	0	0
2.00	2	2	0	0	0
2.00	3	1	3	0	0
4.00	1	2	0	0	0
4.00	2	2	2	0	0
4.00	3	2	1	0	0

APPENDIX G

BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE-PHASE TEST AND
96-HOUR REFERENCE TOXICANT TEST FOR *CITHARICHTHYS sigmaeus*

TABLE G.1. Test Results for 96-Hour *C. stigmaeus* Suspended-Particulate-Phase Test, Richmond Harbor Program

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP I	0	1	9	1	0.95
COMP I	0	2	10	0	
COMP I	0	3	10	0	
COMP I	0	4	9	1	
COMP I	10	1	9	1	0.98
COMP I	10	2	10	0	
COMP I	10	3	10	0	
COMP I	10	4	10	0	
COMP I	50	1	9	1	0.95
COMP I	50	2	9	1	
COMP I	50	3	10	0	
COMP I	50	4	10	0	
COMP I	100	1	10	0	0.98
COMP I	100	2	10	0	
COMP I	100	3	10	0	
COMP I	100	4	9	1	
COMP II	0	1	10	0	0.95
COMP II	0	2	10	0	
COMP II	0	3	10	0	
COMP II	0	4	8	2	
COMP II	10	1	9	1	0.95
COMP II	10	2	10	0	
COMP II	10	3	10	0	
COMP II	10	4	9	1	
COMP II	50	1	10	0	0.93
COMP II	50	2	9	1	
COMP II	50	3	10	0	
COMP II	50	4	8	2	
COMP II	100	1	10	0	0.93
COMP II	100	2	9	1	
COMP II	100	3	9	1	
COMP II	100	4	9	1	

TABLE G.1. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP III	0	1	10	0	0.93
COMP III	0	2	9	1	
COMP III	0	3	9	1	
COMP III	0	4	9	1	
COMP III	10	1	9	1	0.98
COMP III	10	2	10	0	
COMP III	10	3	10	0	
COMP III	10	4	10	0	
COMP III	50	1	10	0	0.95
COMP III	50	2	10	0	
COMP III	50	3	9	1	
COMP III	50	4	9	1	
COMP III	100	1	10	0	1.00
COMP III	100	2	10	0	
COMP III	100	3	10	0	
COMP III	100	4	10	0	
TC-5 Upper Comp	0	1	10	0	1.00
TC-5 Upper Comp	0	2	10	0	
TC-5 Upper Comp	0	3	10	0	
TC-5 Upper Comp	0	4	10	0	
TC-5 Upper Comp	10	1	10	0	1.00
TC-5 Upper Comp	10	2	10	0	
TC-5 Upper Comp	10	3	10	0	
TC-5 Upper Comp	10	4	10	0	
TC-5 Upper Comp	50	1	8	2	0.90
TC-5 Upper Comp	50	2	8	2	
TC-5 Upper Comp	50	3	10	0	
TC-5 Upper Comp	50	4	10	0	
TC-5 Upper Comp	100	1	4	6	0.23
TC-5 Upper Comp	100	2	3	7	
TC-5 Upper Comp	100	3	1	9	
TC-5 Upper Comp	100	4	1	9	

TABLE G.1. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP IV	0	1	9	1	0.98
COMP IV	0	2	10	0	
COMP IV	0	3	10	0	
COMP IV	0	4	10	0	
COMP IV	10	1	9	1	0.90
COMP IV	10	2	10	0	
COMP IV	10	3	10	0	
COMP IV	10	4	7	3	
COMP IV	50	1	10	0	0.95
COMP IV	50	2	9	1	
COMP IV	50	3	9	1	
COMP IV	50	4	10	0	
COMP IV	100	1	8	2	0.90
COMP IV	100	2	10	0	
COMP IV	100	3	9	1	
COMP IV	100	4	9	1	
COMP V	0	1	10	0	0.98
COMP V	0	2	9	1	
COMP V	0	3	10	0	
COMP V	0	4	10	0	
COMP V	10	1	8	2	0.93
COMP V	10	2	10	0	
COMP V	10	3	9	1	
COMP V	10	4	10	0	
COMP V	50	1	10	0	0.98
COMP V	50	2	9	1	
COMP V	50	3	10	0	
COMP V	50	4	10	0	
COMP V	100	1	8	2	0.93
COMP V	100	2	10	0	
COMP V	100	3	9	1	
COMP V	100	4	10	0	

TABLE G.1. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP VI	0	1	9	1	
COMP VI	0	2	9	1	
COMP VI	0	3	10	0	
COMP VI	0	4	10	0	0.95
COMP VI	10	1	8	2	
COMP VI	10	2	10	0	
COMP VI	10	3	10	0	
COMP VI	10	4	10	0	0.95
COMP VI	50	1	10	0	
COMP VI	50	2	9	1	
COMP VI	50	3	10	0	
COMP VI	50	4	10	0	0.98
COMP VI	100	1	10	0	
COMP VI	100	2	10	0	
COMP VI	100	3	10	0	
COMP VI	100	4	9	1	0.98

(a) Survival based on initial exposure of 10 individuals per replicate.

TABLE G.2. Summary of Mean Proportion Surviving 96-Hour
C. stigmaeus Suspended-Particulate-Phase Test,
Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Concentration (%)</u>	<u>Mean Proportion Surviving</u>
COMP I	0	0.95
COMP I	10	0.98
COMP I	50	0.95
COMP I	100	0.98
COMP II	0	0.95
COMP II	10	0.95
COMP II	50	0.93
COMP II	100	0.93
COMP III	0	0.93
COMP III	10	0.98
COMP III	50	0.95
COMP III	100	1.00
COMP IV	0	0.98
COMP IV	10	0.90
COMP IV	50	0.95
COMP IV	100	0.90
COMP V	0	0.98
COMP V	10	0.93
COMP V	50	0.98
COMP V	100	0.93
COMP VI	0	0.95
COMP VI	10	0.95
COMP VI	50	0.98
COMP VI	100	0.98
TC-5 Upper Comp	0	1.00
TC-5 Upper Comp	10	1.00
TC-5 Upper Comp	50	0.90
TC-5 Upper Comp	100	0.23

TABLE G.3. Water Quality Summary for 96-Hour *C. stigmaeus* Suspended-Particulate-Phase Test, Richmond Harbor Program

Sediment Treatment	Concentration (%)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		13.0	17.0	7.57	8.57	4.0	NA ^(a)	30.0	34.0
COMP I	0	15.1	16.5	7.98	8.17	7.2	8.6	32.0	32.0
COMP I	10	15.0	16.8	7.94	8.13	6.8	8.2	32.0	32.0
COMP I	50	14.8	16.1	7.85	8.21	7.2	8.0	32.0	33.0
COMP I	100	15.0	16.4	7.78	8.32	7.0	8.5	32.0	32.0
COMP II	0	0.0	16.3	7.93	8.11	7.0	8.1	32.0	33.0
COMP II	10	14.8	15.8	7.90	8.15	7.2	8.2	32.0	32.0
COMP II	50	14.9	16.1	7.86	8.20	6.6	8.1	32.0	33.0
COMP II	100	15.1	16.0	7.78	8.29	7.2	8.2	32.0	32.0
COMP III	0	15.0	18.3	7.91	8.16	6.6	8.8	32.0	32.0
COMP III	10	14.8	18.1	7.89	8.20	6.4	8.7	32.0	32.0
COMP III	50	14.6	17.8	7.97	8.24	7.1	8.5	32.0	32.0
COMP III	100	14.8	17.7	7.88	8.24	6.3	8.7	32.0	32.0
TC-5 Upper Comp	0	14.0	15.5	7.92	8.20	7.0	9.0	32.0	32.0
TC-5 Upper Comp	10	14.0	15.4	7.93	8.17	7.3	9.0	32.0	32.0
TC-5 Upper Comp	50	14.2	15.6	8.04	8.27	7.4	9.2	32.0	32.0
TC-5 Upper Comp	100	14.9	15.8	8.12	8.47	7.5	9.3	31.0	32.0
COMP IV	0	14.2	15.7	7.91	8.13	7.2	9.1	32.0	32.0
COMP IV	10	14.2	15.5	7.93	8.13	7.3	9.2	32.0	33.0
COMP IV	50	14.8	15.6	7.91	8.14	6.9	9.2	32.0	32.0
COMP IV	100	14.9	16.9	8.04	8.21	7.4	9.2	31.0	32.0
COMP V	0	14.5	15.5	7.86	8.13	7.3	9.0	32.0	32.0
COMP V	10	14.4	15.6	7.97	8.40	7.3	9.2	32.0	32.0
COMP V	50	14.6	15.5	7.97	8.18	7.1	9.8	32.0	32.0
COMP V	100	14.9	15.8	7.80	8.30	6.6	9.7	32.0	32.0
COMP VI	0	14.4	15.6	7.86	8.14	6.9	9.2	32.0	32.0
COMP VI	10	14.4	15.5	7.93	8.15	7.3	9.0	32.0	32.0
COMP VI	50	14.2	15.6	7.86	8.16	7.0	9.0	32.0	32.0
COMP VI	100	14.4	15.7	7.92	8.28	7.3	8.9	32.0	32.0

(a) NA Not applicable.

TABLE G.4. Daily Observations of *C. stigmaeus* During 96-Hour Suspended-Particulate-Phase Test, Richmond Harbor Program

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i> Live						<i>C. stigmaeus</i> Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP I	0	1	10	10	10	10	9	9	0	0	0	0	1	0
COMP I	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0	4	10	10	10	9	9	9	0	0	0	1	0	0
COMP I	10	1	10	10	10	10	10	9	0	0	0	0	0	1
COMP I	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50	1	10	10	10	9	9	9	0	0	0	1	0	0
COMP I	50	2	10	10	10	10	10	9	0	0	0	0	0	1
COMP I	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	4	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	0	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	4	10	10	9	8	8	8	0	0	1	1	0	0
COMP II	10	1	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10	4	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	50	2	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	50	4	10	10	10	9	9	8	0	0	0	1	0	1
COMP II	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	100	2	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	100	3	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	100	4	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	0	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0	2	10	10	10	10	10	9	0	0	0	0	0	1
COMP III	0	3	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	0	4	10	10	10	10	10	9	0	0	0	0	0	1
COMP III	10	1	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50	3	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	50	4	10	10	10	9	9	9	0	0	0	1	0	0

TABLE G.4. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i> Live						<i>C. stigmaeus</i> Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP III	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	1	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	2	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	1	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	2	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	50	1	10	10	10	10	9	8	0	0	0	0	1	1
TC-5 Upper Comp	50	2	10	10	10	8	8	8	0	0	0	2	0	0
TC-5 Upper Comp	50	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	50	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	100	1	10	10	4	4	4	4	0	0	6	0	0	0
TC-5 Upper Comp	100	2	10	10	4	3	3	3	0	0	6	1	0	0
TC-5 Upper Comp	100	3	10	10	1	1	1	1	0	0	9	0	0	0
TC-5 Upper Comp	100	4	10	10	2	2	1	1	0	0	8	0	1	0
COMP IV	0	1	10	10	10	9	9	9	0	0	0	1	0	0
COMP IV	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	1	10	10	10	10	9	9	0	0	0	0	1	0
COMP IV	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	4	10	10	9	9	8	7	0	0	1	0	1	1
COMP IV	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	50	2	10	10	9	9	9	9	0	0	1	0	0	0
COMP IV	50	3	10	10	10	10	9	9	0	0	0	0	1	0
COMP IV	50	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100	1	10	9	9	8	8	8	0	1	0	1	0	0
COMP IV	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100	3	10	10	9	9	9	9	0	0	1	0	0	0
COMP IV	100	4	10	10	10	10	9	9	0	0	0	0	1	0
COMP V	0	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0	2	10	10	9	9	9	9	0	0	1	0	0	0
COMP V	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	10	1	10	10	10	9	8	8	0	0	0	1	1	0
COMP V	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	10	3	10	10	10	9	9	9	0	0	0	1	0	0
COMP V	10	4	10	10	10	10	10	10	0	0	0	0	0	0

TABLE G.4. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>C. stigmaeus</i> Live						<i>C. stigmaeus</i> Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP V	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50	2	10	10	10	10	9	9	0	0	0	0	1	0
COMP V	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	100	1	10	10	10	9	9	8	0	0	0	1	0	1
COMP V	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	100	3	10	10	9	9	9	9	0	0	1	0	0	0
COMP V	100	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0	1	10	10	10	10	10	9	0	0	0	0	0	1
COMP VI	0	2	10	10	10	10	9	9	0	0	0	0	1	0
COMP VI	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10	1	10	10	9	9	8	8	0	0	1	0	1	0
COMP VI	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	50	2	10	10	10	10	9	9	0	0	0	0	0	0
COMP VI	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	50	4	10	10	10	10	9	10	0	0	0	0	0	0
COMP VI	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	4	10	10	9	9	9	9	0	0	1	0	0	0

TABLE G.5. Survival Data for 96-Hour *C. stigmaeus* Reference Toxicant Test, Richmond Harbor Program

Copper Concentration (mg/L)	Replicate	<i>C. stigmaeus</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
0	1	10	0	1.00
0	2	10	0	
0	3	10	0	
0	4	10	0	
0.77	1	6	4	0.77
0.77	2	8	2	
0.77	3	9	1	
0.96	1	9	1	0.77
0.96	2	7	3	
0.96	3	7	3	
1.2	1	9	1	0.53
1.2	2	4	6	
1.2	3	3	7	
1.5	1	0	10	0.27
1.5	2	0	10	
1.5	3	8	2	

(a) Survival based on initial exposure of 10 individuals per replicate.

TABLE G.6. Rank Order Based on Mean Proportion Surviving 96-Hour
C. stigmaeus Reference Toxicant Test, Richmond Harbor
 Program

<u>Copper Concentration (mg/L)</u>	<u>Mean Proportion Surviving</u>
1.5	0.27
1.2	0.53
0.77	0.77
0.96	0.77
0	1.00

TABLE G.7. Water Quality Summary for 96-Hour *C. stigmaeus* Reference Toxicant Test, Richmond Harbor Program

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	7.45	8.45	4.0	NA ^(a)	30.1	34.1
0	14.0	15.5	7.92	8.20	7.0	9.0	32.0	32.0
0.77	14.0	15.5	7.76	8.21	7.1	9.2	32.0	32.5
0.96	14.0	15.6	7.71	8.18	7.1	9.2	32.0	32.5
1.2	14.0	15.6	7.65	8.19	7.4	9.4	32.0	33.0
1.5	14.1	15.5	7.55	8.24	7.3	9.3	32.0	33.0

(a) NA Not applicable.

TABLE G.8. Daily Observations of *C. stigmaeus* During 96-Hour Reference Toxicant Test, Richmond Harbor Program

Copper Concentration (mg/L)	Replicate	<i>C. stigmaeus</i> Live						<i>C. stigmaeus</i> Dead					
		0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
0	1	10	10	10	10	10	10	0	0	0	0	0	0
0	2	10	10	10	10	10	10	0	0	0	0	0	0
0	3	10	10	10	10	10	10	0	0	0	0	0	0
0	4	10	10	10	10	10	10	0	0	0	0	0	0
0.77	1	10	10	10	10	9	6	0	0	0	0	1	3
0.77	2	10	10	10	10	9	8	0	0	0	0	1	1
0.77	3	10	10	10	10	10	9	0	0	0	0	0	1
0.96	1	10	10	10	10	10	9	0	0	0	0	0	1
0.96	2	10	10	10	10	9	7	0	0	0	0	1	2
0.96	3	10	10	10	9	9	7	0	0	0	1	1	2
1.2	1	10	10	10	10	10	9	0	0	0	0	0	1
1.2	2	10	10	10	10	9	4	0	0	0	0	1	5
1.2	3	10	10	10	10	6	3	0	0	0	0	4	3
1.5	1	10	10	10	2	1	0	0	0	0	8	0	1
1.5	2	10	10	10	8	2	0	0	0	0	2	6	2
1.5	3	10	10	10	10	9	8	0	0	0	0	1	1

APPENDIX H

BIOASSAY RESULTS FOR 96-HOUR SUSPENDED-PARTICULATE-PHASE TEST AND
96-HOUR REFERENCE TOXICANT TEST FOR *HOLMESIMYSIS sculpta*

TABLE H.1. Test Results for 96-Hour *H. sculpta* Suspended-Particulate-Phase Test, Richmond Harbor Program

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpta</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP I	0	1	10	0	1.00
COMP I	0	2	10	0	
COMP I	0	3	10	0	
COMP I	0	4	10	0	
COMP I	10	1	6	4	0.90
COMP I	10	2	10	0	
COMP I	10	3	10	0	
COMP I	10	4	10	0	
COMP I	50	1	10	0	1.00
COMP I	50	2	10	0	
COMP I	50	3	10	0	
COMP I	50	4	10	0	
COMP I	100	1	10	0	0.98
COMP I	100	2	10	0	
COMP I	100	3	9	1	
COMP I	100	4	10	0	
COMP II	0	1	10	0	1.00
COMP II	0	2	10	0	
COMP II	0	3	10	0	
COMP II	0	4	10	0	
COMP II	10	1	10	0	1.00
COMP II	10	2	10	0	
COMP II	10	3	10	0	
COMP II	10	4	10	0	
COMP II	50	1	5	5	0.75
COMP II	50	2	9	1	
COMP II	50	3	6	4	
COMP II	50	4	10	0	
COMP II	100	1	9	1	0.95
COMP II	100	2	9	1	
COMP II	100	3	10	0	
COMP II	100	4	10	0	

TABLE H.1. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpta</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP III	0	1	10	0	1.00
COMP III	0	2	10	0	
COMP III	0	3	10	0	
COMP III	0	4	10	0	
COMP III	10	1	10	0	0.95
COMP III	10	2	9	1	
COMP III	10	3	10	0	
COMP III	10	4	9	1	
COMP III	50	1	8	2	0.90
COMP III	50	2	10	0	
COMP III	50	3	9	1	
COMP III	50	4	9	1	
COMP III	100	1	10	0	0.98
COMP III	100	2	10	0	
COMP III	100	3	9	1	
COMP III	100	4	10	0	
TC-5 Upper Comp	0	1	10	0	0.98
TC-5 Upper Comp	0	2	10	0	
TC-5 Upper Comp	0	3	10	0	
TC-5 Upper Comp	0	4	9	1	
TC-5 Upper Comp	10	1	10	0	1.00
TC-5 Upper Comp	10	2	10	0	
TC-5 Upper Comp	10	3	10	0	
TC-5 Upper Comp	10	4	10	0	
TC-5 Upper Comp	50	1	9	1	0.98
TC-5 Upper Comp	50	2	10	0	
TC-5 Upper Comp	50	3	10	0	
TC-5 Upper Comp	50	4	10	0	
TC-5 Upper Comp	100	1	10	0	0.95
TC-5 Upper Comp	100	2	10	0	
TC-5 Upper Comp	100	3	10	0	
TC-5 Upper Comp	100	4	8	2	

TABLE H.1. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpta</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP IV	0	1	7	3	0.93
COMP IV	0	2	10	0	
COMP IV	0	3	10	0	
COMP IV	0	4	10	0	
COMP IV	10	1	10	0	1.00
COMP IV	10	2	10	0	
COMP IV	10	3	10	0	
COMP IV	10	4	10	0	
COMP IV	50	1	10	0	0.98
COMP IV	50	2	10	0	
COMP IV	50	3	10	0	
COMP IV	50	4	9	1	
COMP IV	100	1	10	0	0.98
COMP IV	100	2	10	0	
COMP IV	100	3	9	1	
COMP IV	100	4	10	0	
COMP V	0	1	8	2	0.93
COMP V	0	2	10	0	
COMP V	0	3	10	0	
COMP V	0	4	9	1	
COMP V	10	1	9	1	0.98
COMP V	10	2	10	0	
COMP V	10	3	10	0	
COMP V	10	4	10	0	
COMP V	50	1	10	0	0.98
COMP V	50	2	10	0	
COMP V	50	3	10	0	
COMP V	50	4	9	1	
COMP V	100	1	6	4	0.85
COMP V	100	2	8	2	
COMP V	100	3	10	0	
COMP V	100	4	10	0	

TABLE H.1. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpta</i>		Mean Proportion Surviving
			Live ^(a)	Dead or Missing	
COMP VI	0	1	9	1	0.95
COMP VI	0	2	10	0	
COMP VI	0	3	10	0	
COMP VI	0	4	9	1	
COMP VI	10	1	8	2	0.88
COMP VI	10	2	10	0	
COMP VI	10	3	9	1	
COMP VI	10	4	8	2	
COMP VI	50	1	8	2	0.90
COMP VI	50	2	9	1	
COMP VI	50	3	9	1	
COMP VI	50	4	10	0	
COMP VI	100	1	10	0	0.95
COMP VI	100	2	10	0	
COMP VI	100	3	10	0	
COMP VI	100	4	8	2	

(a) Survival based on initial exposure of 10 individuals per replicate.

TABLE H.2. Summary of Mean Proportion Surviving for 96-Hour
H. sculpta Suspended-Particulate-Phase Test, Richmond
Harbor Program

<u>Sediment Treatment</u>	<u>Concentration (%)</u>	<u>Mean Proportion Surviving</u>
COMP I	0	1.00
COMP I	10	0.90
COMP I	50	1.00
COMP I	100	0.98
COMP II	0	1.00
COMP II	10	1.00
COMP II	50	0.75
COMP II	100	0.95
COMP III	0	1.00
COMP III	10	0.95
COMP III	50	0.90
COMP III	100	0.98
COMP IV	0	0.93
COMP IV	10	1.00
COMP IV	50	0.98
COMP IV	100	0.98
COMP V	0	0.93
COMP V	10	0.98
COMP V	50	0.98
COMP V	100	0.85
COMP VI	0	0.95
COMP VI	10	0.88
COMP VI	50	0.90
COMP VI	100	0.95
TC-5 Upper Comp	0	0.98
TC-5 Upper Comp	10	1.00
TC-5 Upper Comp	50	0.98
TC-5 Upper Comp	100	0.95

TABLE H.3. Water Quality Summary for 96-Hour *H. sculpta* Suspended-Particulate-Phase Test, Richmond Harbor Program

		Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
Sediment Treatment	Concentration (%)	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		13.0	17.0	7.54	8.54	4.0	NA ^(a)	30.2	34.2
COMP I	0	14.6	15.2	7.90	8.23	7.5	8.2	31.5	32.5
COMP I	10	14.6	15.3	7.94	8.21	7.4	8.2	31.5	33.0
COMP I	50	14.6	15.3	7.83	8.24	7.4	8.2	31.5	33.0
COMP I	100	14.6	15.5	7.80	8.31	7.5	8.2	31.5	32.5
COMP II	0	14.6	15.4	7.93	8.20	7.5	8.3	31.5	33.0
COMP II	10	14.3	15.2	7.92	8.19	7.3	8.2	31.5	33.0
COMP II	50	14.5	15.2	7.87	8.32	7.4	8.3	32.0	32.5
COMP II	100	14.6	15.2	7.81	8.33	7.4	8.2	31.5	32.5
COMP III	0	14.6	15.2	7.86	8.19	7.5	8.1	32.0	33.5
COMP III	10	14.6	15.4	7.99	8.26	7.2	8.2	32.0	33.5
COMP III	50	14.8	15.3	8.05	8.26	7.3	8.2	31.5	33.0
COMP III	100	14.6	15.4	8.06	8.34	7.4	8.1	32.0	32.5
TC-5 Upper Comp	0	14.4	15.2	7.93	8.23	7.2	7.9	31.5	33.5
TC-5 Upper Comp	10	14.3	15.1	7.95	8.22	7.2	8.1	31.5	33.0
TC-5 Upper Comp	50	14.3	15.4	8.01	8.38	7.3	8.1	31.5	33.0
TC-5 Upper Comp	100	14.4	15.2	8.04	8.45	7.4	8.1	32.0	33.5
COMP IV	0	14.7	15.0	7.88	8.27	7.6	8.2	31.5	33.5
COMP IV	10	14.7	15.1	7.98	8.29	7.5	8.3	31.5	33.0
COMP IV	50	14.7	15.2	8.03	8.25	7.4	8.2	32.0	33.5
COMP IV	100	14.7	15.4	7.95	8.28	7.4	8.0	32.0	32.5
COMP V	0	14.5	15.3	7.92	8.24	7.5	8.2	32.0	33.5
COMP V	10	14.4	15.2	7.94	8.21	7.4	8.3	31.5	33.0
COMP V	50	14.5	15.2	7.89	8.28	7.5	8.2	31.5	32.5
COMP V	100	14.6	15.5	7.83	8.31	7.3	8.2	31.5	32.5
COMP VI	0	14.9	15.3	7.90	8.32	7.4	8.4	31.5	32.5
COMP VI	10	14.9	15.4	7.93	8.28	7.2	8.2	32.0	33.0
COMP VI	50	14.9	15.3	7.84	8.30	7.3	8.1	31.5	32.0
COMP VI	100	14.8	15.4	7.72	8.37	7.2	8.0	32.0	32.5

(a) NA Not applicable.

TABLE H.4. Daily Observations of 96-Hour *H. sculpta* Suspended-Particulate-Phase Test, Richmond Harbor Program

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpta</i> Live						<i>H. sculpta</i> Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP I	0	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10	1	10	10	10	9	7	6	0	0	0	1	2	1
COMP I	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	50	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP I	100	3	10	10	10	9	9	9	0	0	0	1	0	0
COMP I	100	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	50	1	10	10	10	10	7	5	0	0	0	0	3	2
COMP II	50	2	10	10	10	9	9	9	0	0	0	1	0	0
COMP II	50	3	10	10	10	10	9	6	0	0	0	0	1	3
COMP II	50	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	100	1	10	10	10	10	9	9	0	0	0	0	1	0
COMP II	100	2	10	10	10	10	10	9	0	0	0	0	0	1
COMP II	100	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP II	100	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10	2	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	10	4	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	50	1	10	10	9	8	8	8	0	0	1	1	0	0
COMP III	50	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	50	3	10	10	10	10	10	9	0	0	0	0	0	1
COMP III	50	4	10	10	9	9	9	9	0	0	1	0	0	0

TABLE H.4. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpta</i> Live						<i>H. sculpta</i> Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP III	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP III	100	3	10	10	10	10	9	9	0	0	0	0	1	0
COMP III	100	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	1	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	2	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	0	4	10	10	10	10	10	9	0	0	0	0	0	1
TC-5 Upper Comp	10	1	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	2	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	10	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	50	1	10	10	10	10	9	9	0	0	0	0	1	0
TC-5 Upper Comp	50	2	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	50	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	50	4	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	100	1	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	100	2	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	100	3	10	10	10	10	10	10	0	0	0	0	0	0
TC-5 Upper Comp	100	4	10	10	10	9	9	8	0	0	0	1	0	1
COMP IV	0	1	10	10	10	10	9	7	0	0	0	0	1	2
COMP IV	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	0	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	50	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	50	4	10	10	10	10	10	9	0	0	0	0	0	1
COMP IV	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP IV	100	3	10	10	10	10	10	9	0	0	0	0	0	1
COMP IV	100	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0	1	10	10	10	10	9	8	0	0	0	0	1	1
COMP V	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	0	4	10	10	10	10	10	9	0	0	0	0	0	1

TABLE H.4. (contd)

Sediment Treatment	Concentration (%)	Replicate	<i>H. sculpia</i> Live						<i>H. sculpia</i> Dead					
			0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
COMP V	10	1	10	10	10	10	10	9	0	0	0	0	0	1
COMP V	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	10	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	10	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	50	4	10	10	10	9	9	9	0	0	0	1	0	0
COMP V	100	1	10	10	9	8	6	6	0	0	1	1	2	0
COMP V	100	2	10	10	10	10	10	8	0	0	0	0	0	2
COMP V	100	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP V	100	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0	1	10	10	10	9	9	9	0	0	0	1	0	0
COMP VI	0	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	0	4	10	10	10	10	9	9	0	0	0	0	1	0
COMP VI	10	1	10	10	10	9	8	8	0	0	0	1	1	0
COMP VI	10	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	10	3	10	10	9	9	9	9	0	0	1	0	0	0
COMP VI	10	4	10	10	10	9	8	8	0	0	0	1	1	0
COMP VI	50	1	10	10	10	9	10	8	0	0	0	1	0	1
COMP VI	50	2	10	10	10	9	9	9	0	0	0	1	0	0
COMP VI	50	3	10	10	10	10	10	9	0	0	0	0	0	1
COMP VI	50	4	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	1	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	2	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	3	10	10	10	10	10	10	0	0	0	0	0	0
COMP VI	100	4	10	10	10	8	8	8	0	0	0	2	0	0

TABLE H.5. Test Results for 96-Hour *H. sculpta* Reference Toxicant Test, Richmond Harbor Program

Zinc Concentration (mg/L)	Replicate	<i>H. sculpta</i>		Mean Proportion Surviving
		Live ^(a)	Dead or Missing	
0	1	10	0	1.00
0	2	10	0	
0	3	10	0	
0.125	1	7	3	0.77
0.125	2	8	2	
0.125	3	8	2	
0.25	1	5	5	0.30
0.25	2	2	8	
0.25	3	2	8	
0.50	1	0	10	0.00
0.50	2	0	10	
0.50	3	0	10	
1.00	1	0	10	0.00
1.00	2	0	10	
1.00	3	0	10	
2.00	1	0	10	0.00
2.00	2	0	10	
2.00	3	0	10	

(a) Survival based on initial exposure of 10 individuals per replicate.

TABLE H.6. Rank Order Based on Mean Proportion Surviving 96-Hour
H. sculpta Reference Toxicant Test, Richmond Harbor
 Program

<u>Zinc Concentration (mg/L)</u>	<u>Mean Proportion Surviving</u>
0.50	0.00
1.00	0.00
2.00	0.00
0.25	0.30
0.125	0.77
0	1.00

TABLE H.7. Water Quality Summary for 96-Hour *H. sculpta* Reference Toxicant Test, Richmond Harbor Program

Zinc 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	7.53	8.53	4.0	NA ^(a)	30.3	34.3
0	14.7	15.3	7.93	8.21	7.4	8.0	32.0	33.0
0.125	14.4	15.0	7.89	8.25	6.9	8.1	32.0	33.0
0.25	14.4	15.2	7.95	8.25	7.4	8.2	32.0	33.0
0.50	14.4	15.2	7.90	8.18	7.3	8.1	32.0	33.0
1.00	14.4	15.1	7.93	8.24	4.0	8.2	32.0	32.0
2.00	14.4	15.1	7.93	8.20	7.7	8.2	32.0	32.5

(a) NA Not applicable.

TABLE H.8. Daily Observations of *H. sculpta* During 96-Hour Reference Toxicant Test, Richmond Harbor Program

Zinc Concentration (mg/L)	Replicate	<i>H. sculpta</i> Live						<i>H. sculpta</i> Dead					
		0h	4h	24h	48h	72h	96h	0h	4h	24h	48h	72h	96h
0	1	10	10	10	10	10	10	0	0	0	0	0	0
0	2	10	10	10	10	10	10	0	0	0	0	0	0
0	3	10	10	10	10	10	10	0	0	0	0	0	0
0.125	1	10	10	10	10	7	7	0	0	0	0	3	0
0.125	2	10	10	10	10	10	8	0	0	0	0	0	2
0.125	3	10	10	10	10	10	8	0	0	0	0	0	2
0.25	1	10	10	10	9	7	5	0	0	0	1	2	3
0.25	2	10	10	10	7	5	2	0	0	0	3	2	1
0.25	3	10	10	10	5	3	2	0	0	0	5	2	2
0.50	1	10	10	10	6	2	0	0	0	0	4	4	1
0.50	2	10	10	10	5	1	0	0	0	0	5	4	10
0.50	3	10	10	10	5	0	0	0	0	0	5	5	10
1.00	1	10	10	10	1	0	0	0	0	0	9	1	10
1.00	2	10	10	7	1	0	0	0	0	3	6	1	10
1.00	3	10	10	9	0	0	0	0	0	1	9	10	10
2.00	1	10	10	5	0	0	0	0	0	5	5	10	10
2.00	2	10	10	5	0	0	0	0	0	5	5	10	10
2.00	3	10	10	3	0	0	0	0	0	7	3	10	10

APPENDIX I

BIOASSAY RESULTS FOR 48-HOUR SUSPENDED-PARTICULATE-PHASE TEST AND 48-HOUR REFERENCE TOXICANT TEST FOR *MYTILUS edulis*

TABLE I.1. Test Results for All Replicates in 48-Hour Larval *M. edulis* Suspended-Particulate-Phase Test, Richmond Harbor Program

Sediment Treatment	Concentration(%)	Replicate	Number of Larvae at Developmental Stage			Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
			Normal D- Shaped Shell	Earlier Stages	Abnormal w/ Shell				
COMP I	0	1	219	23	82	67.1		99.2	
COMP I	0	2	222	21	63	68.0		93.7	
COMP I	0	3	203	49	53	62.2		93.4	
COMP I	0	4	198	37	96	60.6	64.5	101.4	96.9
COMP I	10	1	184	54	41	56.4		85.5	
COMP I	10	2	133	23	68	40.7		68.6	
COMP I	10	3	250	23	23	76.6		90.7	
COMP I	10	4	170	13	114	52.1	56.4	91.0	83.9
COMP I	50	1	127	9	8	38.9		44.1	
COMP I	50	2	231	37	65	70.8		102.0	
COMP I	50	3	206	20	37	63.1		80.6	
COMP I	50	4	155	63	21	47.5	55.1	73.2	75.0
COMP I	100	1	182	12	72	55.7		81.5	
COMP I	100	2	0 ^(b)	0	0	0		0	
COMP I	100	3	149	12	36	45.6		60.3	
COMP I	100	4	156	40	52	47.8	49.7	76.0	72.6
COMP II	0	1	188	20	39	57.6		75.7	
COMP II	0	2	223	34	30	68.3		87.9	
COMP II	0	3	173	22	65	53.0		79.6	
COMP II	0	4	212	53	43	64.9	60.9	94.3	84.4
COMP II	10	1	190	20	45	58.2		78.1	
COMP II	10	2	224	23	35	68.6		86.4	
COMP II	10	3	203	34	44	62.2		86.1	
COMP II	10	4	171	29	54	52.4	60.3	77.8	82.1
COMP II	50	1	172	28	42	52.7		74.1	
COMP II	50	2	177	18	39	54.2		71.7	
COMP II	50	3	169	15	10	51.8		59.4	
COMP II	50	4	0	0	0	0	52.9	0	68.4

TABLE I.1. (contd)

Sediment Treatment	Concentration(%)	Replicate	Number of Larvae at Developmental Stage			Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
			Normal D- Shaped Shell	Earlier Stages	Abnormal w/ Shell				
COMP II	100	1	0	0	0	0		0	
COMP II	100	2	146	99	78	44.7		98.9	
COMP II	100	3	186	13	103	57.0		92.5	
COMP II	100	4	203	15	94	62.2	54.6	95.6	95.7
COMP III	0	1	221	13	70	67.7		93.1	
COMP III	0	2	210	30	68	64.3		94.3	
COMP III	0	3	174	30	64	53.3		82.1	
COMP III	0	4	201	46	75	61.6	61.7	98.6	92.0
COMP III	10	1	197	23	33	60.3		77.5	
COMP III	10	2	181	28	44	55.4		77.5	
COMP III	10	3	194	43	59	59.4		90.7	
COMP III	10	4	167	19	36	51.1	56.6	68.0	78.4
COMP III	50	1	191	37	52	58.5		85.8	
COMP III	50	2	216	58	50	66.2		99.2	
COMP III	50	3	266	24	40	81.5		101.1	
COMP III	50	4	180	22	101	55.1	65.3	92.8	94.7
COMP III	100	1	181	38	85	55.4		93.1	
COMP III	100	2	0	0	0	0		0	
COMP III	100	3	184	21	63	56.4		82.1	
COMP III	100	4	171	12	63	52.4	54.7	75.3	83.5
TC-5 Upper Comp	0	1	NO ^(c)	ND	NO	ND		ND	
TC-5 Upper Comp	0	2	ND	ND	ND	ND		ND	
TC-5 Upper Comp	0	3	ND	ND	ND	ND		ND	
TC-5 Upper Comp	0	4	ND	ND	ND	ND	ND	ND	ND
TC-5 Upper Comp	10	1	190	37	43	58.2		82.7	
TC-5 Upper Comp	10	2	142	76	55	43.5		83.6	
TC-5 Upper Comp	10	3	170	57	58	52.1		87.3	
TC-5 Upper Comp	10	4	214	41	33	65.5	54.8	88.2	85.5

TABLE I.1. (contd)

Sediment Treatment	Concentration(%)	Replicate	Number of Larvae at Developmental Stage			Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
			Normal D- Shaped Shell	Earlier Stages	Abnormal w/ Shell				
TC-5 Upper Comp	50	1	181	21	58	55.4		79.6	
TC-5 Upper Comp	50	2	144	24	112	44.1		85.8	
TC-5 Upper Comp	50	3	166	10	49	50.8		68.9	
TC-5 Upper Comp	50	4	141	23	47	43.2	48.4	64.6	74.7
TC-5 Upper Comp	100	1	2	207	50	0.6		79.3	
TC-5 Upper Comp	100	3	7	66	152	2.1		68.9	
TC-5 Upper Comp	100	2	7	93	171	2.1		83.0	
TC-5 Upper Comp	100	4	13	67	157	4.0	2.2	72.6	76.0
COMP IV	0	1	233	22	75	71.4		101.1	
COMP IV	0	2	211	47	64	64.6		98.6	
COMP IV	0	3	166	26	39	50.8		70.8	
COMP IV	0	4	178	32	46	54.5	60.3	78.4	87.2
COMP IV	10	1	192	53	42	58.8		87.9	
COMP IV	10	2	186	19	75	57.0		85.8	
COMP IV	10	3	192	21	60	58.8		83.6	
COMP IV	10	4	199	20	96	60.9	58.9	96.5	88.4
COMP IV	50	1	178	19	83	54.5		85.8	
COMP IV	50	2	193	28	58	59.1		85.5	
COMP IV	50	3	166	30	23	50.8		67.1	
COMP IV	50	4	193	38	71	59.1	55.9	92.5	82.7
COMP IV	100	1	179	22	77	54.8		85.1	
COMP IV	100	2	158	26	74	48.4		79.0	
COMP IV	100	3	186	63	56	57.0		93.4	
COMP IV	100	4	194	26	52	59.4	54.9	83.3	85.2
COMP V	0	1	176	11	41	53.9		69.8	
COMP V	0	2	197	53	98	60.3		106.6	
COMP V	0	3	175	33	51	53.6		79.3	
COMP V	0	4	222	19	87	68.0	59.0	100.5	89.1

TABLE I.1. (contd)

Sediment Treatment	Concentration(%)	Replicate	Number of Larvae at Developmental Stage			Percent Normal (a)	Mean Percent Normal	Percent Survival (a)	Mean Percent Survival
			Normal D- Shaped Shell	Earlier Stages	Abnormal w/ Shell				
COMP V	10	1	190	25	38	58.2		77.5	
COMP V	10	2	172	14	48	52.7		71.7	
COMP V	10	3	192	36	36	58.8		80.9	
COMP V	10	4	186	17	49	57.0	56.7	77.2	76.8
COMP V	50	1	185	23	76	56.7		87.0	
COMP V	50	2	173	22	30	53.0		68.9	
COMP V	50	3	0	0	0	0		0	
COMP V	50	4	191	27	86	58.5	56.0	93.1	83.0
COMP V	100	1	182	37	85	55.7		93.1	
COMP V	100	2	203	1	82	62.2		87.6	
COMP V	100	3	177	23	53	54.2		77.5	
COMP V	100	4	194	25	43	59.4	57.9	80.2	84.6
COMP VI	0	1	198	32	71	60.6		92.2	
COMP VI	0	2	236	27	55	72.3		97.4	
COMP VI	0	3	221	31	66	67.7		97.4	
COMP VI	0	4	206	9	57	63.1	65.9	83.3	92.6
COMP VI	10	1	192	12	68	58.8		83.3	
COMP VI	10	2	199	21	89	60.9		94.6	
COMP VI	10	3	153	14	51	46.9		66.8	
COMP VI	10	4	189	49	46	57.9	56.1	87.0	82.9
COMP VI	50	1	212	12	29	64.9		77.5	
COMP VI	50	2	189	30	48	57.9		81.8	
COMP VI	50	3	189	28	81	57.9		91.3	
COMP VI	50	4	163	38	30	49.9	57.7	70.8	80.3
COMP VI	100	1	169	7	115	51.8		89.1	
COMP VI	100	2	164	15	56	50.2		72.0	
COMP VI	100	3	168	15	74	51.5		78.7	
COMP VI	100	4	143	17	85	43.8	49.3	75.0	78.7

(a) Percent normal and percent survival based on stocking density of 326.5 larvae per 10 mL.

(b) Difficult to see because of particle debris.

(c) ND No data available; sample not taken.

**TABLE I.2. Water Quality Summary for 48-Hour Larval *M. edulis*
Suspended-Particulate-Phase Test, Richmond
Harbor Program**

Sediment Treatment	Concentration %	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		14.0	18.0	7.55	8.55	4.0	NA ^(a)	28.9	32.9
COMP I	0	16.2	16.9	8.03	8.11	7.5	7.8	30.0	31.5
COMP I	10	16.2	16.9	7.95	8.14	7.5	7.9	30.5	32.5
COMP I	50	16.2	16.8	8.03	8.27	7.4	7.8	30.0	32.0
COMP I	100	16.2	16.9	8.15	8.26	7.3	7.8	30.0	31.5
COMP II	0	16.2	16.9	8.08	8.18	7.3	7.9	30.0	31.5
COMP II	10	16.3	16.8	8.01	8.16	7.1	7.8	30.0	32.5
COMP II	50	16.2	16.8	8.11	8.27	7.3	7.8	30.0	32.0
COMP II	100	16.3	16.8	7.88	8.26	7.4	7.7	30.0	31.5
COMP III	0	16.2	16.9	8.02	8.11	7.5	7.9	30.0	32.0
COMP III	10	16.3	16.8	8.01	8.18	7.5	7.8	30.0	32.5
COMP III	50	16.3	16.8	8.06	8.24	7.4	7.8	31.0	32.0
COMP III	100	16.3	16.9	8.17	8.35	7.4	7.8	30.0	31.0
TC-5 Upper Comp	0	16.3	16.9	8.06	8.12	7.5	7.9	30.0	31.5
TC-5 Upper Comp	10	16.3	17.0	8.04	8.14	7.6	7.8	31.0	32.5
TC-5 Upper Comp	50	16.2	16.8	8.15	8.24	7.1	7.7	30.0	31.5
TC-5 Upper Comp	100	16.2	16.8	8.21	8.32	7.5	7.7	31.0	32.5
COMP IV	0	16.2	16.9	8.01	8.15	7.2	8.0	30.0	31.5
COMP IV	10	16.3	16.8	8.01	8.16	7.6	7.9	30.0	32.0
COMP IV	50	16.3	16.8	8.04	8.23	7.5	7.8	31.0	32.0
COMP IV	100	16.2	16.8	7.83	8.23	7.5	7.8	30.0	31.5
COMP V	0	16.3	16.9	8.04	8.15	7.5	7.9	30.0	31.5
COMP V	10	16.3	16.9	8.01	8.16	7.5	7.9	30.0	32.5
COMP V	50	16.3	16.8	8.06	8.17	7.5	7.8	30.0	32.0
COMP V	100	16.3	17.0	8.07	8.27	7.4	7.8	30.0	31.5
COMP VI	0	16.2	16.8	8.04	8.13	7.5	8.0	30.0	31.5
COMP VI	10	16.3	16.9	8.00	8.14	7.5	7.9	30.5	32.5
COMP VI	50	16.3	16.8	8.07	8.19	7.4	7.7	31.0	32.5
COMP VI	100	16.3	16.8	8.13	8.20	7.4	7.8	30.0	31.0

(a) NA Not applicable.

TABLE I.3. Survival Data for All Replicates in 48-Hour Larval *M. edulis* Reference Toxicant Test, Richmond Harbor Program

Copper Concentration (µg/L)	Replicate	Number of Larvae at Developmental Stage			Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
		Normal D- Shaped Shell	Earlier Stages	Abnormal w/ Shell				
0.0	1	167	116	26	51.1		94.6	
0.0	2	200	30	66	61.3		90.7	
0.0	3	185	72	24	56.7	56.4	86.1	90.5
1.0	1	166	48	21	50.8		72.0	
1.0	2	197	76	28	60.3		92.2	
1.0	3	165	62	67	50.5	53.9	90.0	84.7
4.0	1	184	85	77	56.4		106.0	
4.0	2	154	70	30	47.2		77.8	
4.0	3	128	55	25	39.2	47.6	63.7	82.5
16.0	1	0	124	4	0.0		39.2	
16.0	2	1	126	6	0.3		40.7	
16.0	3	2	100	53	0.6	0.3	47.5	42.5
64.0	1	0 ^(b)	9	1	0.0		3.1	
64.0	2	ND	ND	ND	ND		ND	
64.0	3	ND	ND	ND	ND	0.0	ND	3.1

(a) Percent normal and percent survival based on stocking density of 326.5 larvae per 10 mL.

(b) ND No data available; sample not taken.

APPENDIX J

TISSUE CHEMISTRY AND QUALITY ASSURANCE DATA
FOR *MACOMA nasuta*

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs)
LABORATORY: Battelle Ocean Sciences (Duxbury, Mass)
MATRIX: *M. nasuta*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
8270	40% - 120%	±30%	20 µg/kg

HOLDING TIMES Samples were frozen for up to 2 months prior to extraction. All four extraction batches were analyzed within the EPA extract holding time of 40 days (EPA 1986).

DETECTION LIMITS Target detection limits were met for all PAH compounds.

METHOD BLANKS Four method blanks were analyzed. Naphthalene was detected at low levels in all four method blanks at levels not sufficiently high to require data correction or flagging. Fluorene, anthracene, fluoranthene, chrysene, and benzo(k)fluoranthene also had detectable amounts in up to two of the method blanks; all values reported were below the method detection limit and no data were flagged or corrected. Only one HPAH compound, pyrene, was detected above the detection limit in two of the four blanks and the data were not flagged or blank corrected.

MATRIX SPIKES Four sets of background samples were spiked in duplicate with all 16 PAH compounds. One set of spikes was extracted and analyzed with each of the four batches of samples to assess accuracy and precision. Spike recoveries for LPAH compounds ranged from 98% to 128% with only acenaphthalene in both spikes for Batch A slightly exceeding the QA/QC limits. Relative percent differences (RPDs) between spike duplicate recoveries ranged from 0% to 6% indicating acceptable precision of the method.

The HPAH spike recoveries ranged from 65% to 127%. Four recoveries exceeded the upper QA/QC range. These exceedences do not affect data quality or bias any sample results. The RPDs between spike recoveries ranged from 0% to 20%, within the acceptable precision goal.

REPLICATES

Four sample were analyzed in triplicate (COMP V, R-AM, R-BF, and C-SB). Precision was measured by Relative Standard Deviation (RSD) between results. The RSD values ranged from 6% to 60% for LPAHs detected in all triplicate analyses with only two measurements exceeding the precision goal. The HPAH RSD values ranged from 1% to 65%, with only one RSD value exceeding the goal. Overall, these measurements indicate acceptable precision of the method.

SRMs

Tissue sample SRM 1974 (NIST) was analyzed once with each extraction batch (a total of 4 analyses). This SRM was certified for 8 of the 16 PAH compounds measured. In general, values measured were near the certified values and all concentrations were within $\pm 30\%$ of the certified mean value with the exception of anthracene, benzo(a)pyrene, and benzo(ghi)perylene. No criteria was given for SRMs in the QA/QC Plan; therefore, values were not flagged.

SURROGATES

Three radiolabelled PAH compounds (naphthalene d8, acenaphthene d10, and benzo(a)pyrene d12) were added as surrogates to samples prior to analysis. Recoveries for most samples were within the QA/QC requirements. Four samples had recoveries slightly below the QC limits for two of the three surrogates measured and one sample (a background clam sample) had all three surrogates below the lower QC limit. These recoveries were still all above 20%, requiring no re-extractions. Results for these four samples may be biased low based on these recoveries.

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Chlorinated Pesticides and PCBs
LABORATORY: Battelle Ocean Sciences (Duxbury, Mass)
MATRIX: *M. nasuta*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS:

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Pesticides	8080	40% - 120%	±30%	2.0 µg/kg
PCBs	8080	40% - 120%	±30%	20 µg/kg

HOLDING TIMES Samples were frozen for up to 2 months prior to extraction. All sample extracts were analyzed within the EPA extract holding time of 40 days (EPA 1986).

DETECTION LIMITS Target detection limits for pesticides (2 µg/kg wet weight, 30 µg/kg for toxaphene) were met for all samples with the exception of chlordane. The detection limits for chlordane ranged from 2.214 to 7.023. The elevated detection limits for chlordane reflect the multiple peak nature of the compound. Target PCB detection limits (20 µg/kg wet weight) were met for all samples.

METHOD BLANKS One method blank was analyzed with each of the four extraction batches. Alpha, beta, delta, and gamma-BHC, 4,4'-DDE, and 4,4'-DDT were found in at least one method blank. However, in all cases, levels detected were low; therefore, data were flagged or blank corrected. No PCBs were detected in any of the method blanks.

MATRIX SPIKES Four background samples were spiked in duplicate with 18 pesticides and 1 PCB (aroclor 1254). Pesticide spike recoveries ranged from 6% to 191%. Endrin aldehyde produced low recoveries of 6% to 48% for all spikes. These low recoveries suggest that sample values for endrin aldehyde may be underestimated; however, endrin aldehyde is a breakdown product of endrin and was not found in any samples. Three pesticides (endosulfan I, endosulfan II, and endosulfan sulfate) exceeded the upper recovery limit for both spikes in Batch A (ranging from 122% to 140%). The greatest spike recovery exceedences were for endosulfan II in Batch C with recoveries of 184% and 191%. Because endosulfan II was not detected above the method detection limit in any samples, this does not affect the quality of the data.

Aroclor 1254 spike recoveries ranged from 106% to 141%. Batch A and Batch B spike recoveries exceeded the upper QA/QC requirements. Since the surrogate recoveries for these samples were not elevated above QA/QC requirements, the high spike recoveries may reflect an inaccurate spiking concentration.

Relative percent differences between spike duplicate recoveries for pesticides ranged from 0% to 60% with only 2 out of 64 calculations exceeding OA/QC requirements. The exceedences were for endrin aldehyde.

Relative percent differences between spike duplicate recoveries for PCBs ranged from 2% to 4% and were within OA/QC requirements.

SRMs

NOT APPLICABLE

REPLICATES

Four samples were analyzed in triplicate (COMP V, R-AM, F-PF, and C-SB), and precision was measured by calculating the relative standard deviation (RSD) between the replicates. Pesticide RSD values ranged from 1% to 33% for samples having pesticides detected in all three replicates. All RSD values, with the exception of gamma-BHC in Batch C were within the precision goal of $\pm 30\%$, indicating acceptable precision.

The PCB RSD values ranged from 4% to 8%, indicating acceptable precision.

SURROGATES

Two compounds, dibromooctafluorobiphenyl (DBOFB) and tetrachloronaphthalene (TCN), were added to all samples prior to extraction to assess the efficiency of the method. Recoveries for the samples were within the OA/QC requirements, with the exception of DBOFB for one of the background samples. This recovery was above 20%; therefore, re-extraction was not required.

ADDITIONAL INFORMATION

An "E" flag was used to flag selected PCB/Pesticide data. This "E" flag indicates that the compound of interest was only detected on the primary column and was not confirmed to be that compound on the second column.

QA/QC SUMMARY

PROGRAM Richmond Harbor Program
PARAMETER: Metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, and Zn)
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: *M. nasuta*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS

	<u>Analysis</u>	<u>QA/QC Document</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Arsenic	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg
Cadmium	AA	MSL-M-33	75% - 125%	±20%	0.1 mg/kg
Chromium	AA	PNL-SP-19	NA	±20%	1.0 mg/kg
Copper	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg
Lead	AA	PNL-SP-19	NA	±20%	1.0 mg/kg
Mercury	ICP-MS	MSL-M-11	75% - 125%	±20%	0.02 mg/kg
Nickel	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg
Selenium	XRF	MSL-M-33	75% - 125%	±20%	0.5 mg/kg
Silver	AA	MSL-M-33	75% - 125%	±20%	1.0 mg/kg
Zinc	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg

HOLDING TIMES

Recommended holding times for metals in tissues based on the 1991 Implementation Manual (EPA/USACE 1991) are 6 months (< 20° C) for all metals except Hg, which is 28 days. After receipt at MSL, *M. nasuta* tissue samples for this project were held frozen for up to 4 weeks and then freeze dried and stored for up to 3 months in sealed containers. Holding times have not been established for samples held freeze dried; however, standard reference material (SRM) prepared by the U.S. National Institute of Standards and Technology (NIST) such as SRM 1566a (oyster tissue) have been issued for up to 10 years after freeze drying without changes to the certified concentrations including those for Hg.

DETECTION LIMITS

Achieved detection limits based on dry weight concentrations were lower than target detection limits for all metals.

METHOD BLANKS

One method blank was analyzed with each of four batches. Low levels of Ag, Cd, and Cr were found in the blanks at levels slightly above the achieved detection but much less than the target detection limits. Tissue samples analyzed by AA or ICP-MS (Ag, Cd, Cr, Hg, and Pb) were corrected for the concentration of metals found in the corresponding blanks. Method blanks were not applicable to metals analyzed by XRF.

MATRIX SPIKES

Four samples (COMP II, COMP V, C-SB, and R-PF) were spiked with Ag, Cd, Cr, Hg, and Pb. Spikes were analyzed at a minimum of 1 per 20 samples. Recoveries ranged from 54% to 129%. Silver recoveries for two out of the four spikes were below the QA/QC requirements. Although no limits are given for Pb, one out of the four spikes was above 125%.

SRMs

The SRM 1566a (oyster tissue) was obtained from the U.S. National Institute of Standards and Technology (NIST). This SRM was analyzed by AA or ICP/MS at a minimum of 1 per 20 samples and 1 per 5 samples for metals analyses by XRF. Ag, Hg, Ni, Pb, and Se values exceeded the certified range for at least two reps of the SRM. Experience has shown that Hg values are routinely lower than the certified range. Six of the fourteen Ni measurements (performed by XRF) were outside of the certified range. Other QC measurements for this metal (i.e., spikes and replicates) are acceptable, indicating that the variability may be a result of non-homogeneity of the SRM rather than an analytical bias. Although some metals exceeded certified ranges, all values fell within $\pm 20\%$ of the certified mean.

REPLICATES

Four samples (COMP II, COMP V, R-PF, and C-SB) were analyzed in triplicate for all metals. Precision was measured by Relative Standard Deviation (RSD) between replicate results. The RSDs ranged from 1% to 50%. Eight out of forty calculated RSD values (Ag, Cd, Cr, and Se) exceeded the QA/QC requirements.

SURROGATES

NOT APPLICABLE

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: *M. nasuta*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS:

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Monobutyltin	MSL-M-4	-	±30%	10 µg/kg
Dibutyltin	MSL-M-4	40% - 120%	±30%	10 µg/kg
Tributyltin	MSL-M-4	40% - 120%	±30%	10 µg/kg

HOLDING TIMES

No holding times have been established for butyltins in tissues; however, samples were kept frozen until used for analyses. All tissue samples were initially extracted in four batches and analyzed within 2 months. Because of low surrogate recoveries (< 40%), approximately 30% of the samples were re-extracted and re-analyzed approximately 2.5 months after receipt.

DETECTION LIMITS

Target detection limits (10 µg/kg) were met for all butyltin tissue samples.

METHOD BLANKS

A total of 11 method blanks were analyzed, a minimum of 1 blank per 20 samples. Butyltins were not detected in any method blanks.

MATRIX SPIKES

Five samples (COMP IV, R-AM, COMP III, R-PF, and R-AC) were spiked in duplicate to assess the accuracy and precision of the method. One set of spike and spike duplicate analyses was performed with each extraction batch. Recoveries for tri- and dibutyltin ranged from 30% to 77% with 42 of the 48 recoveries within the QA/QC requirements.

Relative percent difference (RPD) values were compared between spike and spike duplicate recoveries to assess precision. The RPD values for tri- and dibutyltin ranged from 10% to 39%. Two sets of RPDs out of the six MS/MSD samples analyzed exceeded the QA/QC requirements. In general, the precision of the analyses, based on spike duplicate recovery data, was acceptable.

SRMs

NOT APPLICABLE

REPLICATES

Five samples (COMP III, TC-5 Upper Comp, R-OS, C-SB, and the MSL background) were analyzed in triplicate, one per each extraction batch. Batch A triplicates had low surrogate recoveries and were not reported. Precision between triplicate analyses was measured by Relative Standard Deviation (RSD) and ranged from 3% to 28%, which is within the QA/QC requirements. Dibutyltin was not found in any of the triplicates; therefore, no RSDs were calculated.

SURROGATES

Tripropyltin was added as surrogate to each sample prior to extraction to assess extraction efficiency. Percent recoveries ranged from 30% to 76%. Three recoveries were out of or below the QA/QC requirements. These exceedences were all above 30%, so no further actions were required.

TABLE J.1. Total Polynuclear Aromatic Hydrocarbons (PAHs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PAHs ($\mu\text{g/kg}$ dry weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP I	1	D	28.80	157.27	186.07
COMP I	2	D	35.59	205.39	240.98
COMP I	3	A	41.85	178.58	220.43
COMP I	4	B	37.60	217.70	255.30
COMP I	5	A	46.29	218.29	264.58
COMP II	1	D	20.41	110.58	130.99
COMP II	2	A	42.03	197.52	239.55
COMP II	3	C	38.31	120.12	158.43
COMP II	4	D	22.88	147.86	170.74
COMP II	5	C	43.47	168.68	212.15
COMP III	1	C	25.99	17.47	43.46
COMP III	2	C	27.43	42.51	69.94
COMP III	3	A	36.24	57.19	93.43
COMP III	4	D	21.27	52.16	73.43
COMP III	5	C	23.70	33.90	57.60
TC-5 Upper Comp	1	C	70.67	956.45	1027.12
TC-5 Upper Comp	2	C	58.45	843.73	902.18
TC-5 Upper Comp	3	C	72.38	863.06	935.44
TC-5 Upper Comp	4	A	58.68	659.41	718.09
TC-5 Upper Comp	5	A	52.67	618.68	671.35
COMP IV	1	C	32.29	18.75	51.04
COMP IV	2	C	23.78	12.54	36.32
COMP IV	3	A	29.18	32.38	61.56
COMP IV	4	C	30.47	12.56	43.03
COMP IV	5	A	38.64	29.67	68.31
COMP V	1	A	35.99	369.31	405.30
COMP V	2	A	55.60	435.19	490.79
COMP V	3	A	49.38	491.12	540.50
COMP V	4	D	26.86	281.23	308.09
COMP V Replicate 1	5	B	73.86	404.48	478.34
COMP V Replicate 2	5	B	56.02	415.43	471.45
COMP V Replicate 3	5	B	34.39	397.30	431.69
COMP VI	1	C	41.22	288.05	329.27
COMP VI	2	A	43.84	407.71	451.55
COMP VI	3	B	66.10	487.84	553.94
COMP VI	4	A	56.53	393.77	450.30
COMP VI	5	D	11.85	326.66	338.51

TABLE J.1. (contd)

R-AC	1	B	189.31	4979.20	5168.51
R-AC	2	C	151.57	3180.60	3332.17
R-AC	3	C	246.64	6922.55	7169.19
R-AC	4	A	192.34	5950.02	6142.36
R-AC	5	D	191.98	6074.82	6266.80
R-AM	1	B	45.13	630.33	675.46
R-AM Replicate 1	2	C	67.95	666.55	734.50
R-AM Replicate 2	2	C	77.01	747.44	824.45
R-AM Replicate 3	2	C	75.46	711.70	787.16
R-AM	3	B	108.44	1600.96	1709.40
R-AM	4	B	115.93	1885.00	2000.93
R-AM	5	B	121.95	1327.63	1449.58
R-BF	1	D	28.28	144.25	172.53
R-BF	2	B	37.58	285.96	323.54
R-BF	3	B	44.51	248.48	292.99
R-BF	4	A	44.44	237.82	282.26
R-BF	5	A	41.94	221.90	263.84
R-OS	1	B	34.43	56.36	90.79
R-OS	2	D	14.41	17.87	32.28
R-OS	3	B	40.44	35.56	76.00
R-OS	4	D	23.50	28.22	51.72
R-OS	5	C	40.79	35.47	76.26
R-PF	1	C	36.57	25.61	62.18
R-PF	2	C	30.66	18.40	49.06
R-PF Replicate 1	3	D	28.97	23.97	52.94
R-PF Replicate 2	3	D	24.16	20.96	45.12
R-PF Replicate 3	3	D	27.39	18.60	45.99
R-PF	4	D	22.72	24.61	47.33
R-PF	5	A	38.50	41.22	79.72
C-SB	1	C	29.70	59.75	89.45
C-SB	2	D	31.22	62.53	93.75
C-SB	3	B	19.07	83.92	102.99
C-SB Replicate 1	4	A	35.24	46.93	82.17
C-SB Replicate 2	4	A	38.65	64.73	103.38
C-SB Replicate 3	4	A	33.42	44.90	78.32
C-SB	5	D	22.31	51.38	73.69

TABLE J.1. (contd)

C-NE	1	B	51.00	51.06	102.06
C-NE	2	B	32.59	33.64	66.23
C-NE	3	B	24.81	40.73	65.54
C-NE	4	B	36.94	52.74	89.68
C-NE	5	B	36.03	46.26	82.29
MSL Background	1	A	48.37	159.17	207.54
MSL Background	2	B	25.89	154.68	180.57
MSL Background	3	C	32.08	183.37	215.45
MSL Background	4	D	31.32	134.43	165.75
MSL Background	5	D	21.65	195.26	216.91

TABLE J.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ dry weight)					
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
COMP I	1	D	8.16 J ^(a)	11.41 U ^(b)	2.63 J	4.68 J	10.96	2.37 J
COMP I	2	D	8.74 J	10.04 U	5.43 U	5.98	18.06	2.81 J
COMP I	3	A	18.10	9.83 U	5.32 U	5.72 J	14.36	3.67 J
COMP I	4	B	11.12 J	0.48 J	2.55 J	3.35 J	16.02	4.08 J
COMP I	5	A	19.60	11.95 U	6.47 U	5.89 J	16.02	4.78 J
COMP II	1	D	9.52 J	11.98 U	6.49 U	7.00 U	9.05	1.84 J
COMP II	2	A	15.00	10.45 U	3.79 J	5.65 J	14.71	2.88 J
COMP II	3	C	13.49	9.79 U	3.89 J	5.58 J	13.15	2.20 J
COMP II	4	D	7.94 J	11.77 U	6.37 U	6.87 U	12.22	2.72 J
COMP II	5	C	17.65	10.77 U	3.45 J	5.75 J	14.14	2.48 J
COMP III	1	C	12.07	11.46 U	6.20 U	4.18 J	9.74	5.07 U
COMP III	2	C	12.67	10.22 U	5.53 U	3.97 J	10.79	4.52 U
COMP III	3	A	13.99	10.56 U	2.75 J	6.07 J	12.34	1.09 J
COMP III	4	O	8.28 J	10.60 U	5.74 U	2.61 J	10.38	4.69 U
COMP III	5	C	10.06 J	9.99 U	1.44 J	4.13 J	7.43	0.64 J
TC-5 Upper Comp	1	C	22.91	10.44 U	5.65 U	7.12	32.46	8.18
TC-5 Upper Comp	2	C	18.08	10.36 U	3.17 J	5.02 J	26.85	5.33
TC-5 Upper Comp	3	C	21.95	10.86 U	5.88 U	8.38	35.21	6.84
TC-5 Upper Comp	4	A	25.51	10.69 U	2.23 J	4.91 J	21.27	4.76
TC-5 Upper Comp	5	A	16.34	11.46 U	6.20 U	7.29	23.60	5.44
COMP IV	1	C	14.81	12.84 U	2.09 J	4.38 J	11.01	5.68 U
COMP IV	2	C	11.14	10.31 U	5.58 U	4.14 J	8.50	4.56 U
COMP IV	3	A	11.29	9.23 U	2.49 J	4.42 J	10.09	0.89 J
COMP IV	4	C	16.02 J	18.53 U	10.03 U	4.72 J	9.73	8.19 U
COMP IV	5	A	16.56	10.02 U	5.42 J	6.10	10.56	4.43 U
COMP V	1	A	11.21	10.80 U	5.85 U	4.85 J	15.03	4.90
COMP V	2	A	21.99	10.83 U	2.88 J	6.19 J	19.50	5.04
COMP V	3	A	14.46	9.30 U	3.64 J	5.82	19.00	6.46
COMP V	4	D	8.52 J	11.31 U	1.56 J	3.84 J	10.69	2.25 J
COMP V Replicate 1	5	B	32.33	0.93 J	3.69 J	9.19 J	21.54	6.18 J
COMP V Replicate 2	5	B	20.01 J	1.00 J	3.50 J	6.88 J	19.13	5.50 J
COMP V Replicate 3	5	B	8.13 J	0.87 J	2.97 J	3.72 J	13.91	4.79 J
COMP VI	1	C	21.36	11.79 U	1.30 J	3.96 J	11.38	3.22 J
COMP VI	2	A	16.74	11.24 U	6.09 U	5.74 J	16.18	5.18
COMP VI	3	B	28.24 J	1.25 J	2.94 J	6.07 J	21.43	6.17 J
COMP VI	4	A	25.85	11.48 U	6.21 U	6.31 J	19.25	5.12
COMP VI	5	D	13.24 U	13.00 U	7.03 U	7.59 U	11.85	5.75 U
R-AC	1	B	5.99 J	1.71 J	9.91	10.24	116.13	45.33
R-AC	2	C	17.61	11.74 U	5.90 J	10.37	87.75	29.94
R-AC	3	C	20.97	2.10 J	11.70	13.96	137.37	60.54
R-AC	4	A	22.01	10.69 U	8.89	12.28	102.49	46.67
R-AC	5	D	10.94 J	11.22 U	8.26	11.66	116.07	45.05
R-AM	1	B	6.69 J	1.08 J	1.78 J	3.59 J	22.81	9.18
R-AM Replicate 1	2	C	16.19 J	17.77 U	3.98 J	7.40 J	31.31	9.07
R-AM Replicate 2	2	C	23.50	17.99 U	9.74 U	8.47 J	33.90	11.14
R-AM Replicate 3	2	C	20.04	17.27 U	4.26 J	7.69 J	32.49	10.98
R-AM	3	B	14.29	3.75 J	3.55 J	7.85	54.61	24.39
R-AM	4	B	28.47	3.87 J	3.47 J	9.04 J	51.68	19.40
R-AM	5	B	8.39 J	5.25 J	4.44 J	7.96	68.52	27.39

TABLE J.2. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)					
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
R-BF	1	D	11.66 J	13.04 U	7.06 U	3.82 J	10.96	1.84 J
R-BF	2	B	11.68	0.55 J	2.07 J	4.34 J	14.77	4.17
R-BF	3	B	16.05	0.61 J	2.21 J	5.38 J	16.32	3.94 J
R-BF	4	A	20.74	12.12 U	6.56 U	6.68 J	13.30	3.72 J
R-BF	5	A	18.32	9.33 U	5.05 U	5.59	14.77	3.26 J
R-OS	1	B	13.24	0.45 J	2.14 J	4.69 J	12.40	1.51 J
R-OS	2	D	5.56 J	10.57 U	5.72 U	6.18 U	8.85	4.67 U
R-OS	3	B	18.49	10.63 U	2.07 J	5.43 J	12.95	1.50 J
R-OS	4	D	6.97 J	10.02 U	3.86 J	4.12 J	8.55	4.43 U
R-OS	5	C	17.91	9.64 U	5.49	4.78 J	11.69	0.92 J
R-PF	1	C	18.54	11.43 U	2.20 J	4.26 J	10.42	1.15 J
R-PF	2	C	13.68	10.96 U	5.93 U	4.65 J	10.97	1.36 J
R-PF Replicate 1	3	D	14.69 J	17.83 U	9.65 U	3.35 J	10.93	7.88 U
R-PF Replicate 2	3	D	12.15 J	17.36 U	9.40 U	10.14 U	12.01	7.67 U
R-PF Replicate 3	3	D	12.28 J	17.79 U	9.63 U	5.43 J	9.68	7.87 U
R-PF	4	D	8.75 J	13.19 U	7.14 U	5.02 J	8.95	5.83 U
R-PF	5	A	12.76	10.27 U	3.21 J	6.25	14.66	1.62 J
C-SB	1	C	8.93 J	9.26 U	2.45 J	4.22 J	12.08	2.02 J
C-SB	2	D	10.29 J	11.73 U	4.28 J	4.81 J	11.84	5.18 U
C-SB	3	B	4.58 J	11.11 U	1.42 J	3.06 J	8.77	1.24 J
C-SB Replicate 1	4	A	20.24	15.28 U	2.34 J	8.93 U	11.42	1.24 J
C-SB Replicate 2	4	A	19.28	14.85 U	8.04 U	7.19 J	12.18	6.56 U
C-SB Replicate 3	4	A	17.78	14.20 U	7.69 U	6.03 J	9.61	6.28 U
C-SB	5	D	9.57 J	12.45 U	6.74 U	4.35 J	8.39	5.50 U
C-NE	1	B	20.73	10.61 U	2.88 J	5.84 J	20.13	1.42 J
C-NE	2	B	11.65	11.17 U	2.54 J	4.38 J	12.96	1.06 J
C-NE	3	B	5.09 J	9.42 U	2.09 J	3.37 J	13.34	0.92 J
C-NE	4	B	11.77	11.34 U	2.64 J	4.89 J	16.39	1.25 J
C-NE	5	B	11.52	9.83 U	2.09 J	5.01 J	16.10	1.31 J
MSL Background	1	A	14.96	10.15 U	7.44	5.92 J	17.19	2.86 J
MSL Background	2	B	4.98 J	11.12 U	2.43 J	3.40 J	14.00	1.08 J
MSL Background	3	C	12.60	11.15 U	6.03 U	4.93 J	14.55	4.93 U
MSL Background	4	D	9.66 J	10.99 U	3.51 J	3.20 J	14.95	4.86 U
MSL Background	5	D	5.67 J	10.99 U	5.95 U	2.11 J	13.87	4.86 U

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

(b) U The analyte was not present above the level of the associated value.

TABLE J.3. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

<i>M. nasuta</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	Benzo(k) fluor-anthene	Benzo(a) Pyrene	Indeno (1,2,3-c) Pyrene	Dibenzo (a,h) anthracene	Benzo (g,h,i) perylene
COMP I	1	D	27.51	53.24	6.65 J ^(a)	10.05	22.03	19.81	10.26	8.99 U ^(b)	6.12 U	7.72 J
COMP I	2	D	41.42	76.66	9.74	16.22	25.78	18.34	17.23	7.91 U	5.38 U	10.73 U
COMP I	3	A	36.06	53.23	11.67	16.75	18.20	13.90	12.61	6.44 J	5.27 U	9.72 J
COMP I	4	B	36.17	61.56	12.27	18.96	25.18	17.15	20.67	10.17	1.01 J	14.56
COMP I	5	A	38.95	62.42	13.86	17.87	31.34	11.53	17.62	12.51	6.40 U	12.19 J
COMP II	1	O	18.08	31.92	5.21 J	10.89	20.21	10.81	13.46	9.44 U	6.43 U	12.81 U
COMP II	2	A	32.00	63.90	10.06	13.61	27.50	13.46	15.87	10.08	5.60 U	11.04 J
COMP II	3	C	22.80	38.67	4.85 J	9.00	14.67	17.78	12.35	7.71 U	5.25 U	10.46 U
COMP II	4	D	25.25	53.14	6.52 J	11.90	19.97	14.82	16.26	9.27 U	6.31 U	12.58 U
COMP II	5	C	28.97	56.84	8.33	13.08	22.68	14.55	14.90	8.48 U	5.77 U	9.33 J
COMP III	1	C	7.70	7.38	8.48 U	2.39 J	8.65 U	7.21 U	7.52 U	9.03 U	6.14 U	12.25 U
COMP III	2	C	13.18	10.53	1.95 J	4.00 J	5.80 J	3.59 J	3.46 J	8.06 U	5.48 U	10.93 U
COMP III	3	A	13.60	13.26	4.09 J	6.07	7.94 J	3.98 J	4.21 J	8.32 U	5.66 U	4.04 J
COMP III	4	O	14.35	13.81	1.90 J	5.97	7.97 J	4.13 J	4.03 J	8.35 U	5.68 U	11.33 U
COMP III	5	C	8.05	7.58	1.20 J	3.93 J	7.26 J	3.27 J	2.61 J	7.87 U	5.36 U	10.67 U
TC-5 Upper Comp	1	C	174.18	325.30	53.57	81.43	116.32	74.30	71.11	28.43	5.60 U	31.81
TC-5 Upper Comp	2	C	152.49	285.94	41.59	64.17	92.45	76.73	67.42	28.42	5.56 U	34.52
TC-5 Upper Comp	3	C	179.08	312.37	42.87	75.64	75.69	76.79	73.75	8.56 U	5.82 U	26.87
TC-5 Upper Comp	4	A	130.79	206.83	43.44	63.19	65.73	41.43	56.37	27.47	5.73 U	24.16
TC-5 Upper Comp	5	A	134.31	205.69	43.24	62.33	54.45	39.33	41.76	19.56	6.15 U	18.01
COMP IV	1	C	7.84	5.98 J	1.45 J	3.48 J	9.70 U	8.08 U	8.43 U	10.12 U	6.89 U	13.73 U
COMP IV	2	C	5.82	4.89 J	7.63 U	1.83 J	7.78 U	6.49 U	6.76 U	8.12 U	5.53 U	11.02 U
COMP IV	3	A	10.42	7.16	2.50 J	7.34	3.14 J	1.82 J	6.05 U	7.27 U	4.95 U	9.86 U
COMP IV	4	C	6.84 J	3.74 J	13.71 U	1.98 J	13.99 U	11.66 U	12.16 U	14.60 U	9.93 U	19.80 U
COMP IV	5	A	9.08	6.00	2.04 J	7.16	5.39 J	6.31 U	6.58 U	7.90 U	5.37 U	10.71 U
COMP V	1	A	41.12	144.97	18.76	24.31	52.14	32.62	27.20	10.97	5.79 U	17.22
COMP V	2	A	47.58	178.64	17.53	32.02	55.69	41.30	36.92	11.24	5.80 U	14.27
COMP V	3	A	50.49	161.32	30.13	32.48	71.90	46.69	47.22	25.06	4.99 U	25.83
COMP V	4	D	26.30	101.03	9.04	14.46	51.58	28.49	26.37	9.74	6.07 U	14.22
COMP V Replicate 1	5	B	42.92	148.45	18.54	29.90	52.93	33.99	41.18	14.87 J	1.75 J	19.95 J
COMP V Replicate 2	5	B	43.61	148.00	18.87	30.50	52.07	42.32	41.61	15.64 J	2.05 J	20.76 J
COMP V Replicate 3	5	B	41.49	143.01	17.56	27.32	57.03	36.91	41.60	13.74	1.35 J	17.29

TABLE J.3. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> 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-c) Pyrene	Dibenzo (a,h) anthracene	Benzo (g,h,i) perylene
COMP VI	1	C	22.83	110.09	10.15	15.76	50.03	29.01	23.95	9.58	6.32 U	16.65
COMP VI	2	A	38.42	161.27	25.05	28.65	52.95	39.03	33.25	13.44	6.03 U	15.65
COMP VI	3	B	45.89	182.55	18.88 J	32.25	71.90	47.99	47.83	17.04 J	1.92 J	21.59 J
COMP VI	4	A	37.43	143.66	23.87	28.29	46.28	45.69	35.82	16.46	6.15 U	16.27
COMP VI	5	O	30.29	150.58	9.77	18.72	54.01	30.21	33.08	10.24 U	6.97 U	13.89 U
R-AC	1	B	1032.19	2345.15	224.75	302.80	287.11	225.83	346.82	100.21	5.39	108.95
R-AC	2	C	636.14	1490.52	103.07	147.79	202.34	249.31	241.54	50.94	6.29 U	58.95
R-AC	3	C	1448.54	3521.14	258.21	319.97	451.28	280.34	435.06	105.36	5.59 U	102.65
R-AC	4	A	1243.58	2791.36	321.90	352.76	370.49	221.94	378.29	141.71	5.73 U	127.99
R-AC	5	D	1262.84	2924.16	302.35	375.46	326.20	242.69	392.56	113.67	7.03	127.86
R-AM	1	B	162.42	171.26	50.41	86.61	37.82	44.61	49.84	12.26	1.68 J	13.42
R-AM Replicate 1	2	C	203.36	198.96	44.60	70.65	38.28	51.02	45.45	14.01 U	9.53 U	14.23 J
R-AM Replicate 2	2	C	226.25	230.78	51.39	93.71	45.44	44.10	43.38	14.18 U	9.65 U	12.39 J
R-AM Replicate 3	2	C	216.37	215.09	45.16	82.35	34.51	49.67	53.14	13.61 U	9.26 U	15.41 J
R-AM	3	B	354.99	395.26	160.62	233.78	104.23	117.42	142.51	44.59	4.91 J	42.65
R-AM	4	B	391.35	460.95	186.37	302.05	120.31	141.95	177.52	48.44	5.86 J	50.20
R-AM	5	B	311.37	338.03	134.61	209.50	77.97	82.04	108.76	29.88	3.64 J	31.83
R-BF	1	D	26.28	28.80	7.76 J	13.73	24.31	10.39	15.11	7.50 J	6.99 U	10.37 J
R-BF	2	B	58.02	63.86	14.10	27.84	39.53	20.51	27.88	12.22	1.14 J	20.86
R-BF	3	B	48.81	59.98	12.52	23.16	36.70	21.81	24.93	8.09 U	1.10 J	19.47
R-BF	4	A	50.76	47.60	15.75	25.15	33.36	16.51	20.17	12.23	6.50 U	16.29
R-BF	5	A	44.60	42.84	13.52	21.37	29.24	18.70	18.48	13.64	5.00 U	19.51
R-OS	1	B	20.42	14.06	3.06 J	8.18	3.64 J	1.60 J	1.79 J	1.38 J	5.53 U	2.23 J
R-OS	2	D	8.24	5.72	7.82 U	3.91 J	7.98 U	6.65 U	6.94 U	8.33 U	5.67 U	11.30 U
R-OS	3	B	10.60	6.94	2.58 J	5.57	3.43 J	1.67 J	1.80 J	1.23 J	5.70 U	1.74 J
R-OS	4	D	10.66	8.27	1.10 J	3.54 J	4.65 J	6.30 U	6.57 U	7.90 U	5.37 U	10.71 U
R-OS	5	C	11.65	8.38	4.76 J	4.73 J	2.37 J	2.10 J	1.48 J	7.60 U	5.17 U	10.31 U
R-PF	1	C	8.70	7.29	1.02 J	2.49 J	3.89 J	2.22 J	7.50 U	9.01 U	6.13 U	12.22 U
R-PF	2	C	8.24	7.73	8.11 U	2.43 J	8.28 U	6.90 U	7.19 U	8.64 U	5.88 U	11.72 U
R-PF Replicate 1	3	D	10.38	8.91 J	13.19 U	4.68 J	13.47 U	11.22 U	11.70 U	14.06 U	9.56 U	19.06 U
R-PF Replicate 2	3	O	9.39	8.22 J	12.84 U	3.35 J	13.11 U	10.93 U	11.39 U	13.68 U	9.31 U	18.55 U
R-PF Replicate 3	3	D	8.12	7.48 J	13.16 U	3.00 J	13.43 U	11.20 U	11.67 U	14.02 U	9.54 U	19.02 U
R-PF	4	D	8.99	6.61 J	9.76 U	3.38 J	4.43 J	8.30 U	1.20 J	10.40 U	7.07 U	14.10 U
R-PF	5	A	13.83	8.28	2.80 J	7.15	4.89 J	2.21 J	2.06 J	8.10 U	5.51 U	10.98 U

TABLE J.3. (contd)

			<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ dry weight)									
Sediment Treatment	Replicate	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) Pyrene	Dibenzo (a,h) anthracene	Benzo (g,h,i) perylene
C-SB	1	C	23.93	12.49	2.75 J	7.34	7.04	6.20	6.08 U	7.30 U	4.97 U	9.90 U
C-SB	2	D	25.97	11.83	2.59 J	5.72 J	6.65 J	2.99 J	6.78 J	9.24 U	6.29 U	12.53 U
C-SB	3	B	31.89	18.35	4.31 J	8.20	8.64	5.06 J	2.73 J	1.98 J	5.96 U	2.76 J
C-SB Replicate 1	4	A	18.77	9.74	2.67 J	6.43 J	4.22 J	3.34 J	1.76 J	12.05 U	8.19 U	16.33 U
C-SB Replicate 2	4	A	21.22	26.46	2.34 J	6.07 J	6.03 J	2.61 J	9.74 U	11.70 U	7.96 U	15.87 U
C-SB Replicate 3	4	A	18.51	9.18	1.81 J	7.20 J	5.65 J	2.55 J	9.32 U	11.19 U	7.62 U	15.18 U
C-SB	5	D	19.00	13.08	1.99 J	6.52	6.74 J	4.05 J	8.17 U	9.81 U	6.67 U	13.31 U
C-NE	1	B	18.44	12.42	3.30 J	8.98	3.29 J	1.40 J	1.21 J	0.63 J	5.69 U	1.39 J
C-NE	2	B	11.98	7.53	2.27 J	7.55	2.22 J	1.18 J	0.91 J	8.80 U	5.99 U	11.94 U
C-NE	3	B	16.74	10.71	2.21 J	7.04	2.30 J	1.12 J	0.61 J	7.43 U	5.05 U	10.07 U
C-NE	4	B	20.79	13.06	3.54 J	10.58	2.76 J	1.19 J	0.82 J	8.93 U	6.08 U	12.12 U
C-NE	5	B	17.07	10.93	2.79 J	8.87	2.82 J	1.31 J	0.92 J	0.61 J	5.27 U	0.94 J
MSL Background	1	A	72.08	43.19	6.09 J	19.82	12.05	4.55 J	1.39 J	8.00 U	5.44 U	10.85 U
MSL Background	2	B	69.47	41.24	7.14 J	20.84	7.30 J	5.28 J	2.66 J	0.75 J	5.96 U	11.88 U
MSL Background	3	C	72.63	63.42	6.25 J	19.66	13.37	8.04	7.32 U	8.79 U	5.98 U	11.92 U
MSL Background	4	D	50.62	36.03	5.42 J	24.22	11.57	6.57 J	7.21 U	8.66 U	5.89 U	11.75 U
MSL Background	5	D	85.68	58.81	6.53 J	25.76	9.45	9.03	7.21 U	8.66 U	5.89 U	11.74 U

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

(b) U The analyte was not present above the level of the associated value.

TABLE J.4. Total Polynuclear Aromatic Hydrocarbons (PAHs), Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PAHs ($\mu\text{g}/\text{kg}$ wet weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP I	1	D	10.85	3.12	17.06	20.19
COMP I	2	D	12.31	4.38	25.29	29.67
COMP I	3	A	12.58	5.26	22.46	27.72
COMP I	4	B	10.95	4.12	23.83	27.94
COMP I	5	A	12.42	5.75	27.12	32.87
COMP II	1	D	9.87	2.01	10.91	12.93
COMP II	2	A	11.86	4.99	23.43	28.41
COMP II	3	C	12.66	4.85	15.21	20.06
COMP II	4	D	10.52	2.41	15.55	17.95
COMP II	5	C	10.91	4.74	18.40	23.14
COMP III	1	C	10.74	2.79	1.88	4.67
COMP III	2	C	12.02	3.30	5.11	8.41
COMP III	3	A	11.73	4.25	6.71	10.96
COMP III	4	D	11.69	2.49	6.10	8.58
COMP III	5	C	12.22	2.90	4.14	7.04
TC-5 Upper Comp	1	C	11.76	8.31	112.52	120.83
TC-5 Upper Comp	2	C	11.72	6.85	98.86	105.71
TC-5 Upper Comp	3	C	11.42	8.26	98.53	106.79
TC-5 Upper Comp	4	A	12.42	8.62	82.62	91.23
TC-5 Upper Comp	5	A	10.78	5.68	66.71	72.38
COMP IV	1	C	9.62	3.11	1.80	4.91
COMP IV	2	C	11.93	2.84	1.50	4.33
COMP IV	3	A	13.03	3.80	4.22	8.02
COMP IV	4	C	13.34	4.06	1.68	5.74
COMP IV	5	A	12.31	4.76	3.65	8.41
COMP V	1	A	11.44	4.12	42.23	46.35
COMP V	2	A	13.28	7.39	57.81	65.20
COMP V	3	A	13.30	6.57	65.33	71.90
COMP V	4	D	10.90	2.93	30.66	33.59
COMP V Replicate 1	5	B	12.39	9.15	50.11	59.26
COMP V Replicate 2	5	B	12.39	6.94	51.46	58.40
COMP V Replicate 3	5	B	12.39	4.26	49.22	53.48
COMP VI	1	C	10.47	4.31	30.15	34.47
COMP VI	2	A	11.02	4.83	44.94	49.77
COMP VI	3	B	12.94	8.55	63.14	71.69
COMP VI	4	A	10.78	6.09	42.43	48.52
COMP VI	5	D	9.48	1.12	30.96	32.08
R-AC	1	B	12.41	23.49	617.87	641.36
R-AC	2	C	10.54	15.97	335.11	351.08
R-AC	3	C	11.77	29.03	814.85	843.89
R-AC	4	A	11.56	22.24	687.94	710.18
R-AC	5	D	11.02	21.16	669.63	690.79
R-AM	1	B	10.05	4.54	63.36	67.90
R-AM Replicate 1	2	C	10.33	7.02	68.87	75.90
R-AM Replicate 2	2	C	10.33	7.96	77.23	85.19
R-AM Replicate 3	2	C	10.33	7.80	73.54	81.34
R-AM	3	B	12.31	13.34	197.00	210.34
R-AM	4	B	12.40	14.37	233.68	248.06

TABLE J.4. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PAHs ($\mu\text{g/kg}$ wet weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
R-AM	5	B	10.44	12.73	138.58	151.31
R-BF	1	D	11.13	3.15	16.05	19.20
R-BF	2	B	13.42	5.04	38.37	43.41
R-BF	3	B	12.07	5.37	29.99	35.36
R-BF	4	A	10.12	4.50	24.07	28.57
R-BF	5	A	12.83	5.38	28.47	33.85
R-OS	1	B	12.06	4.15	6.80	10.95
R-OS	2	D	11.53	1.66	2.06	3.72
R-OS	3	B	11.56	4.67	4.11	8.78
R-OS	4	D	12.33	2.90	3.48	6.38
R-OS	5	C	12.74	5.20	4.52	9.71
R-PF	1	C	10.78	3.94	2.76	6.70
R-PF	2	C	11.26	3.45	2.07	5.53
R-PF Replicate 1	3	D	10.40	3.01	2.49	5.51
R-PF Replicate 2	3	D	10.40	2.51	2.18	4.69
R-PF Replicate 3	3	D	10.40	2.85	1.94	4.78
R-PF	4	D	9.33	2.12	2.30	4.42
R-PF	5	A	12.22	4.70	5.04	9.74
C-SB	1	C	12.45	3.70	7.44	11.14
C-SB	2	D	10.40	3.25	6.50	9.75
C-SB	3	B	10.96	2.09	9.20	11.29
C-SB Replicate 1	4	A	11.33	3.99	5.32	9.31
C-SB Replicate 2	4	A	11.33	4.38	7.34	11.72
C-SB Replicate 3	4	A	11.33	3.79	5.09	8.88
C-SB	5	D	9.85	2.20	5.06	7.26
C-NE	1	B	11.64	5.93	5.94	11.88
C-NE	2	B	10.40	3.39	3.50	6.89
C-NE	3	B	13.08	3.25	5.33	8.57
C-NE	4	B	10.83	4.00	5.71	9.71
C-NE	5	B	12.59	45.25	58.10	103.35
MSL Background	1	A	12.16	5.88	19.36	25.24
MSL Background	2	B	10.85	2.81	16.78	19.58
MSL Background	3	C	10.94	3.51	20.05	23.56
MSL Background	4	D	11.08	3.47	14.89	18.36
MSL Background	5	D	11.18	2.42	21.82	24.24

TABLE J.5. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs ($\mu\text{g}/\text{kg}$ wet weight)					
				Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Target DL (a)				20.0	20.0	20.0	20.0	20.0	20.0
Achieved DL High				NA (b)	1.86	1.34	1.05	NA	1.09
Achieved DL Low				NA	1.15	0.64	0.69	NA	0.54
COMP I	1	O	10.85	0.89 J (c)	1.24 U (d)	0.29 J	0.51 J	1.19	0.26 J
COMP I	2	O	12.31	1.08 J	1.24 U	0.67 U	0.74	2.22	0.35 J
COMP I	3	A	12.58	2.28	1.24 U	0.67 U	0.72 J	1.81	0.46 J
COMP I	4	B	10.95	1.22 J	0.05 J	0.28 J	0.37 J	1.75	0.45 J
COMP I	5	A	12.42	2.44	1.48 U	0.80 U	0.73 J	1.99	0.59 J
COMP II	1	D	9.87	0.94 J	1.18 U	0.64 U	0.69 U	0.89	0.18 J
COMP II	2	A	11.86	1.78	1.24 U	0.45 J	0.67 J	1.74	0.34 J
COMP II	3	C	12.66	1.71	1.24 U	0.49 J	0.71 J	1.67	0.28 J
COMP II	4	O	10.52	0.83 J	1.24 U	0.67 U	0.72 U	1.28	0.29 J
COMP II	5	C	10.91	1.92	1.17 U	0.38 J	0.63 J	1.54	0.27 J
COMP III	1	C	10.74	1.30	1.23 U	0.67 U	0.45 J	1.05	0.54 U
COMP III	2	C	12.02	1.52	1.23 U	0.66 U	0.48 J	1.30	0.54 U
COMP III	3	A	11.73	1.64	1.24 U	0.32 J	0.71 J	1.45	0.13 J
COMP III	4	D	11.69	0.97 J	1.24 U	0.67 U	0.31 J	1.21	0.55 U
COMP III	5	C	12.22	1.23 J	1.22 U	0.18 J	0.50 J	0.91	0.08 J
TC-5 Upper Comp	1	C	11.76	2.70	1.23 U	0.66 U	0.84	3.82	0.96
TC-5 Upper Comp	2	C	11.72	2.12	1.21 U	0.37 J	0.59 J	3.15	0.62
TC-5 Upper Comp	3	C	11.42	2.51	1.24 U	0.67 U	0.96	4.02	0.78
TC-5 Upper Comp	4	A	12.42	3.17	1.33 U	0.28 J	0.61 J	2.64	0.59
TC-5 Upper Comp	5	A	10.78	1.76	1.24 U	0.67 U	0.79	2.54	0.59
COMP IV	1	C	9.62	1.42	1.24 U	0.20 J	0.42 J	1.06	0.55 U
COMP IV	2	C	11.93	1.33	1.23 U	0.67 U	0.49 J	1.01	0.54 U
COMP IV	3	A	13.03	1.47	1.20 U	0.32 J	0.58 J	1.31	0.12 J
COMP IV	4	C	13.34	2.14 J	2.47 U	1.34 U	0.63 J	1.30	1.09 U
COMP IV	5	A	12.31	2.04	1.23 U	0.67 J	0.75	1.30	0.55 U
COMP V	1	A	11.44	1.28	1.24 U	0.67 U	0.55 J	1.72	0.56
COMP V	2	A	13.28	2.92	1.44 U	0.38 J	0.82 J	2.59	0.67
COMP V	3	A	13.30	1.92	1.24 U	0.48 J	0.77	2.53	0.86
COMP V	4	D	10.90	0.93 J	1.23 U	0.17 J	0.42 J	1.17	0.25 J
COMP V Replicate 1	5	B	12.39	4.01	0.12 J	0.46 J	1.14 J	2.67	0.77 J
COMP V Replicate 2	5	B	12.39	2.48 J	0.12 J	0.43 J	0.85 J	2.37	0.68 J
COMP V Replicate 3	5	B	12.39	1.01 J	0.11 J	0.37 J	0.46 J	1.72	0.59 J
COMP VI	1	C	10.47	2.24	1.23 U	0.14 J	0.41 J	1.19	0.34 J
COMP VI	2	A	11.02	1.85	1.24 U	0.67 U	0.63 J	1.78	0.57
COMP VI	3	B	12.94	3.65 J	0.16 J	0.38 J	0.79 J	2.77	0.80 J
COMP VI	4	A	10.78	2.79	1.24 U	0.67 U	0.68 J	2.07	0.55
COMP VI	5	D	9.48	1.25 U	1.23 U	0.67 U	0.72 U	1.12	0.54 U
R-AC	1	B	12.41	0.74 J	0.21 J	1.23	1.27	14.41	5.62
R-AC	2	C	10.54	1.86	1.24 U	0.62 J	1.09	9.25	3.15
R-AC	3	C	11.77	2.47	0.25 J	1.38	1.64	16.17	7.13
R-AC	4	A	11.56	2.54	1.24 U	1.03	1.42	11.85	5.40
R-AC	5	D	11.02	1.21 J	1.24 U	0.91	1.29	12.79	4.97

TABLE J.5. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
				Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
R-AM	1	B	10.05	0.67 J	0.11 J	0.18 J	0.36 J	2.29	0.92
R-AM Replicate 1	2	C	10.33	1.67 J	1.84 U	0.41 J	0.76 J	3.24	0.94
R-AM Replicate 2	2	C	10.33	2.43	1.86 U	1.01 U	0.88 J	3.50	1.15
R-AM Replicate 3	2	C	10.33	2.07	1.78 U	0.44 J	0.79 J	3.36	1.13
R-AM	3	B	12.31	1.76	0.46 J	0.44 J	0.97	6.72	3.00
R-AM	4	B	12.40	3.53	0.48 J	0.43 J	1.12 J	6.41	2.41
R-AM	5	B	10.44	0.88 J	0.55 J	0.46 J	0.83	7.15	2.86
R-BF	1	D	11.13	1.30 J	1.45 U	0.79 U	0.43 J	1.22	0.20 J
R-BF	2	B	13.42	1.57	0.07 J	0.28 J	0.58 J	1.98	0.56
R-BF	3	B	12.07	1.94	0.07 J	0.27 J	0.65 J	1.97	0.48 J
R-BF	4	A	10.12	2.10	1.23 U	0.66 U	0.68 J	1.35	0.38 J
R-BF	5	A	12.83	2.35	1.20 U	0.65 U	0.72	1.89	0.42 J
R-OS	1	B	12.06	1.60	0.05 J	0.26 J	0.57 J	1.50	0.18 J
R-OS	2	D	11.53	0.64 J	1.22 U	0.66 U	0.71 U	1.02	0.54 U
R-OS	3	B	11.56	2.14	1.23 U	0.24 J	0.63 J	1.50	0.17 J
R-OS	4	D	12.33	0.86 J	1.24 U	0.48 J	0.51 J	1.05	0.55 U
R-OS	5	C	12.74	2.28	1.23 U	0.70	0.61 J	1.49	0.12 J
R-PF	1	C	10.78	2.00	1.23 U	0.24 J	0.46 J	1.12	0.12 J
R-PF	2	C	11.26	1.54	1.23 U	0.67 U	0.52 J	1.24	0.15 J
R-PF Replicate 1	3	D	10.40	1.53 J	1.86 U	1.00 U	0.35 J	1.14	0.82 U
R-PF Replicate 2	3	D	10.40	1.26 J	1.81 U	0.98 U	1.05 U	1.25	0.80 U
R-PF Replicate 3	3	D	10.40	1.28 J	1.85 U	1.00 U	0.56 J	1.01	0.82 U
R-PF	4	D	9.33	0.82 J	1.23 U	0.67 U	0.47 J	0.84	0.54 U
R-PF	5	A	12.22	1.56	1.25 U	0.39 J	0.76	1.79	0.20 J
C-SB	1	C	12.45	1.11 J	1.15 U	0.31 J	0.53 J	1.50	0.25 J
C-SB	2	D	10.40	1.07 J	1.22 U	0.44 J	0.50 J	1.23	0.54 U
C-SB	3	B	10.96	0.50 J	1.22 U	0.16 J	0.34 J	0.96	0.14 J
C-SB Replicate 1	4	A	11.33	2.29	1.73 U	0.27 J	1.01 U	1.29	0.14 J
C-SB Replicate 2	4	A	11.33	2.19	1.68 U	0.91 U	0.81 J	1.38	0.74 U
C-SB Replicate 3	4	A	11.33	2.02	1.61 U	0.87 U	0.68 J	1.09	0.71 U
C-SB	5	D	9.85	0.94 J	1.23 U	0.66 U	0.43 J	0.83	0.54 U
C-NE	1	B	11.64	2.41	1.23 U	0.34 J	0.68 J	2.34	0.17 J
C-NE	2	B	10.40	1.21	1.16 U	0.26 J	0.46 J	1.35	0.11 J
C-NE	3	B	13.08	0.67 J	1.23 U	0.27 J	0.44 J	1.75	0.12 J
C-NE	4	B	10.83	1.27	1.23 U	0.29 J	0.53 J	1.77	0.14 J
C-NE	5	B	12.59	1.45	1.24 U	0.26 J	0.63 J	2.03	0.16 J
MSL Background	1	A	12.16	1.82	1.23 U	0.90	0.72 J	2.09	0.35 J
MSL Background	2	B	10.85	0.54 J	1.21 U	0.26 J	0.37 J	1.52	0.12 J
MSL Background	3	C	10.94	1.38	1.22 U	0.66 U	0.54 J	1.59	0.54 U
MSL Background	4	D	11.08	1.07 J	1.22 U	0.39 J	0.35 J	1.66	0.54 U
MSL Background	5	D	11.18	0.63 J	1.23 U	0.66 U	0.24 J	1.55	0.54 U

(a) DL Detection limit.

(b) NA Not applicable; analyte detected in all samples.

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

(d) U The analyte was not present above the level of the associated value.

TABLE J.6. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)									
				Fluor-anthene	Pyrene	Benzo(a) Anthra-cene	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)				20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Achieved High DL				NA ^(b)	NA	1.83	NA	1.87	1.17	1.62	1.95	1.32	2.64
Achieved Low DL				NA	NA	0.91	NA	0.92	0.77	0.76	0.92	0.62	1.23
COMP I	1	D	10.85	2.98	5.78	0.72 J ^(c)	1.09	2.39	2.15	1.11	0.98 U ^(d)	0.66 U	0.84 J
COMP I	2	D	12.31	5.10	9.44	1.20	2.00	3.17	2.26	2.12	0.97 U	0.66 U	1.32 U
COMP I	3	A	12.58	4.53	6.69	1.47	2.11	2.29	1.75	1.59	0.81 J	0.66 U	1.22 J
COMP I	4	B	10.95	3.96	6.74	1.34	2.08	2.76	1.88	2.26	1.11	0.11 J	1.59
COMP I	5	A	12.42	4.84	7.76	1.72	2.22	3.89	1.43	2.19	1.55	0.80 U	1.51 J
COMP II	1	D	9.87	1.78	3.15	0.51 J	1.07	1.99	1.07	1.33	0.93 U	0.63 U	1.26 U
COMP II	2	A	11.86	3.80	7.58	1.19	1.61	3.26	1.60	1.88	1.20	0.66 U	1.31 J
COMP II	3	C	12.66	2.89	4.90	0.61 J	1.14	1.86	2.25	1.56	0.98 U	0.66 U	1.32 U
COMP II	4	O	10.52	2.66	5.59	0.69 J	1.25	2.10	1.56	1.71	0.97 U	0.66 U	1.32 U
COMP II	5	C	10.91	3.16	6.20	0.91	1.43	2.47	1.59	1.62	0.92 U	0.63 U	1.02 J
COMP III	1	C	10.74	0.83	0.79	0.91 U	0.26 J	0.93 U	0.77 U	0.81 U	0.97 U	0.66 U	1.32 U
COMP III	2	C	12.02	1.58	1.27	0.23 J	0.48 J	0.70 J	0.43 J	0.42 J	0.97 U	0.66 U	1.31 U
COMP III	3	A	11.73	1.60	1.56	0.48 J	0.71	0.93 J	0.47 J	0.49 J	0.98 U	0.66 U	0.47 J
COMP III	4	D	11.69	1.68	1.61	0.22 J	0.70	0.93 J	0.48 J	0.47 J	0.98 U	0.66 U	1.32 U
COMP III	5	C	12.22	0.98	0.93	0.15 J	0.48 J	0.89 J	0.40 J	0.32 J	0.96 U	0.66 U	1.30 U
TC-5 Upper Comp	1	C	11.76	20.49	38.27	6.30	9.58	13.68	8.74	8.37	3.34	0.66 U	3.74
TC-5 Upper Comp	2	C	11.72	17.87	33.50	4.87	7.52	10.83	8.99	7.90	3.33	0.65 U	4.04
TC-5 Upper Comp	3	C	11.42	20.44	35.66	4.89	8.64	8.64	8.77	8.42	0.98 U	0.66 U	3.07
TC-5 Upper Comp	4	A	12.42	16.25	25.69	5.40	7.85	8.16	5.15	7.00	3.41	0.71 U	3.00
TC-5 Upper Comp	5	A	10.78	14.48	22.18	4.66	6.72	5.87	4.24	4.50	2.11	0.66 U	1.94
COMP IV	1	C	9.62	0.75	0.58 J	0.14 J	0.33 J	0.93 U	0.78 U	0.81 U	0.97 U	0.66 U	1.32 U
COMP IV	2	C	11.93	0.69	0.58 J	0.91 U	0.22 J	0.93 U	0.77 U	0.81 U	0.97 U	0.66 U	1.31 U
COMP IV	3	A	13.03	1.36	0.93	0.33 J	0.96	0.41 J	0.24 J	0.79 U	0.95 U	0.64 U	1.28 U
COMP IV	4	C	13.34	0.91 J	0.50 J	1.83 U	0.26 J	1.87 U	1.55 U	1.62 U	1.95 U	1.32 U	2.64 U
COMP IV	5	A	12.31	1.12	0.74	0.25 J	0.88	0.66 J	0.78 U	0.81 U	0.97 U	0.66 U	1.32 U
COMP V	1	A	11.44	4.70	16.58	2.15	2.78	5.96	3.73	3.11	1.25	0.66 U	1.97
COMP V	2	A	13.28	6.32	23.73	2.33	4.25	7.40	5.49	4.90	1.49	0.77 U	1.90
COMP V	3	A	13.30	6.72	21.46	4.01	4.32	9.56	6.21	6.28	3.33	0.66 U	3.44
COMP V	4	D	10.90	2.87	11.02	0.99	1.58	5.62	3.11	2.88	1.06	0.66 U	1.55

TABLE J.6. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ wet 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
COMP V Replicate 1	5	B	12.39	5.32	18.39	2.30	3.70	6.56	4.21	5.10	1.84 J	0.22 J	2.47 J
COMP V Replicate 2	5	B	12.39	5.40	18.33	2.34	3.78	6.45	5.24	5.15	1.94 J	0.25 J	2.57 J
COMP V Replicate 3	5	B	12.39	5.14	17.72	2.18	3.38	7.06	4.57	5.15	1.70	0.17 J	2.14
COMP VI	1	C	10.47	2.39	11.52	1.06	1.65	5.24	3.04	2.51	1.00	0.66 U	1.74
COMP VI	2	A	11.02	4.23	17.78	2.76	3.16	5.84	4.30	3.66	1.48	0.66 U	1.72
COMP VI	3	B	12.94	5.94	23.63	2.44	4.17	9.31	6.21	6.19	2.21 J	0.25 J	2.79 J
COMP VI	4	A	10.78	4.03	15.48	2.57	3.05	4.99	4.92	3.86	1.77	0.66 U	1.75
COMP VI	5	D	9.48	2.87	14.27	0.93	1.77	5.12	2.86	3.14	0.97 U	0.66 U	1.32 U
R-AC	1	B	12.41	128.08	291.01	27.89	37.57	35.63	28.02	43.04	12.44	0.67	13.52
R-AC	2	C	10.54	67.02	157.04	10.86	15.57	21.32	26.27	25.45	5.37	0.66 U	6.21
R-AC	3	C	11.77	170.31	414.47	30.39	37.66	53.12	33.00	51.21	12.40	0.66 U	12.08
R-AC	4	A	11.56	143.78	322.74	37.22	40.79	42.84	25.66	43.74	16.38	0.66 U	14.80
R-AC	5	D	11.02	139.20	322.33	33.33	41.39	35.96	26.75	43.27	12.53	0.77	14.09
R-AM	1	B	10.05	16.33	17.22	5.07	8.71	3.80	4.48	5.01	1.23	0.17 J	1.35
R-AM Replicate 1	2	C	10.33	21.01	20.56	4.61	7.30	3.96	5.27	4.70	1.45 U	0.98 U	1.47 J
R-AM Replicate 2	2	C	10.33	23.38	23.85	5.31	9.68	4.70	4.56	4.48	1.47 U	1.00 U	1.28 J
R-AM Replicate 3	2	C	10.33	22.36	22.23	4.67	8.51	3.57	5.13	5.49	1.41 U	0.96 U	1.59 J
R-AM	3	B	12.31	43.68	48.64	19.76	28.77	12.83	14.45	17.54	5.49	0.60 J	5.25
R-AM	4	B	12.40	48.52	57.14	23.10	37.45	14.91	17.60	22.01	6.01	0.73 J	6.22
R-AM	5	B	10.44	32.50	35.28	14.05	21.87	8.14	8.56	11.35	3.12	0.38 J	3.32
R-BF	1	D	11.13	2.92	3.20	0.86 J	1.53	2.70	1.16	1.68	0.83 J	0.78 U	1.15 J
R-BF	2	B	13.42	7.79	8.57	1.89	3.74	5.30	2.75	3.74	1.64	0.15 J	2.80
R-BF	3	B	12.07	5.89	7.24	1.51	2.79	4.43	2.63	3.01	0.98 U	0.13 J	2.35
R-BF	4	A	10.12	5.14	4.82	1.59	2.55	3.38	1.67	2.04	1.24	0.66 U	1.65
R-BF	5	A	12.83	5.72	5.50	1.73	2.74	3.75	2.40	2.37	1.75	0.64 U	2.50
R-OS	1	B	12.06	2.46	1.70	0.37 J	0.99	0.44 J	0.19 J	0.22 J	0.17 J	0.67 U	0.27 J
R-OS	2	D	11.53	0.95	0.66	0.90 U	0.45 J	0.92 U	0.77 U	0.80 U	0.96 U	0.65 U	1.30 U
R-OS	3	B	11.56	1.23	0.80	0.30 J	0.64	0.40 J	0.19 J	0.21 J	0.14 J	0.66 U	0.20 J
R-OS	4	D	12.33	1.31	1.02	0.14 J	0.44 J	0.57 J	0.78 U	0.81 U	0.97 U	0.66 U	1.32 U
R-OS	5	C	12.74	1.48	1.07	0.61 J	0.60 J	0.30 J	0.27 J	0.19 J	0.97 U	0.66 U	1.31 U

TABLE J.6. (contd)

				<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ wet weight)									
Sediment Treatment	Replicate	Analytical Batch	Percent 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
R-PF	1	C	10.78	0.94	0.79	0.11 J	0.27 J	0.42 J	0.24 J	0.81 U	0.97 U	0.66 U	1.32 U
R-PF	2	C	11.26	0.93	0.87	0.91 U	0.27 J	0.93 U	0.78 U	0.81 U	0.97 U	0.66 U	1.32 U
R-PF Replicate 1	3	D	10.40	1.08	0.93 J	1.37 U	0.49 J	1.40 U	1.17 U	1.22 U	1.46 U	0.99 U	1.98 U
R-PF Replicate 2	3	D	10.40	0.98	0.86 J	1.34 U	0.35 J	1.36 U	1.14 U	1.19 U	1.42 U	0.97 U	1.93 U
R-PF Replicate 3	3	D	10.40	0.84	0.78 J	1.37 U	0.31 J	1.40 U	1.17 U	1.21 U	1.46 U	0.99 U	1.98 U
R-PF	4	D	9.33	0.84	0.62 J	0.91 U	0.32 J	0.41 J	0.77 U	0.11 J	0.97 U	0.66 U	1.32 U
R-PF	5	A	12.22	1.69	1.01	0.34 J	0.87	0.60 J	0.27 J	0.25 J	0.99 U	0.67 U	1.34 U
C-SB	1	C	12.45	2.98	1.56	0.34 J	0.91	0.88	0.77	0.76 U	0.91 U	0.62 U	1.23 U
C-SB	2	D	10.40	2.70	1.23	0.27 J	0.59 J	0.69 J	0.31 J	0.70 J	0.96 U	0.65 U	1.30 U
C-SB	3	B	10.96	3.50	2.01	0.47 J	0.90	0.95	0.55 J	0.30 J	0.22 J	0.65 U	0.30 J
C-SB Replicate 1	4	A	11.33	2.13	1.10	0.30 J	0.73 J	0.48 J	0.38 J	0.20 J	1.37 U	0.93 U	1.85 U
C-SB Replicate 2	4	A	11.33	2.41	3.00	0.27 J	0.69 J	0.68 J	0.30 J	1.10 U	1.33 U	0.90 U	1.80 U
C-SB Replicate 3	4	A	11.33	2.10	1.04	0.21 J	0.82 J	0.64 J	0.29 J	1.06 U	1.27 U	0.86 U	1.72 U
C-SB	5	D	9.85	1.87	1.29	0.20 J	0.64	0.66 J	0.40 J	0.80 U	0.97 U	0.66 U	1.31 U
C-NE	1	B	11.64	2.15	1.45	0.38 J	1.05	0.38 J	0.16 J	0.14 J	0.07 J	0.66 U	0.16 J
C-NE	2	B	10.40	1.25	0.78	0.24 J	0.79	0.23 J	0.12 J	0.09 J	0.92 U	0.62 U	1.24 U
C-NE	3	B	13.08	2.19	1.40	0.29 J	0.92	0.30 J	0.15 J	0.08 J	0.97 U	0.66 U	1.32 U
C-NE	4	B	10.83	2.25	1.41	0.38 J	1.15	0.30 J	0.13 J	0.09 J	0.97 U	0.66 U	1.31 U
C-NE	5	B	12.59	2.15	1.38	0.35 J	1.12	0.36 J	0.16 J	0.12 J	0.08 J	0.66 U	0.12 J
MSL Background	1	A	12.16	8.76	5.25	0.74 J	2.41	1.47	0.55 J	0.17 J	0.97 U	0.66 U	1.32 U
MSL Background	2	B	10.85	7.53	4.47	0.77 J	2.26	0.79 J	0.57 J	0.29 J	0.08 J	0.65 U	1.29 U
MSL Background	3	C	10.94	7.94	6.93	0.68 J	2.15	1.46	0.88	0.80 U	0.96 U	0.65 U	1.30 U
MSL Background	4	D	11.08	5.61	3.99	0.60 J	2.68	1.28	0.73 J	0.80 U	0.96 U	0.65 U	1.30 U
MSL Background	5	D	11.18	9.58	6.57	0.73 J	2.88	1.06	1.01	0.81 U	0.97 U	0.66 U	1.31 U

(a) DL Detection limit.

(b) NA Not applicable; analyte detected in all samples.

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

(d) U The analyte was not present above the level of the associated value.

TABLE J.7. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

			<i>M. nasuta</i> LPAHs (µg/kg dry weight)					
Sediment Treatment	Replicate	Analytical Batch	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Method Blank								
Blank	1	A	4.19 J ^(a)	11.00 U ^(b)	5.96 U	6.43 U	4.99 U	4.86 U
Blank	2	B	5.06 J	12.11 U	6.56 U	0.85 J	2.36 J	0.33 J
Blank	3	C	13.93	11.55 U	6.25 U	1.49 J	3.22 J	0.49 J
Blank	4	D	7.69 J	12.27 U	6.64 U	7.17 U	5.56 U	5.43 U
Matrix Spikes								
MSL Background	1	A	14.96	10.15 U	7.44	5.92 J	17.19	2.86 J
Background MS	1	A	252.82	275.24	231.43	246.13	244.10	227.38
Concentration Recovered			237.86	275.24	223.99	240.21	226.91	224.52
Spike Amount			218.64	218.64	218.64	218.64	218.64	218.64
Percent Recovery			109%	126% ^(c)	102%	110%	104%	103%
MSL Background	1	A	14.96	10.15 U	7.44	5.92 J	17.19	2.86 J
Background MSD	1	A	251.97	279.72	228.35	244.20	240.35	229.59
Concentration Recovered			237.01	279.72	220.91	238.28	223.16	226.73
Spike Amount			218.88	218.88	218.88	218.88	218.88	218.88
Percent Recovery			108%	128% ^(c)	101%	109%	102%	104%
MS/MSD RPD			0%	2%	1%	1%	2%	1%
MS/MSD I-STAT			0.00	0.01	0.01	0.00	0.01	0.00
MSL Background	2	B	4.98 J	11.12 U	2.43 J	3.40 J	14.00	1.08 J
Background MS	2	B	272.09	258.55	256.32	266.13	280.88	249.68
Concentration Recovered			267.11	258.55	253.89	262.73	266.88	248.60
Spike Amount			243.09	243.09	243.09	243.09	243.09	243.09
Percent Recovery			110%	106%	104%	108%	110%	102%
MSL Background	2	B	4.98 J	11.12 U	2.43 J	3.40 J	14.00	1.08 J
Background MSD	2	B	262.53	256.56	241.44	257.11	273.57	242.99
Concentration Recovered			257.55	256.56	239.01	253.71	259.57	241.91
Spike Amount			224.78	224.78	224.78	224.78	224.78	224.78
Percent Recovery			115%	114%	106%	113%	115%	108%
MS/MSD RPD			4%	7%	2%	4%	5%	5%
MS/MSD I-STAT			0.02	0.04	0.01	0.02	0.03	0.03
MSL Background	3	C	12.60	11.15 U	6.03 U	4.93 J	14.55	4.93 U
Background MS	3	C	271.96	256.90	244.86	262.70	272.98	235.43
Concentration Recovered			259.36	256.90	244.86	257.77	258.43	235.43
Spike Amount			235.29	235.29	235.29	235.29	235.29	235.29
Percent Recovery			110%	109%	104%	110%	110%	100%
MSL Background	3	C	12.60	11.15 U	6.03 U	4.93 J	14.55	4.93 U
Background MSD	3	C	267.88	266.18	257.45	268.03	278.44	237.58
Concentration Recovered			255.28	266.18	257.45	263.10	263.89	237.58
Spike Amount			242.06	242.06	242.06	242.06	242.06	242.06
Percent Recovery			105%	110%	106%	109%	109%	98%
MS/MSD RPD			4%	1%	2%	1%	1%	2%
MS/MSD I-STAT			0.02	0.00	0.01	0.00	0.00	0.01

TABLE J.7. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ dry weight)					
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
MSL Background	4	D	9.66 J	10.99 U	3.51 J	3.20 J	14.95	4.86 U
Background MS	4	D	265.44	270.31	264.35	267.88	261.50	233.69
Concentration Recovered			255.78	270.31	260.84	264.68	246.55	233.69
Spike Amount			239.52	239.52	239.52	239.52	239.52	239.52
Percent Recovery			107%	113%	109%	111%	103%	98%
MSL Background	4	D	9.66 J	10.99 U	3.51 J	3.20 J	14.95	4.86 U
Background MSD	4	D	266.44	279.55	261.76	262.75	255.56	223.43
Concentration Recovered			256.78	279.55	258.25	259.55	240.61	223.43
Spike Amount			238.81	238.81	238.81	238.81	238.81	238.81
Percent Recovery			108%	117%	108%	109%	101%	94%
MS/MSD RPD			1%	4%	1%	2%	2%	4%
MS/MSD I-STAT			0.00	0.02	0.00	0.01	0.01	0.02
<u>Standard Reference Material</u>								
Certified Value			NC ^(d)	NC	NC	NC	45.00 ±11.0	6.10 ±1.7
SRM 1974		A	NA ^(e)	NA	NA	NA	48.06	10.84 J
SRM 1974		B	NA	NA	NA	NA	55.57	9.83 J
SRM 1974		C	NA	NA	NA	NA	44.53	5.51 J
SRM 1974		D	NA	NA	NA	NA	39.14	2.80 J
<u>Analytical Replicates</u>								
COMP V Replicate 1	5	B	32.33	0.93 J	3.69 J	9.19 J	21.54	6.18 J
COMP V Replicate 2	5	B	20.01 J	1.00 J	3.50 J	6.88 J	19.13	5.50 J
COMP V Replicate 3	5	B	8.13 J	0.87 J	2.97 J	3.72 J	13.91	4.79 J
RSD			60% ^(f)	7%	11%	42% ^(f)	21%	13%
R-AM Replicate 1	2	C	16.19 J	17.77 U	3.98 J	7.40 J	31.31	9.07
R-AM Replicate 2	2	C	23.50	17.99 U	9.74 U	8.47 J	33.90	11.14
R-AM Replicate 3	2	C	20.04	17.27 U	4.26 J	7.69 J	32.49	10.98
RSD			18%	NA	NA	7%	4%	11%
R-PF Replicate 1	3	D	14.69 J	17.83 U	9.65 U	3.35 J	10.93	7.88 U
R-PF Replicate 2	3	D	12.15 J	17.36 U	9.40 U	10.14 U	12.01	7.67 U
R-PF Replicate 3	3	D	12.28 J	17.79 U	9.63 U	5.43 J	9.68	7.87 U
RSD			11%	NA	NA	NA	11%	NA
C-SB Replicate 1	4	A	20.24	15.28 U	2.34 J	8.93 U	11.42	1.24 J
C-SB Replicate 2	4	A	19.28	14.85 U	8.04 U	7.19 J	12.18	6.56 U
C-SB Replicate 3	4	A	17.78	14.20 U	7.69 U	6.03 J	9.61	6.28 U
RSD			6%	NA	NA	NA	12%	NA

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

(b) U The analyte was not present above the level of the associated value.

(c) Recovery outside quality control range (40%-120%).

(d) NC Not certified.

(e) NA Not applicable.

(f) Value exceeds relative precision range of 30%.

TABLE J.8. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

			<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ dry weight)									
Sediment Treatment	Replicate	Analytical Batch	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
<u>Method Blank</u>												
Blank	1	A	4.74 U ^(a)	1.93 J ^(b)	8.14 U	5.70 U	8.31 U	6.92 U	7.22 U	8.67 U	5.90 U	11.76 U
Blank	2	B	2.19 J	8.30	8.96 U	0.49 J	0.36 J	0.20 J	7.95 U	9.55 U	6.50 U	12.94 U
Blank	3	C	1.50 J	3.83 J	8.54 U	5.98 U	8.72 U	7.27 U	7.58 U	9.10 U	6.19 U	12.34 U
Blank	4	D	1.88 J	8.94	9.08 U	6.35 U	9.27 U	7.72 U	8.05 U	9.67 U	6.58 U	13.12 U
<u>Matrix Spikes</u>												
MSL Background	1	A	72.08	43.19	6.09 J	19.82	12.05	4.55 J	1.39 J	8.00 U	5.44 U	10.85 U
Background MS	1	A	316.88	267.72	245.36	218.03	246.67	236.97	197.48	237.26	211.32	217.62
Concentration Recovered			244.80	224.53	239.27	198.21	234.62	232.42	196.09	237.26	211.32	217.62
Spike Amount			218.64	218.64	218.64	218.64	218.64	218.64	218.64	218.64	218.64	218.64
Percent Recovery			112%	103%	109%	91%	107%	106%	90%	109%	97%	100%
MSL Background	1	A	72.08	43.19	6.09 J	19.82	12.05	4.55 J	1.39 J	8.00 U	5.44 U	10.85 U
Background MSD	1	A	324.20	277.50	258.42	218.64	245.09	248.91	196.04	245.71	198.07	220.39
Concentration Recovered			252.12	234.31	252.33	198.82	233.04	244.36	194.65	245.71	198.07	220.39
Spike Amount			218.88	218.88	218.88	218.88	218.88	218.88	218.88	218.88	218.88	218.88
Percent Recovery			115%	107%	115%	91%	106%	112%	89%	112%	90%	101%
MS/MSD RPD			3%	4%	5%	0%	1%	5%	1%	3%	7%	1%
MS/MSD I-STAT			0.01	0.02	0.03	0.00	0.00	0.02	0.00	0.02	0.03	0.01
MSL Background	2	B	69.47	41.24	7.14 J	20.84	7.30 J	5.28 J	2.66 J	0.75 J	5.96 U	11.88 U
Background MS	2	B	335.00	308.58	262.20	275.66	266.47	281.36	250.75	230.88	234.65	214.38
Concentration Recovered			265.53	267.34	255.06	254.82	259.17	276.08	248.09	230.13	234.65	214.38
Spike Amount			243.09	243.09	243.09	243.09	243.09	243.09	243.09	243.09	243.09	243.09
Percent Recovery			109%	110%	105%	105%	107%	114%	102%	95%	97%	88%
MSL Background	2	B	69.47	41.24	7.14 J	20.84	7.30 J	5.28 J	2.66 J	0.75 J	5.96 U	11.88 U
Background MSO	2	B	333.46	304.21	259.00	272.01	249.83	259.97	237.96	229.35	210.45	222.79
Concentration Recovered			263.99	262.97	251.86	251.17	242.53	254.69	235.30	228.60	210.45	222.79
Spike Amount			224.78	224.78	224.78	224.78	224.78	224.78	224.78	224.78	224.78	224.78
Percent Recovery			117%	117%	112%	112%	108%	113%	105%	102%	94%	99%
MS/MSD RPD			7%	6%	7%	6%	1%	0%	3%	7%	3%	12%
MS/MSD I-STAT			0.04	0.03	0.03	0.03	0.01	0.00	0.01	0.04	0.02	0.06

TABLE J.8. (contd)

		<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ dry weight)										
Sediment Treatment	Replicate	Analytical Batch	Fluor-anthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluor-anthene	Benzo(k) Fluor-anthene	Benzo(a) Pyrene	Indeno (1,2,3-cd) Pyrene	Dibenz(a,h) anthracene	Benzo (g,h,i) perylene
MSL Background	3	C	72.63	63.42	6.25 J	19.66	13.37	8.04	7.32 U	8.79 U	5.98 U	11.92 U
Background MS	3	C	342.96	314.57	220.85	231.35	301.24	282.17	244.18	241.72	213.95	196.07
Concentration Recovered			270.33	251.15	214.60	211.69	287.87	274.13	244.18	241.72	213.95	196.07
Spike Amount			235.29	235.29	235.29	235.29	235.29	235.29	235.29	235.29	235.29	235.29
Percent Recovery			115%	107%	91%	90%	122% ^(c)	117%	104%	103%	91%	83%
MSL Background	3	C	72.63	63.42	6.25 J	19.66	13.37	8.04	7.32 U	8.79 U	5.98 U	11.92 U
Background MSD	3	C	351.20	321.10	220.43	231.33	284.14	257.42	242.66	258.03	230.60	223.47
Concentration Recovered			278.57	257.68	214.18	211.67	270.77	249.38	242.66	258.03	230.60	223.47
Spike Amount			242.06	242.06	242.06	242.06	242.06	242.06	242.06	242.06	242.06	242.06
Percent Recovery			115%	106%	88%	87%	112%	103%	100%	107%	95%	92%
MS/MSD RPD			0%	0%	3%	3%	9%	12%	3%	4%	5%	10%
MS/MSD I-STAT			0.00	0.00	0.02	0.01	0.04	0.06	0.02	0.02	0.02	0.05
MSL Background	4	D	50.62	36.03	5.42 J	24.22	11.57	6.57 J	7.21 U	8.66 U	5.89 U	11.75 U
Background MS	4	D	275.12	254.18	188.64	203.57	316.36	297.27	274.63	300.43	281.18	251.74
Concentration Recovered			224.50	218.15	183.22	179.35	304.79	290.70	274.63	300.43	281.18	251.74
Spike Amount			239.52	239.52	239.52	239.52	239.52	239.52	239.52	239.52	239.52	239.52
Percent Recovery			94%	91%	76%	75%	127% ^(c)	121% ^(c)	115%	125% ^(c)	117%	105%
MSL Background	4	D	50.62	36.03	5.42 J	24.22	11.57	6.57 J	7.21 U	8.66 U	5.89 U	11.75 U
Background MSO	4	D	255.33	235.38	161.80	179.94	291.04	288.85	247.93	245.51	240.54	220.54
Concentration Recovered			204.71	199.35	156.38	155.72	279.47	282.28	247.93	245.51	240.54	220.54
Spike Amount			238.81	238.81	238.81	238.81	238.81	238.81	238.81	238.81	238.81	238.81
Percent Recovery			86%	83%	65%	65%	117%	118%	104%	103%	101%	92%
MS/MSD RPD			9%	9%	16%	14%	8%	3%	10%	20%	15%	13%
MS/MSD I-STAT			0.04	0.04	0.08	0.07	0.04	0.01	0.05	0.10	0.08	0.06
<u>Standard Reference Material</u>												
Certified Value			272.00 ± 47.0	276.00 ± 30.0	NC ^(d)	NC	52.30 ± 9.4	NC	18.60 ± 3.8	14.60 ± 2.7	NC	20.00 ± 2.3
SRM 1974		A	279.27	259.27	NA ^(e)	NA	52.15	NA	10.66 J	NA	NA	25.67 J
SRM 1974		B	301.46	302.28	NA	NA	60.22	NA	18.70 J	16.64 J	NA	27.68 J
SRM 1974		C	239.01	239.09	NA	NA	46.59	NA	NM	NA	NA	32.37 J
SRM 1974		D	232.95	237.98	NA	NA	54.76	NA	9.73 J	NA	NA	21.22 J

TABLE J.8. (contd)

			<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)									
Sediment Treatment	Replicate	Analytical Batch	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
<u>Analytical Replicates</u>												
COMP V Replicate 1	5	B	42.92	148.45	18.54	29.90	52.93	33.99	41.18	14.87 J	1.75 J	19.95 J
COMP V Replicate 2	5	B	43.61	148.00	18.87	30.50	52.07	42.32	41.61	15.64 J	2.05 J	20.76 J
COMP V Replicate 3	5	B	41.49	143.01	17.56	27.32	57.03	36.91	41.60	13.74	1.35 J	17.29
RSD			3%	2%	4%	6%	5%	11%	1%	6%	20%	9%
R-AM Replicate 1	2	C	203.36	198.96	44.60	70.65	38.28	51.02	45.45	14.01 U	9.53 U	14.23 J
R-AM Replicate 2	2	C	226.25	230.78	51.39	93.71	45.44	44.10	43.38	14.18 U	9.65 U	12.39 J
R-AM Replicate 3	2	C	216.37	215.09	45.16	82.35	34.51	49.67	53.14	13.61 U	9.26 U	15.41 J
RSD			5%	7%	8%	14%	14%	8%	11%	NA	NA	11%
R-PF Replicate 1	3	D	10.38	8.91 J	13.19 U	4.68 J	13.47 U	11.22 U	11.70 U	14.06 U	9.56 U	19.06 U
R-PF Replicate 2	3	D	9.39	8.22 J	12.84 U	3.35 J	13.11 U	10.93 U	11.39 U	13.68 U	9.31 U	18.55 U
R-PF Replicate 3	3	D	8.12	7.48 J	13.16 U	3.00 J	13.43 U	11.20 U	11.67 U	14.02 U	9.54 U	19.02 U
RSD			12%	9%	NA	24%	NA	NA	NA	NA	NA	NA
C-SB Replicate 1	4	A	18.77	9.74	2.67 J	6.43 J	4.22 J	3.34 J	1.76 J	12.05 U	8.19 U	16.33 U
C-SB Replicate 2	4	A	21.22	26.46	2.34 J	6.07 J	6.03 J	2.61 J	9.74 U	11.70 U	7.96 U	15.87 U
C-SB Replicate 3	4	A	18.51	9.18	1.81 J	7.20 J	5.65 J	2.55 J	9.32 U	11.19 U	7.62 U	15.18 U
RSD			8%	65% ^(f)	19%	9%	18%	16%	NA	NA	NA	NA

(a) U The analyte was not present above the level of the associated value.

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

(c) Recovery outside quality control range (40%-120%).

(d) NC Not certified.

(e) NA Not applicable.

(f) Value exceeds relative precision range of 30%.

TABLE J.9. Surrogate Recoveries for Polynuclear Aromatic Hydrocarbons (PAHs) Including Quality Control Data, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Surrogate Percent Recoveries		
			Naphthalene d8	Acenaphthene d10	Benzo(a) Pyrene d12
COMP I	1	D	58.18	69.48	55.99
COMP I	2	D	39.63 ^(a)	42.89	35.12 ^(a)
COMP I	3	A	63.86	63.21	66.91
COMP I	4	B	79.67	77.94	73.71
COMP I	5	A	69.73	69.18	69.24
COMP II	1	D	63.27	75.07	66.80
COMP II	2	A	66.20	67.12	69.78
COMP II	3	C	52.59	56.12	42.98
COMP II	4	D	55.47	61.35	53.69
COMP II	5	C	60.29	58.13	50.99
COMP III	1	C	58.30	61.97	44.68
COMP III	2	C	62.52	66.69	53.60
COMP III	3	A	64.12	64.70	62.93
COMP III	4	D	59.73	60.97	46.44
COMP III	5	C	69.76	77.23	56.56
TC-5 Upper Comp	1	C	57.85	60.65	54.97
TC-5 Upper Comp	2	C	61.45	66.10	50.08
TC-5 Upper Comp	3	C	52.55	58.27	51.36
TC-5 Upper Comp	4	A	61.16	63.42	63.50
TC-5 Upper Comp	5	A	65.12	67.71	64.08
COMP IV	1	C	61.14	64.81	54.43
COMP IV	2	C	53.13	64.68	57.12
COMP IV	3	A	65.58	71.42	64.36
COMP IV	4	C	59.28	65.70	50.21
COMP IV	5	A	60.66	61.35	60.27
COMP V	1	A	55.51	58.74	63.28
COMP V	2	A	64.51	66.56	64.23
COMP V	3	A	64.45	67.00	64.34
COMP V	4	D	70.92	76.58	55.85
COMP V Replicate 1	5	B	79.63	77.13	75.05
COMP V Replicate 2	5	B	78.34	74.81	74.30
COMP V Replicate 3	5	B	78.69	77.90	75.44

TABLE J.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Surrogate Percent Recoveries		
			Naphthalene d8	Acenaphthene d10	Benzo(a) Pyrene d12
COMP VI	1	C	62.57	65.67	57.04
COMP VI	2	A	56.78	58.56	56.47
COMP VI	3	B	78.02	76.83	73.39
COMP VI	4	A	59.02	58.81	63.90
COMP VI	5	D	36.34 ^(a)	40.57	35.04 ^(a)
R-AC	1	B	76.94	76.67	73.89
R-AC	2	C	57.38	69.18	65.02
R-AC	3	C	65.10	67.14	66.82
R-AC	4	A	61.63	63.43	70.13
R-AC	5	D	63.87	67.60	68.84
R-AM	1	B	78.00	76.10	70.39
R-AM Replicate 1	2	C	66.26	69.56	50.31
R-AM Replicate 2	2	C	57.24	56.77	54.39
R-AM Replicate 3	2	C	58.39	58.99	51.39
R-AM	3	B	78.71	77.43	75.33
R-AM	4	B	64.52	62.76	62.99
R-AM	5	B	77.60	76.98	78.10
R-BF	1	D	67.04	71.15	56.70
R-BF	2	B	80.12	78.82	74.31
R-BF	3	B	79.24	79.06	75.82
R-BF	4	A	58.78	59.60	58.08
R-BF	5	A	61.99	62.26	61.59
R-OS	1	B	79.83	77.70	76.84
R-OS	2	D	44.27	48.56	39.35 ^(a)
R-OS	3	B	65.35	63.88	61.18
R-OS	4	D	72.42	81.86	60.07
R-OS	5	C	57.92	59.65	45.66
R-PF	1	C	66.57	70.73	53.62
R-PF	2	C	55.12	60.01	41.47
R-PF Replicate 1	3	D	61.34	61.99	52.90
R-PF Replicate 2	3	D	59.60	62.54	43.65
R-PF Replicate 3	3	D	66.24	70.07	48.67
R-PF	4	D	68.56	72.43	57.42
R-PF	5	A	57.85	59.71	46.68
C-SB	1	C	65.81	71.86	52.75
C-SB	2	D	57.09	63.49	50.60
C-SB	3	B	69.42	67.22	64.93

TABLE J.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Surrogate Percent Recoveries		
			Naphthalene d8	Acenaphthene d10	Benzo(a) Pyrene d12
C-SB Replicate 1	4	A	65.06	65.54	64.50
C-SB Replicate 2	4	A	64.01	67.39	63.49
C-SB Replicate 3	4	A	63.32	63.50	59.47
C-SB	5	D	62.57	73.46	62.99
C-NE	1	B	77.70	75.48	74.07
C-NE	2	B	77.01	76.82	74.07
C-NE	3	B	75.41	78.70	77.26
C-NE	4	B	80.30	79.43	74.88
C-NE	5	B	75.09	74.67	73.75
MSL Background	1	A	64.89	64.98	61.06
MSL Background	2	B	80.61	78.97	75.73
MSL Background	3	C	60.19	70.06	56.76
MSL Background	4	D	33.30 ^(a)	38.12 ^(a)	28.47 ^(a)
MSL Background	5	D	40.91	49.03	31.00 ^(a)

Quality Control DataMethod Blank

Blank	1	A	20.01 ^(a)	18.41 ^(a)	18.27 ^(a)
Blank	2	B	24.95 ^(a)	25.04 ^(a)	25.15 ^(a)
Blank	3	C	18.69 ^(a)	18.34 ^(a)	16.94 ^(a)
Blank	4	D	21.50 ^(a)	20.38 ^(a)	18.33 ^(a)

Matrix Spikes

MSL Background MS	A	65	70	72
MSL Background MSD	A	63	68	73
MS/MSD RPD		3	3	1
MS/MSD I-STAT		0.02	0.01	0.01
MSL Background MS	B	82	82	81
MSL Background MSD	B	77	77	78
MS/MSD RPD		6	6	4
MS/MSD I-STAT		0.03	0.03	0.02
MSL Background MS	C	67	70	65
MSL Background MSD	C	68	69	66
MS/MSD RPD		1	1	2
MS/MSD I-STAT		0.01	0.01	0.01

TABLE J.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Surrogate Percent Recoveries		
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) Pyrene d12
MSL Background MS		D	61	68	53
MSL Background MSD		D	56	67	56
MS/MSD RPD			9	1	6
MS/MSD I-STAT			0.04	0.01	0.03
<u>Standard Reference Material</u>					
SRM 1974		A	67.08	69.33	61.56
SRM 1974		B	76.15	77.43	74.27
SRM 1974		C	68.11	75.31	59.62
SRM 1974		D	67.07	69.59	54.39
<u>Analytical Replicates</u>					
COMP V Replicate 1	5	B	79.63	77.13	75.05
COMP V Replicate 2	5	B	78.34	74.81	74.30
COMP V Replicate 3	5	B	78.69	77.90	75.44
RSD			1	2	1
R-AM Replicate 1	2	C	66.26	69.56	50.31
R-AM Replicate 2	2	C	57.24	56.77	54.39
R-AM Replicate 3	2	C	58.39	58.99	51.39
RSD			8	11	4
R-PF Replicate 1	3	D	61.34	61.99	52.90
R-PF Replicate 2	3	D	59.60	62.54	43.65
R-PF Replicate 3	3	D	66.24	70.07	48.67
RSD			6	7	10
C-SB Replicate 1	4	A	65.06	65.54	64.50
C-SB Replicate 2	4	A	64.01	67.39	63.49
C-SB Replicate 3	4	A	63.32	63.50	59.47
RSD			1	3	4

(a) Recovery outside quality control range (40%-120%).

TABLE J.10. Chlorinated Pesticides (alphabetical, Aldrin - 4'4-DDT), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Chlor-dane	4,4'-DDD	4,4'-DDE	4,4'-DDT
COMP I	1	D	0.688 U ^(a)	0.705 U	0.705 U	0.705 U	4.591 E ^(b)	21.811 U	3.309	4.003	1.482 U
COMP I	2	D	0.605 U	0.766 E	0.620 U	0.782 E	4.570 E	19.186 U	3.467	3.625	1.304 U
COMP I	3	A	0.593 U	0.990	0.607 U	0.607 U	4.584 E	18.790 U	4.682	4.467	1.277 U
COMP I	4	B	0.673 U	1.953	0.689 U	0.689 U	3.653 E	21.327 U	4.597	6.242	0.826 J ^(c)
COMP I	5	A	0.721 U	1.164 E	0.738 U	0.738 U	3.495 E	22.834 U	4.466	5.181	1.552 U
COMP II	1	D	0.723 U	0.405 JE	0.740 U	0.740 U	3.475 E	22.908 U	5.782	4.558	1.557 U
COMP II	2	A	0.630 U	1.008	0.645 U	0.645 U	3.594 E	19.973 U	10.623	6.112	1.357 U
COMP II	3	C	0.590 U	0.016 J	0.604 U	0.604 U	2.042 E	18.711 U	8.157	4.818	1.272 U
COMP II	4	D	0.710 U	0.727 U	0.727 U	0.727 U	4.182 E	22.495 U	6.697	4.237	1.529 U
COMP II	5	C	0.649 U	0.665 U	0.665 U	0.665 U	1.022 E	20.580 U	10.858	5.576	1.399 U
COMP III	1	C	0.691 U	0.708 U	0.708 U	0.708 U	2.869 E	21.905 U	1.048 E	0.650 J	1.489 U
COMP III	2	D	0.617 U	0.611 J	0.631 U	0.631 U	1.982 E	19.544 U	2.425	2.068	1.328 U
COMP III	3	A	0.637 U	1.127	0.652 U	0.652 U	3.571 E	20.177 U	3.388	2.403	1.371 U
COMP III	4	D	0.639 U	0.205 JE	0.655 U	0.655 U	3.001 E	20.263 U	1.936	1.772	1.377 U
COMP III	5	C	0.602 U	0.075 J	0.617 U	0.617 U	3.097 E	19.093 U	2.628	1.071	1.298 U
TC-5 Upper Comp	1	C	0.630 U	0.645 U	0.645 U	0.645 U	2.303 E	19.956 U	16.067	12.313	1.356 U
TC-5 Upper Comp	2	C	0.625 U	0.640 U	0.640 U	0.640 U	2.873 E	19.806 U	10.349 E	10.270 E	1.346 U
TC-5 Upper Comp	3	C	0.655 U	0.670 U	0.670 U	0.670 U	3.008 E	20.754 U	11.163	10.788	1.411 U
TC-5 Upper Comp	4	A	0.645 U	1.103 E	0.660 U	0.660 U	2.969 E	20.432 U	9.842	8.179	1.389 U
TC-5 Upper Comp	5	A	0.691 U	0.904	0.708 U	0.708 U	3.859 E	21.912 U	8.470	7.047	1.489 U
COMP IV	1	C	0.775 U	0.793 U	0.793 U	0.793 U	2.940 E	24.554 U	0.535 U	1.082 U	1.669 U
COMP IV	2	C	0.622 U	0.637 U	0.637 U	0.637 U	4.748 E	19.707 U	0.429 U	0.868 U	1.339 U
COMP IV	3	A	0.556 U	1.064	0.570 U	0.570 U	3.394 E	17.634 U	0.259 J	0.605 J	1.198 U
COMP IV	4	C	1.118 U	1.144 U	1.144 U	1.144 U	1.610 E	35.418 U	0.772 U	1.561 U	2.407 U
COMP IV	5	A	0.605 U	1.079	0.619 U	0.619 U	3.413 E	19.160 U	0.418 U	0.607 J	1.302 U
COMP V	1	A	0.651 U	1.405	0.667 U	0.667 U	4.077 E	20.646 U	55.791	16.138	1.403 U
COMP V	2	A	0.653 U	1.029	0.668 U	0.668 U	3.364 E	20.694 U	76.641	19.253	0.038 J
COMP V	3	A	0.561 U	1.209 E	0.574 U	0.574 U	4.201 E	17.784 U	75.414	24.957	0.506 J
COMP V	4	D	0.682 U	0.699 U	0.699 U	0.150 JE	4.338 E	21.625 U	33.201	10.929	1.470 U
COMP V Replicate 1	5	B	1.457 U	3.311	1.492 U	1.492 U	4.813 E	46.188 U	84.636	20.070	2.083 J
COMP V Replicate 2	5	B	1.240 U	3.043	1.269 U	1.269 U	4.835 E	39.294 U	80.831	19.191	1.846 J
COMP V Replicate 3	5	B	0.861 U	2.319	0.881 U	0.881 U	4.030 E	27.287 U	105.381	21.892	1.528 J

TABLE J.10. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Chlor-dane	4,4'-DDO	4,4'-DDE	4,4'-DDT
COMP VI	1	C	0.711 U	0.728 U	0.728 U	0.728 U	2.694 E	22.537 U	48.761	16.522	1.532 U
COMP VI	2	A	0.678 U	1.409	0.694 U	0.694 U	3.656 E	21.495 U	75.795	17.724	1.461 U
COMP VI	3	B	1.712 U	4.429	1.753 U	1.753 U	5.696 E	54.262 U	156.357	28.138	2.937 J
COMP VI	4	A	0.692 U	1.176	0.709 U	0.709 U	4.655 E	21.939 U	72.746	17.565	0.377 J
COMP VI	5	D	0.784 U	1.218 E	0.803 U	0.224 JE	6.106 E	24.846 U	45.508	12.755 E	0.039 J
R-AC	1	B	0.591 U	1.830	0.605 U	0.605 U	3.356 E	18.736 U	5.003	5.117	1.273 U
R-AC	2	C	0.708 U	0.725 U	0.725 U	0.725 U	3.340 E	22.438 U	2.935	2.320	1.525 U
R-AC	3	C	0.629 U	0.235 JE	0.643 U	0.643 U	3.419 E	19.922 U	5.597	4.256	1.354 U
R-AC	4	A	0.645 U	1.454	0.660 U	0.660 U	3.866 E	20.432 U	6.001	4.275	1.389 U
R-AC	5	D	0.677 U	0.732 E	0.693 U	0.029 JE	3.991 E	21.456 U	3.904	3.618	1.458 U
R-AM	1	B	0.695 U	1.848	0.711 U	0.711 U	3.624 E	22.028 U	0.480 U	1.909	1.497 U
R-AM Replicate 1	2	C	1.072 U	1.098 U	1.098 U	1.098 U	1.071 JE	33.978 U	0.740 U	1.497 U	2.309 U
R-AM Replicate 2	2	C	1.085 U	1.111 U	1.111 U	1.111 U	1.825 E	34.389 U	0.749 U	1.515 U	2.337 U
R-AM Replicate 3	2	C	1.042 U	1.066 U	1.066 U	1.066 U	2.138 E	33.016 U	0.719 U	1.455 U	2.244 U
R-AM	3	B	0.751 U	2.117	0.769 U	0.769 U	3.949 E	23.813 U	0.012 J	2.814	1.315 J
R-AM	4	B	1.374 U	3.206	1.406 U	1.406 U	4.919 E	43.529 U	0.949 U	3.665	1.999 J
R-AM	5	B	0.700 U	1.944	0.716 U	0.716 U	3.656 E	22.172 U	0.483 U	2.190	0.951 J
R-BF	1	D	0.787 U	0.805 U	0.805 U	0.805 U	3.323 E	24.933 U	1.401 E	2.132	1.694 U
R-BF	2	B	0.556 U	1.725	0.569 U	0.569 U	4.494 E	17.630 U	2.657	5.246	1.198 U
R-BF	3	B	0.619 U	1.822	0.634 U	0.634 U	4.103 E	19.615 U	2.724	5.486	1.333 U
R-BF	4	A	0.731 U	1.192	0.749 U	0.749 U	3.278 E	23.177 U	2.883	3.420	1.575 U
R-BF	5	A	0.563 U	1.151	0.576 U	0.576 U	2.947 E	17.842 U	3.046	3.386	1.213 U
R-OS	1	B	0.622 U	1.904	0.637 U	0.637 U	3.430 E	19.712 U	0.430 U	4.416	1.340 U
R-OS	2	D	0.638 U	0.961 E	0.653 U	0.219 JE	6.363 E	20.211 U	0.834	4.615	1.374 U
R-OS	3	B	0.641 U	1.772	0.657 U	0.657 U	3.564 E	20.327 U	0.443 U	4.060	1.381 U
R-OS	4	D	0.604 U	0.148 J	0.619 U	0.460 JE	3.289 E	19.150 U	0.417 U	3.569	1.301 U
R-OS	5	C	0.582 U	0.748 E	0.595 U	0.595 U	3.824 E	18.434 U	0.402 U	3.293 E	1.253 U
R-PF	1	C	0.690 U	0.706 U	0.706 U	0.706 U	2.670 E	21.858 U	0.476 U	4.091	1.486 U
R-PF	2	C	0.661 U	0.677 U	0.677 U	0.677 U	3.002 E	20.956 U	0.457 U	3.753	1.424 U
R-PF Replicate 1	3	D	1.076 U	1.101 U	1.101 U	1.101 U	3.015 E	34.093 U	0.743 U	3.708	2.317 U
R-PF Replicate 2	3	D	1.047 U	1.072 U	1.072 U	1.072 U	2.161 E	33.185 U	0.723 U	5.011	2.255 U
R-PF Replicate 3	3	D	1.073 U	1.099 U	1.099 U	1.099 U	3.105 E	34.011 U	0.741 U	4.986	2.311 U
R-PF	4	D	0.796 U	0.212 JE	0.814 U	0.227 JE	3.607 E	25.216 U	0.549 U	4.151	1.714 U
R-PF	5	A	0.620 U	1.077	0.634 U	0.634 U	4.393 E	19.636 U	0.428 U	5.668	1.335 U

TABLE J.10. (contd)

			<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
Sediment Treatment	Replicate	Analytical Batch	(Lindane)								
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlor-dane	4,4'-DDD	4,4'-DDE	4,4'-DDT
C-SB	1	C	0.559 U	0.073 J	0.572 U	0.572 U	3.636 E	17.709 U	0.386 U	0.780 U	1.204 U
C-SB	2	D	0.707 U	0.724 U	0.724 U	0.724 U	4.009 E	22.417 U	0.488 U	0.837 J	1.523 U
C-SB	3	B	0.670 U	2.065	0.686 U	0.686 U	3.327 E	21.238 U	0.463 U	2.623	1.443 U
C-SB Replicate 1	4	A	0.922 U	1.386	0.944 U	0.944 U	2.647 E	29.216 U	0.637 U	1.109 J	1.986 U
C-SB Replicate 2	4	A	0.896 U	2.066	0.917 U	0.917 U	2.788 E	28.388 U	0.619 U	0.902 J	1.929 U
C-SB Replicate 3	4	A	0.857 U	1.202	0.877 U	0.877 U	3.020 E	27.152 U	0.592 U	0.889 J	1.845 U
C-SB	5	D	0.751 U	0.361 JE	0.769 U	0.769 U	3.960 U	23.797 U	0.519 U	0.494 J	1.617 U
C-NE	1	B	0.640 U	2.130	0.655 U	0.655 U	3.941 E	20.280 U	0.442 U	2.602	1.378 U
C-NE	2	B	0.674 U	1.936	0.690 U	0.690 U	3.847 E	21.353 U	0.465 U	2.265	1.451 U
C-NE	3	B	0.568 U	1.961	0.582 U	0.582 U	3.387 E	18.014 U	0.393 U	2.422	1.224 U
C-NE	4	B	0.684 U	2.200	0.700 U	0.700 U	4.440 E	21.672 U	0.472 U	3.041	1.473 U
C-NE	5	B	0.593 U	2.011	0.607 U	0.607 U	3.499 E	18.795 U	0.410 U	2.118	1.169 J
MSL Background	1	A	0.612 U	1.200	0.627 U	0.627 U	3.390 E	19.400 U	0.938	0.436 J	1.319 U
MSL Background	2	B	0.671 U	1.840	0.686 U	0.686 U	3.542 E	21.251 U	0.463 U	1.764	1.444 U
MSL Background	3	C	0.673 U	0.688 U	0.688 U	0.688 U	3.524 E	21.314 U	0.464 U	0.939 U	1.449 U
MSL Background	4	O	0.663 U	0.252 JE	0.679 U	0.679 U	4.480 E	21.012 U	0.458 U	0.926 U	1.428 U
MSL Background	5	O	0.663 U	0.678 U	0.678 U	0.305 JE	3.829 E	20.999 U	0.458 U	0.925 U	1.427 U

(a) U The analyte was not present above the level of the associated value.

(b) E Value an estimate; analyte not detected on confirmation column.

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

TABLE J.11. Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
			Dieldrin	Endo-sulfan I	Endo-sulfan II	Endo-sulfan Sulfate	Endrin	Endrin aldehyde	Hepta-chlor	Hepta-chlor-epoxide	Toxa-phene
COMP I	1	D	0.766 J ^(a)	2.181 U ^(b)	2.181 U	2.181 U	6.932 U	2.181 U	1.439 U	0.790 U	21.811 U
COMP I	2	D	0.472 J	1.918 U	1.918 U	1.918 U	6.098 U	1.918 U	1.266 U	0.694 U	19.186 U
COMP I	3	A	0.508 J	1.879 U	1.879 U	1.879 U	5.972 U	1.879 U	1.240 U	0.680 U	18.790 U
COMP I	4	B	1.363 J	2.133 U	2.133 U	2.133 U	6.778 U	2.133 U	1.407 U	0.772 U	21.327 U
COMP I	5	A	0.333 J	2.283 U	2.283 U	2.283 U	7.257 U	2.283 U	1.507 U	0.827 U	22.834 U
COMP II	1	D	1.277 J	2.291 U	0.155 JE ^(c)	2.291 U	7.281 U	2.291 U	1.512 U	0.829 U	22.908 U
COMP II	2	A	1.406 J	1.997 U	1.997 U	1.997 U	6.348 U	1.997 U	1.318 U	0.723 U	19.973 U
COMP II	3	C	1.319 J	1.871 U	1.871 U	1.871 U	5.947 U	1.871 U	1.235 U	0.677 U	18.711 U
COMP II	4	D	1.074 JE	2.249 U	0.264 JE	2.249 U	7.149 U	2.249 U	1.484 U	0.814 U	22.495 U
COMP II	5	C	0.968 J	2.058 U	2.058 U	2.058 U	6.541 U	2.058 U	1.358 U	0.745 U	20.580 U
COMP III	1	C	7.384 U	2.190 U	2.190 U	2.190 U	6.962 U	2.190 U	1.446 U	0.793 U	21.905 U
COMP III	2	D	0.681 J	1.954 U	1.954 U	1.954 U	6.212 U	1.954 U	1.290 U	0.707 U	19.544 U
COMP III	3	A	0.288 J	2.018 U	2.018 U	2.018 U	6.413 U	2.018 U	1.332 U	0.730 U	20.177 U
COMP III	4	D	0.557 J	2.026 U	2.026 U	2.026 U	6.440 U	2.026 U	1.337 U	0.733 U	20.263 U
COMP III	5	C	6.436 U	1.909 U	1.909 U	1.909 U	6.068 U	1.909 U	1.260 U	0.691 U	19.093 U
TC-5 Upper Comp	1	C	2.949 J	1.996 U	1.996 U	2.228 E	6.343 U	1.996 U	1.317 U	0.722 U	19.956 U
TC-5 Upper Comp	2	C	2.039 JE	1.980 U	1.980 U	1.980 U	6.295 U	1.980 U	1.307 U	0.717 U	19.806 U
TC-5 Upper Comp	3	C	2.441 J	2.075 U	2.075 U	2.022 JE	6.596 U	2.075 U	1.370 U	0.751 U	20.754 U
TC-5 Upper Comp	4	A	1.493 J	2.043 U	2.043 U	2.043 U	6.494 U	2.043 U	1.348 U	0.740 U	20.432 U
TC-5 Upper Comp	5	A	1.483 J	2.191 U	2.191 U	2.191 U	6.964 U	2.191 U	1.446 U	0.793 U	21.912 U
COMP IV	1	C	8.276 U	2.455 U	2.455 U	2.455 U	7.804 U	2.455 U	1.620 U	0.889 U	24.554 U
COMP IV	2	C	6.643 U	1.971 U	1.971 U	1.971 U	6.263 U	1.971 U	1.301 U	0.713 U	19.707 U
COMP IV	3	A	5.944 U	1.763 U	1.763 U	1.763 U	5.605 U	1.763 U	1.164 U	0.638 U	17.634 U
COMP IV	4	C	11.938 U	3.542 U	3.542 U	3.542 U	11.257 U	3.542 U	2.337 U	1.282 U	35.418 U
COMP IV	5	A	6.458 U	1.916 U	1.916 U	1.916 U	6.089 U	1.916 U	1.264 U	0.694 U	19.160 U
COMP V	1	A	5.231 J	2.064 U	2.064 U	2.064 U	6.562 U	2.064 U	1.362 U	0.747 U	20.646 U
COMP V	2	A	6.186 J	2.069 U	2.069 U	2.069 U	6.577 U	2.069 U	1.366 U	0.749 U	20.694 U
COMP V	3	A	6.859 U	1.778 U	1.778 U	1.778 U	5.652 U	1.778 U	1.174 U	0.644 U	17.784 U
COMP V	4	D	5.534 J	2.162 U	0.549 JE	2.162 U	6.873 U	2.162 U	1.427 U	0.783 U	21.625 U
COMP V Replicate 1	5	B	7.507 J	4.619 U	0.997 J	4.619 U	14.680 U	4.619 U	3.048 U	1.672 U	46.188 U
COMP V Replicate 2	5	B	7.322 J	3.929 U	0.652 J	3.929 U	12.489 U	3.929 U	2.593 U	1.422 U	39.294 U
COMP V Replicate 3	5	B	7.417 J	2.729 U	1.137 J	2.729 U	8.673 U	2.729 U	1.801 U	0.988 U	27.287 U

TABLE J.11. (contd)

<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry 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
COMP VI	1	C	7.828	2.254 U	2.254 U	2.254 U	7.163 U	2.254 U	1.487 U	0.816 U	22.537 U
COMP VI	2	A	6.905 J	2.149 U	2.149 U	2.149 U	6.832 U	2.149 U	1.419 U	0.778 U	21.495 U
COMP VI	3	B	9.066 J	5.426 U	0.621 J	5.426 U	17.246 U	5.426 U	3.581 U	1.964 U	54.262 U
COMP VI	4	A	6.421 J	2.194 U	2.194 U	2.194 U	6.973 U	2.194 U	1.448 U	0.794 U	21.939 U
COMP VI	5	D	6.252 J	2.484 U	1.533 JE	2.484 U	7.897 U	2.484 U	1.640 U	0.899 U	24.846 U
R-AC	1	B	0.993 J	1.873 U	1.873 U	1.873 U	5.955 U	1.873 U	1.236 U	0.661 JE	18.736 U
R-AC	2	C	7.563 U	2.244 U	2.244 U	2.244 U	7.131 U	2.244 U	1.481 U	0.812 U	22.438 U
R-AC	3	C	6.715 U	1.992 U	1.992 U	1.992 U	6.332 U	1.992 U	1.315 U	0.721 U	19.922 U
R-AC	4	A	6.887 U	2.043 U	2.043 U	2.043 U	6.494 U	2.043 U	1.348 U	0.740 U	20.432 U
R-AC	5	D	0.285 J	2.145 U	2.145 U	2.145 U	6.819 U	2.145 U	1.416 U	0.777 U	21.456 U
R-AM	1	B	0.671 J	2.203 U	0.002 J	2.203 U	7.001 U	2.203 U	1.454 U	0.797 U	22.028 U
R-AM Replicate 1	2	C	11.453 U	3.398 U	3.398 U	3.398 U	10.799 U	3.398 U	2.242 U	1.230 U	33.978 U
R-AM Replicate 2	2	C	11.592 U	3.439 U	3.439 U	3.439 U	10.930 U	3.439 U	2.269 U	1.245 U	34.389 U
R-AM Replicate 3	2	C	11.129 U	3.301 U	3.301 U	3.301 U	10.493 U	3.301 U	2.179 U	1.195 U	33.016 U
R-AM	3	B	0.772 J	2.381 U	0.445 J	2.381 U	7.569 U	2.381 U	1.572 U	0.862 U	23.813 U
R-AM	4	B	1.110 J	4.353 U	4.353 U	4.353 U	13.835 U	4.353 U	2.873 U	1.576 U	43.529 U
R-AM	5	B	0.711 J	2.217 U	0.325 J	2.217 U	7.047 U	2.217 U	1.463 U	0.803 U	22.172 U
R-BF	1	D	0.317 J	2.493 U	2.493 U	2.493 U	7.924 U	2.493 U	1.645 U	0.902 U	24.933 U
R-BF	2	B	1.276 J	1.763 U	0.787 J	1.763 U	5.603 U	1.763 U	1.163 U	0.638 U	17.630 U
R-BF	3	B	1.300 J	1.961 U	0.868 J	1.961 U	6.234 U	1.961 U	1.294 U	0.710 U	19.615 U
R-BF	4	A	0.253 J	2.318 U	2.318 U	2.318 U	7.366 U	2.318 U	1.530 U	0.839 U	23.177 U
R-BF	5	A	0.673 J	1.784 U	1.784 U	1.784 U	5.671 U	1.784 U	1.177 U	0.646 U	17.842 U
R-OS	1	B	0.617 J	1.971 U	0.065 J	1.971 U	6.265 U	1.971 U	1.301 U	0.714 U	19.712 U
R-OS	2	D	6.813 U	2.021 U	2.021 U	2.021 U	6.424 U	2.021 U	1.334 U	0.732 U	20.211 U
R-OS	3	B	0.542 J	2.033 U	2.033 U	2.033 U	6.460 U	2.033 U	1.341 U	0.736 U	20.327 U
R-OS	4	D	6.455 U	1.915 U	1.915 U	1.915 U	6.086 U	1.915 U	1.264 U	0.693 U	19.150 U
R-OS	5	C	6.214 U	1.843 U	1.843 U	1.843 U	5.859 U	1.843 U	1.217 U	0.667 U	18.434 U
R-PF	1	C	7.368 U	2.186 U	2.186 U	2.186 U	6.947 U	2.186 U	1.442 U	0.791 U	21.858 U
R-PF	2	C	7.064 U	2.096 U	2.096 U	2.096 U	6.660 U	2.096 U	1.383 U	0.759 U	20.956 U
R-PF Replicate 1	3	D	11.492 U	3.409 U	3.409 U	3.409 U	10.835 U	3.409 U	2.250 U	1.234 U	34.093 U
R-PF Replicate 2	3	D	11.186 U	3.318 U	3.318 U	3.318 U	10.547 U	3.318 U	2.190 U	1.201 U	33.185 U
R-PF Replicate 3	3	D	11.464 U	3.401 U	3.401 U	3.401 U	10.810 U	3.401 U	2.244 U	1.231 U	34.011 U
R-PF	4	D	8.499 U	2.521 U	2.521 U	2.521 U	8.014 U	2.521 U	1.664 U	0.913 U	25.216 U
R-PF	5	A	6.619 U	1.964 U	1.964 U	1.964 U	6.241 U	1.964 U	1.296 U	0.711 U	19.636 U

TABLE J.11. (contd)

<i>M. nasua</i> Pesticides ($\mu\text{g}/\text{kg}$ dry 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
C-SB	1	C	5.969 U	1.771 U	1.771 U	1.771 U	5.628 U	1.771 U	1.169 U	0.641 U	17.709 U
C-SB	2	D	7.556 U	2.242 U	2.242 U	2.242 U	7.125 U	2.242 U	1.479 U	0.811 U	22.417 U
C-SB	3	B	0.631 J	2.124 U	2.124 U	2.124 U	6.750 U	2.124 U	1.402 U	0.769 U	21.238 U
C-SB Replicate 1	4	A	9.848 U	2.921 U	2.921 U	2.921 U	9.286 U	2.921 U	1.928 U	1.058 U	29.216 U
C-SB Replicate 2	4	A	9.569 U	2.839 U	2.839 U	2.839 U	9.022 J	2.839 U	1.873 U	1.028 U	28.388 U
C-SB Replicate 3	4	A	9.152 U	2.715 U	2.715 U	2.715 U	8.629 U	2.715 U	1.792 U	0.983 U	27.152 U
C-SB	5	D	8.021 U	2.380 U	2.380 U	2.380 U	7.563 U	2.380 U	1.570 U	0.861 U	23.797 U
C-NE	1	B	0.739 J	2.028 U	2.028 U	2.028 U	6.446 U	2.028 U	1.338 U	0.734 U	20.280 U
C-NE	2	B	0.668 J	2.135 U	2.135 U	2.135 U	6.786 U	2.135 U	1.409 U	0.773 U	21.353 U
C-NE	3	B	0.699 J	1.801 U	1.801 U	1.801 U	5.725 U	1.801 U	1.189 U	0.652 U	18.014 U
C-NE	4	B	0.814 J	2.167 U	2.167 U	2.167 U	6.888 U	2.167 U	1.430 U	0.784 U	21.672 U
C-NE	5	B	0.621 J	1.879 U	0.318 J	1.879 U	5.974 U	1.879 U	1.240 U	0.680 U	18.795 U
MSL Background	1	A	6.539 U	1.940 U	1.940 U	1.940 U	6.166 U	1.940 U	1.280 U	0.702 U	19.400 U
MSL Background	2	B	0.755 J	2.125 U	0.008 J	2.125 U	6.754 U	2.125 U	1.402 U	0.769 U	21.251 U
MSL Background	3	C	7.184 U	2.131 U	2.131 U	2.131 U	6.774 U	2.131 U	1.407 U	0.772 U	21.314 U
MSL Background	4	D	7.082 U	2.101 U	2.101 U	2.101 U	6.678 U	2.101 U	1.387 U	0.761 U	21.012 U
MSL Background	5	D	7.078 U	2.100 U	2.100 U	2.100 U	6.674 U	2.100 U	1.386 U	0.760 U	20.999 U

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

(b) U The analyte was not present above the level of the associated value.

(c) E Value an estimate; analyte not detected on confirmation column.

TABLE J.12. Chlorinated Pesticides (alphabetical, Aldrin - 4'4-DDT), Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet weight)								
				Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Chlor-dane	4,4'-DDD	4,4'-DDE	4,4'-DDT
DL Target (a)				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
DL Achieved High				0.222	0.153	0.185	0.185	0.390	7.023	0.118	0.208	0.321
DL Achieved Low				0.070	0.073	0.075	0.071	0.390	2.214	0.048	0.097	0.15
COMP I	1	D	10.850	0.075 U ^(b)	0.076 U	0.076 U	0.076 U	0.498 E ^(c)	2.366 U	0.359	0.434	0.161 U
COMP I	2	D	12.311	0.074 U	0.094 E	0.076 U	0.096 E	0.563 E	2.362 U	0.427	0.446	0.161 U
COMP I	3	A	12.576	0.075 U	0.125	0.076 U	0.076 U	0.576 E	2.363 U	0.589	0.562	0.161 U ^(d)
COMP I	4	B	10.945	0.074 U	0.214	0.075 U	0.075 U	0.400 E	2.334 U	0.503	0.683	0.090 J ^(d)
COMP I	5	A	12.424	0.090 U	0.145 E	0.092 U	0.092 U	0.434 E	2.837 U	0.555	0.644	0.193 U
COMP II	1	D	9.869	0.071 U	0.040 JE	0.073 U	0.073 U	0.343 E	2.261 U	0.571	0.450	0.154 U
COMP II	2	A	11.861	0.075 U	0.120	0.077 U	0.077 U	0.426 E	2.369 U	1.260	0.725	0.161 U
COMP II	3	C	12.662	0.075 U	0.002 J	0.076 U	0.076 U	0.259 E	2.369 U	1.033	0.610	0.161 U
COMP II	4	D	10.515	0.075 U	0.076 U	0.076 U	0.076 U	0.440 E	2.365 U	0.704	0.446	0.161 U
COMP II	5	C	10.906	0.071 U	0.073 U	0.073 U	0.073 U	0.111 E	2.244 U	1.184	0.608	0.153 U
COMP III	1	C	10.740	0.074 U	0.076 U	0.076 U	0.076 U	0.308 E	2.353 U	0.113 E	0.070 J	0.160 U
COMP III	2	D	12.021	0.074 U	0.073 J	0.076 U	0.076 U	0.238 E	2.349 U	0.292	0.249	0.160 U
COMP III	3	A	11.733	0.075 U	0.132	0.076 U	0.076 U	0.419 E	2.367 U	0.398	0.282	0.161 U
COMP III	4	D	11.688	0.075 U	0.024 JE	0.077 U	0.077 U	0.351 E	2.368 U	0.226	0.207	0.161 U
COMP III	5	C	12.222	0.074 U	0.009 J	0.075 U	0.075 U	0.379 E	2.334 U	0.321	0.131	0.159 U
TC-5 Upper Comp	1	C	11.764	0.074 U	0.076 U	0.076 U	0.076 U	0.271 E	2.348 U	1.890	1.449	0.160 U
TC-5 Upper Comp	2	C	11.717	0.073 U	0.075 U	0.075 U	0.075 U	0.337 E	2.321 U	1.213 E	1.203 E	0.158 U
TC-5 Upper Comp	3	C	11.416	0.075 U	0.076 U	0.076 U	0.076 U	0.343 E	2.369 U	1.274	1.232	0.161 U
TC-5 Upper Comp	4	A	12.421	0.080 U	0.137 E	0.082 U	0.082 U	0.369 E	2.538 U	1.222	1.016	0.173 U
TC-5 Upper Comp	5	A	10.782	0.075 U	0.097	0.076 U	0.076 U	0.416 E	2.363 U	0.913	0.760	0.161 U
COMP IV	1	C	9.621	0.075 U	0.076 U	0.076 U	0.076 U	0.283 E	2.362 U	0.051 U	0.104 U	0.161 U
COMP IV	2	C	11.926	0.074 U	0.076 U	0.076 U	0.076 U	0.566 E	2.350 U	0.051 U	0.104 U	0.160 U
COMP IV	3	A	13.027	0.072 U	0.139	0.074 U	0.074 U	0.442 E	2.297 U	0.034 J	0.079 J	0.156 U
COMP IV	4	C	13.336	0.149 U	0.153 U	0.153 U	0.153 U	0.215 E	4.723 U	0.103 U	0.208 U	0.321 U
COMP IV	5	A	12.307	0.074 U	0.133	0.076 U	0.076 U	0.420 E	2.358 U	0.051 U	0.075 J	0.160 U
COMP V	1	A	11.436	0.074 U	0.161	0.076 U	0.076 U	0.466 E	2.361 U	6.380	1.846	0.160 U
COMP V	2	A	13.284	0.087 U	0.137	0.089 U	0.089 U	0.447 E	2.749 U	10.181	2.558	0.005 J
COMP V	3	A	13.303	0.075 U	0.161 E	0.076 U	0.076 U	0.559 E	2.366 U	10.032	3.320	0.067 J
COMP V	4	D	10.903	0.074 U	0.076 U	0.076 U	0.016 JE	0.473 E	2.358 U	3.620	1.192	0.160 U

TABLE J.12. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Aldrin	M. nasuta Pesticides ($\mu\text{g}/\text{kg}$ wet weight)							
					(Lindane)				Chlor-dane	4,4'-DDO	4,4'-DOE	4,4'-DDT
COMP V Replicate 1	5	B	12.388	0.180 U	0.410	0.185 U	0.185 U	0.596 E	5.722 U	10.485	2.486	0.258 J
COMP V Replicate 2	5	B	12.388	0.154 U	0.377	0.157 U	0.157 U	0.599 E	4.868 U	10.013	2.377	0.229 J
COMP V Replicate 3	5	B	12.388	0.107 U	0.287	0.109 U	0.109 U	0.499 E	3.380 U	13.055	2.712	0.189 J
COMP VI	1	C	10.468	0.074 U	0.076 U	0.076 U	0.076 U	0.282 E	2.359 U	5.104	1.730	0.160 U
COMP VI	2	A	11.022	0.075 U	0.155	0.076 U	0.076 U	0.403 E	2.369 U	8.354	1.954	0.161 U
COMP VI	3	B	12.942	0.222 U	0.573	0.227 U	0.227 U	0.737 E	7.023 U	20.236	3.642	0.380 J
COMP VI	4	A	10.775	0.075 U	0.127	0.076 U	0.076 U	0.502 E	2.364 U	7.838	1.893	0.041 J
COMP VI	5	D	9.478	0.074 U	0.115 E	0.076 U	0.021 JE	0.579 E	2.355 U	4.313	1.209 E	0.004 J
R-AC	1	B	12.409	0.073 U	0.227	0.075 U	0.075 U	0.416 E	2.325 U	0.621	0.635	0.158 U
R-AC	2	C	10.536	0.075 U	0.076 U	0.076 U	0.076 U	0.352 E	2.364 U	0.309	0.244	0.161 U
R-AC	3	C	11.771	0.074 U	0.028 JE	0.076 U	0.076 U	0.402 E	2.345 U	0.659	0.501	0.159 U
R-AC	4	A	11.562	0.075 U	0.168	0.076 U	0.076 U	0.447 E	2.362 U	0.694	0.494	0.161 U
R-AC	5	D	11.023	0.075 U	0.081 E	0.076 U	0.003 JE	0.440 E	2.365 U	0.430	0.399	0.161 U
R-AM	1	B	10.052	0.070 U	0.186	0.071 U	0.071 U	0.364 E	2.214 U	0.048 U	0.192	0.150 U
R-AM Replicate 1	2	C	10.333	0.111 U	0.113 U	0.113 U	0.113 U	0.111 JE	3.511 U	0.076 U	0.155 U	0.239 U
R-AM Replicate 2	2	C	10.333	0.112 U	0.115 U	0.115 U	0.115 U	0.189 E	3.553 U	0.077 U	0.157 U	0.241 U
R-AM Replicate 3	2	C	10.333	0.108 U	0.110 U	0.110 U	0.110 U	0.221 E	3.412 U	0.074 U	0.150 U	0.232 U
R-AM	3	B	12.305	0.092 U	0.260	0.095 U	0.095 U	0.486 E	2.930 U	0.001 J	0.346	0.162 J
R-AM	4	B	12.397	0.170 U	0.397	0.174 U	0.174 U	0.610 E	5.396 U	0.118 U	0.454	0.248 J
R-AM	5	B	10.438	0.073 U	0.203	0.075 U	0.075 U	0.382 E	2.314 U	0.050 U	0.229	0.099 J
R-BF	1	D	11.127	0.088 U	0.090 U	0.090 U	0.090 U	0.370 E	2.774 U	0.156 E	0.237	0.188 U
R-BF	2	B	13.418	0.075 U	0.231	0.076 U	0.076 U	0.603 E	2.366 U	0.357	0.704	0.161 U
R-BF	3	B	12.068	0.075 U	0.220	0.077 U	0.077 U	0.495 E	2.367 U	0.329	0.662	0.161 U
R-BF	4	A	10.122	0.074 U	0.121	0.076 U	0.076 U	0.332 E	2.346 U	0.292	0.346	0.159 U
R-BF	5	A	12.830	0.072 U	0.148	0.074 U	0.074 U	0.378 E	2.289 U	0.391	0.434	0.156 U
R-OS	1	B	12.064	0.075 U	0.230	0.077 U	0.077 U	0.414 E	2.378 U	0.052 U	0.533	0.162 U
R-OS	2	D	11.528	0.074 U	0.111 E	0.075 U	0.025 JE	0.734 E	2.330 U	0.096	0.532	0.158 U
R-OS	3	B	11.559	0.074 U	0.205	0.076 U	0.076 U	0.412 E	2.350 U	0.051 U	0.469	0.160 U
R-OS	4	D	12.326	0.074 U	0.018 J	0.076 U	0.057 JE	0.405 E	2.360 U	0.051 U	0.440	0.160 U
R-OS	5	C	12.736	0.074 U	0.095 E	0.076 U	0.076 U	0.487 E	2.348 U	0.051 U	0.419 E	0.160 U
R-PF	1	C	10.779	0.074 U	0.076 U	0.076 U	0.076 U	0.288 E	2.356 U	0.051 U	0.441	0.160 U
R-PF	2	C	11.263	0.074 U	0.076 U	0.076 U	0.076 U	0.338 E	2.360 U	0.051 U	0.423	0.160 U

TABLE J.12. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Aldrin	<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)							
					Alpha BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Chlor-dane	4,4'-DDE	4,4'-DDE	4,4'-DDT
R-PF Replicate 1	3	D	10.404	0.112 U	0.115 U	0.115 U	0.115 U	0.314 E	3.547 U	0.077 U	0.386	0.241 U
R-PF Replicate 2	3	D	10.404	0.109 U	0.112 U	0.112 U	0.112 U	0.225 E	3.453 U	0.075 U	0.521	0.235 U
R-PF Replicate 3	3	D	10.404	0.112 U	0.114 U	0.114 U	0.114 U	0.323 E	3.539 U	0.077 U	0.519	0.240 U
R-PF	4	D	9.333	0.074 U	0.020 JE	0.076 U	0.021 JE	0.337 E	2.353 U	0.051 U	0.387	0.160 U
R-PF	5	A	12.220	0.076 U	0.132	0.077 U	0.077 U	0.537 E	2.400 U	0.052 U	0.693	0.163 U
C-SB	1	C	12.453	0.070 U	0.009 J	0.071 U	0.071 U	0.453 E	2.205 U	0.048 U	0.097 U	0.150 U
C-SB	2	O	10.395	0.073 U	0.075 U	0.075 U	0.075 U	0.417 E	2.330 U	0.051 U	0.087 J	0.158 U
C-SB	3	B	10.960	0.073 U	0.226	0.075 U	0.075 U	0.365 E	2.328 U	0.051 U	0.287	0.158 U
C-SB Replicate 1	4	A	11.334	0.104 U	0.157	0.107 U	0.107 U	0.300 E	3.311 U	0.072 U	0.126 J	0.225 U
C-SB Replicate 2	4	A	11.334	0.102 U	0.234	0.104 U	0.104 U	0.316 E	3.217 U	0.070 U	0.102 J	0.219 U
C-SB Replicate 3	4	A	11.334	0.097 U	0.136	0.099 U	0.099 U	0.342 E	3.077 U	0.067 U	0.101 J	0.209 U
C-SB	5	D	9.851	0.074 U	0.036 JE	0.076 U	0.076 U	0.390 U	2.344 U	0.051 U	0.049 J	0.159 U
C-NE	1	B	11.637	0.074 U	0.248	0.076 U	0.076 U	0.459 E	2.360 U	0.051 U	0.303	0.160 U
C-NE	2	B	10.398	0.070 U	0.201	0.072 U	0.072 U	0.400 E	2.220 U	0.048 U	0.236	0.151 U
C-NE	3	B	13.083	0.074 U	0.257	0.076 U	0.076 U	0.443 E	2.357 U	0.051 U	0.317	0.160 U
C-NE	4	B	10.829	0.074 U	0.238	0.076 U	0.076 U	0.481 E	2.347 U	0.051 U	0.329	0.160 U
C-NE	5	B	12.591	0.075 U	0.253	0.076 U	0.076 U	0.441 E	2.366 U	0.052 U	0.267	0.147 J
MSL Background	1	A	12.160	0.074 U	0.146	0.076 U	0.076 U	0.412 E	2.359 U	0.114	0.053 J	0.160 U
MSL Background	2	B	11.185	0.075 U	0.206	0.077 U	0.077 U	0.396 E	2.377 U	0.052 U	0.197	0.162 U
MSL Background	3	C	10.935	0.074 U	0.075 U	0.075 U	0.075 U	0.385 E	2.331 U	0.051 U	0.103 U	0.158 U
MSL Background	4	D	11.079	0.073 U	0.028 JE	0.075 U	0.075 U	0.496 E	2.328 U	0.051 U	0.103 U	0.158 U
MSL Background	5	D	11.176	0.074 U	0.076 U	0.076 U	0.034 JE	0.428 E	2.347 U	0.051 U	0.103 U	0.159 U

(a) OL Detection limit.

(b) U The analyte was not present above the level of the associated value.

(c) E Value an estimate; analyte not detected on confirmation ion.

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

TABLE J.13. Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<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
Target DL ^(a)				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	30.0
Achieved DL High				1.592	0.702	0.472	0.702	1.819	0.702	0.463	0.254	7.023
Achieved DL Low				0.743	0.221	0.221	0.221	0.706	0.221	0.146	0.080	2.205
COMP I	1	D	10.850	0.083 J ^(b)	0.237 U ^(c)	0.237 U	0.237 U	0.752 U	0.237 U	0.156 U	0.086 U	2.366 U
COMP I	2	D	12.311	0.058 J	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.085 U	2.362 U
COMP I	3	A	12.576	0.064 J	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.086 U	2.363 U
COMP I	4	B	10.945	0.149 J	0.233 U	0.233 U	0.233 U	0.742 U	0.233 U	0.154 U	0.084 U	2.334 U
COMP I	5	A	12.424	0.041 J	0.284 U	0.284 U	0.284 U	0.902 U	0.284 U	0.187 U	0.103 U	2.837 U
COMP II	1	D	9.869	0.126 J	0.226 U	0.015 J ^(d)	0.226 U	0.719 U	0.226 U	0.149 U	0.082 U	2.261 U
COMP II	2	A	11.861	0.167 J	0.237 U	0.237 U	0.237 U	0.753 U	0.237 U	0.156 U	0.086 U	2.369 U
COMP II	3	C	12.662	0.167 J	0.237 U	0.237 U	0.237 U	0.753 U	0.237 U	0.156 U	0.086 U	2.369 U
COMP II	4	D	10.515	0.113 J ^(e)	0.236 U	0.028 J ^(e)	0.236 U	0.752 U	0.236 U	0.156 U	0.086 U	2.365 U
COMP II	5	C	10.906	0.106 J	0.224 U	0.224 U	0.224 U	0.713 U	0.224 U	0.148 U	0.081 U	2.244 U
COMP III	1	C	10.740	0.793 U	0.235 U	0.235 U	0.235 U	0.748 U	0.235 U	0.155 U	0.085 U	2.353 U
COMP III	2	D	12.021	0.082 J	0.235 U	0.235 U	0.235 U	0.747 U	0.235 U	0.155 U	0.085 U	2.349 U
COMP III	3	A	11.733	0.034 J	0.237 U	0.237 U	0.237 U	0.752 U	0.237 U	0.156 U	0.086 U	2.367 U
COMP III	4	D	11.688	0.065 J	0.237 U	0.237 U	0.237 U	0.753 U	0.237 U	0.156 U	0.086 U	2.368 U
COMP III	5	C	12.222	0.787 U	0.233 U	0.233 U	0.233 U	0.742 U	0.233 U	0.154 U	0.084 U	2.334 U
TC-5 Upper Comp	1	C	11.764	0.347 J	0.235 U	0.235 U	0.262 E	0.746 U	0.235 U	0.155 U	0.085 U	2.348 U
TC-5 Upper Comp	2	C	11.717	0.239 J ^(e)	0.232 U	0.232 U	0.232 U	0.738 U	0.232 U	0.153 U	0.084 U	2.321 U
TC-5 Upper Comp	3	C	11.416	0.279 J	0.237 U	0.237 U	0.231 J ^(e)	0.753 U	0.237 U	0.156 U	0.086 U	2.369 U
TC-5 Upper Comp	4	A	12.421	0.185 J	0.254 U	0.254 U	0.254 U	0.807 U	0.254 U	0.167 U	0.092 U	2.538 U
TC-5 Upper Comp	5	A	10.782	0.160 J	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.086 U	2.363 U
COMP IV	1	C	9.621	0.796 U	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.086 U	2.362 U
COMP IV	2	C	11.926	0.792 U	0.235 U	0.235 U	0.235 U	0.747 U	0.235 U	0.155 U	0.085 U	2.350 U
COMP IV	3	A	13.027	0.774 U	0.230 U	0.230 U	0.230 U	0.730 U	0.230 U	0.152 U	0.083 U	2.297 U
COMP IV	4	C	13.336	1.592 U	0.472 U	0.472 U	0.472 U	1.501 U	0.472 U	0.312 U	0.171 U	4.723 U
COMP IV	5	A	12.307	0.795 U	0.236 U	0.236 U	0.236 U	0.749 U	0.236 U	0.156 U	0.085 U	2.358 U
COMP V	1	A	11.436	0.598 J	0.236 U	0.236 U	0.236 U	0.750 U	0.236 U	0.156 U	0.085 U	2.361 U
COMP V	2	A	13.284	0.822 J	0.275 U	0.275 U	0.275 U	0.874 U	0.275 U	0.181 U	0.099 U	2.749 U
COMP V	3	A	13.303	0.912	0.237 U	0.237 U	0.237 U	0.752 U	0.237 U	0.156 U	0.086 U	2.366 U
COMP V	4	D	10.903	0.603 J	0.236 U	0.060 J ^(e)	0.236 U	0.749 U	0.236 U	0.156 U	0.085 U	2.358 U

TABLE J.13. (contd)

<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet 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 V Replicate 1	5	B	12.388	0.930 J	0.572 U	0.124 J	0.572 U	1.819 U	0.572 U	0.378 U	0.207 U	5.722 U
COMP V Replicate 2	5	B	12.388	0.907 J	0.487 U	0.081 J	0.487 U	1.547 U	0.487 U	0.321 U	0.176 U	4.868 U
COMP V Replicate 3	5	B	12.388	0.919 J	0.338 U	0.141 J	0.338 U	1.074 U	0.338 U	0.223 U	0.122 U	3.380 U
COMP VI	1	C	10.468	0.819	0.236 U	0.236 U	0.236 U	0.750 U	0.236 U	0.156 U	0.085 U	2.359 U
COMP VI	2	A	11.022	0.761 J	0.237 U	0.237 U	0.237 U	0.753 U	0.237 U	0.156 U	0.086 U	2.369 U
COMP VI	3	B	12.942	1.173 J	0.702 U	0.080 J	0.702 U	2.232 U	0.702 U	0.463 U	0.254 U	7.023 U
COMP VI	4	A	10.775	0.692 J	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.086 U	2.364 U
COMP VI	5	D	9.478	0.593 J	0.235 U	0.145 JE	0.235 U	0.748 U	0.235 U	0.155 U	0.085 U	2.355 U
R-AC	1	B	12.409	0.123 J	0.232 U	0.232 U	0.232 U	0.739 U	0.232 U	0.153 U	0.082 JE	2.325 U
R-AC	2	C	10.536	0.797 U	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.086 U	2.364 U
R-AC	3	C	11.771	0.790 U	0.234 U	0.234 U	0.234 U	0.745 U	0.234 U	0.155 U	0.085 U	2.345 U
R-AC	4	A	11.562	0.796 U	0.236 U	0.236 U	0.236 U	0.751 U	0.236 U	0.156 U	0.086 U	2.362 U
R-AC	5	D	11.023	0.031 J	0.236 U	0.236 U	0.236 U	0.752 U	0.236 U	0.156 U	0.086 U	2.365 U
R-AM	1	B	10.052	0.067 J	0.221 U	0.000	1.221 U	0.704 U	0.221 U	0.146 U	0.080 U	2.214 U
R-AM Replicate 1	2	C	10.333	1.183 U	0.351 U	0.351 U	0.351 U	1.116 U	0.351 U	0.232 U	0.127 U	3.511 U
R-AM Replicate 2	2	C	10.333	1.198 U	0.355 U	0.355 U	0.355 U	1.129 U	0.355 U	0.234 U	0.129 U	3.553 U
R-AM Replicate 3	2	C	10.333	1.150 U	0.341 U	0.341 U	0.341 U	1.084 U	0.341 U	0.225 U	0.123 U	3.412 U
R-AM	3	B	12.305	0.095 J	0.293 U	0.055 J	0.293 U	0.931 U	0.293 U	0.193 U	0.106 U	2.930 U
R-AM	4	B	12.397	0.138 J	0.540 U	0.540 U	0.540 U	1.715 U	0.540 U	0.356 U	0.195 U	5.396 U
R-AM	5	B	10.438	0.074 J	0.231 U	0.034 J	0.231 U	0.736 U	0.231 U	0.153 U	0.084 U	2.314 U
R-BF	1	D	11.127	0.035 J	0.277 U	0.277 U	0.277 U	0.882 U	0.277 U	0.183 U	0.100 U	2.774 U
R-BF	2	B	13.418	0.171 J	0.237 U	0.106 J	0.237 U	0.752 U	0.237 U	0.156 U	0.086 U	2.366 U
R-BF	3	B	12.068	0.157 J	0.237 U	0.105 J	0.237 U	0.752 U	0.237 U	0.156 U	0.086 U	2.367 U
R-BF	4	A	10.122	0.026 J	0.235 U	0.235 U	0.235 U	0.746 U	0.235 U	0.155 U	0.085 U	2.346 U
R-BF	5	A	12.830	0.086 J	0.229 U	0.229 U	0.229 U	0.728 U	0.229 U	0.151 U	0.083 U	2.289 U
R-OS	1	B	12.064	0.074 J	0.238 U	0.008 J	0.238 U	0.756 U	0.238 U	0.157 U	0.086 U	2.378 U
R-OS	2	D	11.528	0.785 U	0.233 U	0.233 U	0.233 U	0.741 U	0.233 U	0.154 U	0.084 U	2.330 U
R-OS	3	B	11.559	0.063 J	0.235 U	0.235 U	0.235 U	0.747 U	0.235 U	0.155 U	0.085 U	2.350 U
R-OS	4	D	12.326	0.796 U	0.236 U	0.236 U	0.236 U	0.750 U	0.236 U	0.156 U	0.085 U	2.360 U
R-OS	5	C	12.736	0.791 U	0.235 U	0.235 U	0.235 U	0.746 U	0.235 U	0.155 U	0.085 U	2.348 U

TABLE J.13. (contd)

<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet 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
R-PF	1	C	10.779	0.794 U	0.236 U	0.236 U	0.236 U	0.749 U	0.236 U	0.155 U	0.085 U	2.356 U
R-PF	2	C	11.263	0.796 U	0.236 U	0.236 U	0.236 U	0.750 U	0.236 U	0.156 U	0.085 U	2.360 U
R-PF Replicate 1	3	D	10.404	1.196 U	0.355 U	0.355 U	0.355 U	1.127 U	0.355 U	0.234 U	0.128 U	3.547 U
R-PF Replicate 2	3	D	10.404	1.164 U	0.345 U	0.345 U	0.345 U	1.097 U	0.345 U	0.228 U	0.125 U	3.453 U
R-PF Replicate 3	3	D	10.404	1.193 U	0.354 U	0.354 U	0.354 U	1.125 U	0.354 U	0.233 U	0.128 U	3.539 U
R-PF	4	D	9.333	0.793 U	0.235 U	0.235 U	0.235 U	0.748 U	0.235 U	0.155 U	0.085 U	2.353 U
R-PF	5	A	12.220	0.809 U	0.240 U	0.240 U	0.240 U	0.763 U	0.240 U	0.158 U	0.087 U	2.400 U
C-SB	1	C	12.453	0.743 U	0.221 U	0.221 U	0.221 U	0.701 U	0.221 U	0.146 U	0.080 U	2.205 U
C-SB	2	D	10.395	0.785 U	0.233 U	0.233 U	0.233 U	0.741 U	0.233 U	0.154 U	0.084 U	2.330 U
C-SB	3	B	10.960	0.069 J	0.233 U	0.233 U	0.233 U	0.740 U	0.233 U	0.154 U	0.084 U	2.328 U
C-SB Replicate 1	4	A	11.334	1.116 U	0.331 U	0.331 U	0.331 U	1.052 U	0.331 U	0.219 U	0.120 U	3.311 U
C-SB Replicate 2	4	A	11.334	1.085 U	0.322 U	0.322 U	0.322 U	1.023 J	0.322 U	0.212 U	0.117 U	3.217 U
C-SB Replicate 3	4	A	11.334	1.037 U	0.308 U	0.308 U	0.308 U	0.978 U	0.308 U	0.203 U	0.111 U	3.077 U
C-SB	5	D	9.851	0.790 U	0.234 U	0.234 U	0.234 U	0.745 U	0.234 U	0.155 U	0.085 U	2.344 U
C-NE	1	B	11.637	0.086 J	0.236 U	0.236 U	0.236 U	0.750 U	0.236 U	0.156 U	0.085 U	2.360 U
C-NE	2	B	10.398	0.069 J	0.222 U	0.222 U	0.222 U	0.706 U	0.222 U	0.147 U	0.080 U	2.220 U
C-NE	3	B	13.083	0.091 J	0.236 U	0.236 U	0.236 U	0.749 U	0.236 U	0.156 U	0.085 U	2.357 U
C-NE	4	B	10.829	0.088 J	0.235 U	0.235 U	0.235 U	0.746 U	0.235 U	0.155 U	0.085 U	2.347 U
C-NE	5	B	12.591	0.078 J	0.237 U	0.040 J	0.237 U	0.752 U	0.237 U	0.156 U	0.086 U	2.366 U
MSL Background	1	A	12.160	0.795 U	0.236 U	0.236 U	0.236 U	0.750 U	0.236 U	0.156 U	0.085 U	2.359 U
MSL Background	2	B	11.185	0.084 J	0.238 U	0.001 J	0.238 U	0.755 U	0.238 U	0.157 U	0.086 U	2.377 U
MSL Background	3	C	10.935	0.786 U	0.233 U	0.233 U	0.233 U	0.741 U	0.233 U	0.154 U	0.084 U	2.331 U
MSL Background	4	D	11.079	0.785 U	0.233 U	0.233 U	0.233 U	0.740 U	0.233 U	0.154 U	0.084 U	2.328 U
MSL Background	5	D	11.176	0.791 U	0.235 U	0.235 U	0.235 U	0.746 U	0.235 U	0.155 U	0.085 U	2.347 U

(a) DL Detection limit.

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

(c) U The analyte was not present above the level of the associated value.

(d) E Value an estimate; analyte not detected on confirmation column.

TABLE J.14. Quality Control Data for Chlorinated Pesticides (alphabetical, Aldrin - 4,4'-DDT), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

			<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
Sediment Treatment	Replicate	Analytical Batch	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Chlor-dane	4,4'-DDD	4,4'-DDE	4,4'-DDT
<u>Method Blank</u>											
Blank	1	A	0.662 U ^(a)	0.678 U	0.678 U	0.975 E ^(b)	0.678 U	20.978 U	0.457 U	0.924 U	1.426 U
Blank	2	B	0.901 U	2.027 E	1.489 E	5.879	1.811 E	28.559 U	0.622 U	1.889	1.941 U
Blank	3	C	0.646 U	0.661 U	0.661 U	0.058 J ^(c)	0.661 U	20.479 U	0.446 U	0.902 U	0.725 JE
Blank	4	D	0.650 U	0.665 U	0.665 U	4.786 E	0.665 U	20.598 U	0.449 U	0.908 U	1.400 U
<u>Matrix Spikes</u>											
MSL Background	1	A	0.612 U	1.200	0.627 U	0.627 U	3.390 E	19.400 U	0.938	0.436 J	1.319 U
Background MS	1	A	20.045	19.382	23.684	23.563	25.051	NM ^(d)	25.642	25.565	20.114
Concentration Recovered			20.045	18.182	23.684	23.563	21.661	NA ^(e)	24.704	25.129	20.114
Spike Amount			21.864	21.864	21.864	21.864	21.864	NS ^(f)	21.864	21.864	21.864
Percent Recovery			92%	83%	108%	108%	99%	NA	113%	115%	92%
MSL Background	1	A	0.612 U	1.200	0.627 U	0.627 U	3.390 E	19.400 U	0.938	0.436 J	1.319 U
Background MSD	1	A	20.027	19.412	21.678	24.021	24.578	NM	24.002	26.468	18.421
Concentration Recovered			20.027	18.212	21.678	24.021	21.188	NA	23.064	26.032	18.421
Spike Amount			21.888	21.888	21.888	21.888	21.888	NS	21.888	21.888	21.888
Percent Recovery			91%	83%	99%	110%	97%	NA	105%	119%	84%
MS/MSD RPD			0%	0%	9%	2%	2%	NA	7%	3%	9%
MS/MSD I-Stat			0.001	0.000	0.045	0.009	0.012	NA	0.035	0.017	0.044
MSL Background	2	B	0.671 U	1.840	0.686 U	0.686 U	3.542 E	21.251 U	0.463 U	1.764	1.444 U
Background MS	2	B	20.090	22.033	25.819	22.379 B	26.278	NM	27.263	25.844	19.808
Concentration Recovered			20.090	20.193	25.819	22.379	22.736	NA	27.263	24.080	19.808
Spike Amount			24.309	24.309	24.309	24.309	24.309	NS	24.309	24.309	24.309
Percent Recovery			83%	83%	106%	92%	94%	NA	112%	99%	81%
MSL Background	2	B	0.671 U	1.840	0.686 U	0.686 U	3.542 E	21.251 U	0.463 U	1.764	1.444 U
Background MSD	2	B	17.745	20.391	22.418	19.914 B	23.909	NM	19.544	23.672	15.760
Concentration Recovered			17.745	18.551	22.418	19.914	20.367	NA	19.544	21.908	15.760
Spike Amount			22.478	22.478	22.478	22.478	22.478	NS	22.478	22.478	22.478
Percent Recovery			79%	83%	100%	89%	91%	NA	87%	97%	70%
MS/MSD RPD			5%	1%	6%	4%	3%	NA	25%	2%	15%
MS/MSD I-Stat			0.023	0.003	0.031	0.019	0.016	NA	0.127	0.008	0.075

TABLE J.14. (contd)

			<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)								
Sediment Treatment	Replicate	Analytical Batch	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	(Lindane) Gamma-BHC	Chlor-dane	4,4'-DDD	4,4'-DDE	4,4'-DDT
MSL Background	3	C	0.673 U	0.688 U	0.688 U	0.688 U	3.524 E	21.314 U	0.464 U	0.939 U	1.449 U
Background MS	3	C	20.201	15.925	22.026	25.615	24.409	NM	28.357	21.523	22.917
Concentration Recovered			20.201	15.925	22.026	25.615	20.885	NA	28.357	21.523	22.917
Spike Amount			23.529	23.529	23.529	23.529	23.529	NS	23.529	23.529	23.529
Percent Recovery			86%	68%	94%	109%	89%	NA	121%(g)	91%	97%
MSL Background	3	C	0.673 U	0.688 U	0.688 U	0.688 U	3.524 E	21.314 U	0.464 U	0.939 U	1.449 U
Background MSD	3	C	19.218	17.575	23.663	26.996	25.667	NM	26.849	20.497	21.438
Concentration Recovered			19.218	17.575	23.663	26.996	22.143	NA	26.849	20.497	21.438
Spike Amount			24.206	24.206	24.206	24.206	24.206	NS	24.206	24.206	24.206
Percent Recovery			79%	73%	98%	112%	91%	NA	111%	85%	89%
MS/MSD RPD			8%	7%	4%	2%	3%	NA	8%	8%	9%
MS/MSD I-Stat			0.039	0.035	0.022	0.012	0.015	NA	0.041	0.039	0.047
MSL Background	4	D	0.663 U	0.252 JE	0.679 U	0.679 U	4.480 E	21.012 U	0.458 U	0.926 U	1.428 U
Background MS	4	D	18.769	17.787	22.353	24.578	24.152	NM	20.314	19.143	19.088
Concentration Recovered			18.769	17.535	22.353	24.578	19.672	NA	20.314	19.143	19.088
Spike Amount			23.952	23.952	23.952	23.952	23.952	NS	23.952	23.952	23.952
Percent Recovery			78%	73%	93%	103%	82%	NA	85%	80%	80%
MSL Background	4	O	0.663 U	0.252 JE	0.679 U	0.679 U	4.480 E	21.012 U	0.458 U	0.926 U	1.428 U
Background MSD	4	O	17.926	16.163	20.240	21.899	23.581	NM	17.601	18.345	14.953
Concentration Recovered			17.926	15.911	20.240	21.899	19.101	NA	17.601	18.345	14.953
Spike Amount			23.881	23.881	23.881	23.881	23.881	NS	23.881	23.881	23.881
Percent Recovery			75%	67%	85%	92%	80%	NA	74%	77%	63%
MS/MSD RPD			4%	9%	10%	11%	3%	NA	14%	4%	24%
MS/MSD I-Stat			0.021	0.047	0.048	0.056	0.013	NA	0.070	0.020	0.120
<u>Standard Reference Material</u>											
Non-certified Value			NC ^(h)	NC	NC	NC	NC	NC	68.0 ± 3.0	48.0 ± 2.0	3.0 ± 2.0
SRM-NIST 1941	1	A	NA	NA	NA	NA	NA	NA	30.29	25.36	0.76 J
SRM-NIST 1941	2	B	NA	NA	NA	NA	NA	NA	52.87	53.51	5.27
SRM-NIST 1941	3	C	NA	NA	NA	NA	NA	NA	61.98	51.41	0.54 JE
SRM-NIST 1941	4	D	NA	NA	NA	NA	NA	NA	50.39	42.03	NM

TABLE J.14. (contd)

		<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)									
Sediment Treatment	Replicate	Analytical Batch	(Lindane)								
			Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC	Chlor-dane	4,4'-DDD	4,4'-DDE	4,4'-DDT
Analytical Replicates											
CDMP V Replicate 1	5	B	1.457 U	3.311	1.492 U	1.492 U	4.813 E	46.188 U	84.636	20.070	2.083 J
CDMP V Replicate 2	5	B	1.240 U	3.043	1.269 U	1.269 U	4.835 E	39.294 U	80.831	19.191	1.846 J
CDMP V Replicate 3	5	B	0.861 U	2.319	0.881 U	0.881 U	4.030 E	27.287 U	105.381	21.892	1.528 J
RSD			NA	18%	NA	NA	10%	NA	15%	7%	15%
R-AM Replicate 1	2	C	1.072 U	1.098 U	1.098 U	1.098 U	1.071 JE	33.978 U	0.740 U	1.497 U	2.309 U
R-AM Replicate 2	2	C	1.085 U	1.111 U	1.111 U	1.110 U	1.825 E	34.389 U	0.749 U	1.515 U	2.337 U
R-AM Replicate 3	2	C	1.042 U	1.066 U	1.066 U	1.066 U	2.138 E ₍₁₎	33.016 U	0.719 U	1.455 U	2.244 U
RSD			NA	NA	NA	NA	33%	NA	NA	NA	NA
R-PF Replicate 1	3	D	1.076 U	1.101 U	1.101 U	1.101 U	3.015 E	34.093 U	0.743 U	3.708	2.317 U
R-PF Replicate 2	3	D	1.047 U	1.072 U	1.072 U	1.072 U	2.161 E	33.185 U	0.723 U	5.011	2.255 U
R-PF Replicate 3	3	D	1.073 U	1.099 U	1.099 U	1.099 U	3.105 E	34.011 U	0.741 U	4.986	2.311 U
RSD			NA	NA	NA	NA	19%	NA	NA	16%	NA
C-SB Replicate 1	4	A	0.922 U	1.386	0.944 U	0.944 U	2.647 E	29.216 U	0.637 U	1.109 J	1.986 U
C-SB Replicate 2	4	A	0.896 U	2.066	0.917 U	0.917 U	2.788 E	28.388 U	0.619 U	0.902 J	1.929 U
C-SB Replicate 3	4	A	0.857 U	1.202	0.877 U	0.877 U	3.020 E	27.152 U	0.592 U	0.889 J	1.845 U
RSD			NA	29%	NA	NA	7%	NA	NA	13%	NA

(a) U The analyte was not present above the level of the associated value.

(b) E Value an estimate; analyte not detected on confirmation column.

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

(d) NM Not measured.

(e) NA Not applicable.

(f) NS Not spiked.

(g) Recovery outside quality control range (40%-120%).

(h) NC Not certified.

(i) Value exceeds relative precision range of 30%.

TABLE J.15. Quality Control Data for Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

			<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry 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 Blank</u>											
Blank	1	A	7.071 U ^(a)	2.098 U	2.098 U	2.098 U	6.667 U	2.098 U	1.384 U	0.759 U	20.978 U
Blank	2	B	0.599 J ^(b)	2.856 U	2.856 U	0.476 J	9.077 U	2.654 J	1.885 U	1.034 U	28.559 U
Blank	3	C	6.903 U	2.048 U	2.048 U	2.048 U	6.509 U	2.048 U	1.351 U	0.741 U	20.479 U
Blank	4	D	6.943 U	2.060 U	2.060 U	2.060 U	6.547 U	2.060 U	1.359 U	0.746 U	20.598 U
<u>Matrix Spikes</u>											
MSL Background	1	A	6.539 U	1.940 U	1.940 U	1.940 U	6.166 U	1.940 U	1.280 U	0.702 U	19.400 U
Background MS	1	A	21.290	19.752	28.362	30.598	26.819	1.329	21.973	18.448	NM ^(c)
Concentration Recovered			21.290	19.752	28.362	30.598	26.819	1.329	21.973	18.448	NA ^(d)
Spike Amount			21.864	21.864	21.864	21.864	21.864	21.864	21.864	21.864	NS ^(e)
Percent Recovery			97%	90%	130% ^(f)	140% ^(f)	123% ^(f)	6% ^(f)	100%	84%	NA
MSL Background	1	A	6.539 U	1.940 U	1.940 U	1.940 U	6.166 U	1.940 U	1.280 U	0.702 U	19.400 U
Background MSD	1	A	21.192	20.894	27.907	29.958	26.623	1.399	20.569	18.369	NM
Concentration Recovered			21.192	20.894	27.907	29.958	26.623	1.399	20.569	18.369	NA
Spike Amount			21.888	21.888	21.888	21.888	21.888	21.888	21.888	21.888	NS
Percent Recovery			97%	95%	128% ^(f)	137% ^(f)	122% ^(f)	6% ^(f)	94%	84%	NA
MS/MSD RPD			1%	6%	2%	2%	1%	5%	7%	1%	NA
MS/MSD I-Stat			0.003	0.028	0.009	0.011	0.004	0.025	0.034	0.003	NA
MSL Background	2	B	0.755 J	2.125 U	0.008 J	2.125 U	6.754 U	2.125 U	1.402 U	0.769 U	21.251 U
Background MS	2	B	20.060	19.950	28.444	23.043	30.975	8.991	24.291	19.381	NM
Concentration Recovered			19.305	19.950	28.436	23.043	30.975	8.991	24.291	19.381	NA
Spike Amount			24.309	24.309	24.309	24.309	24.309	24.309	24.309	24.309	NS
Percent Recovery			79%	82%	117%	95%	127% ^(f)	37% ^(f)	100%	80%	NA
MSL Background	2	B	0.755 J	2.125 U	0.008 J	2.125 U	6.754 U	2.125 U	1.402 U	0.769 U	21.251 U
Background MSD	2	B	17.043	17.170	23.454	18.588	24.772	4.473	20.223	16.418	NM
Concentration Recovered			16.288	17.170	23.446	18.588	24.772	4.473	20.223	16.418	NA
Spike Amount			22.478	22.478	22.478	22.478	22.478	22.478	22.478	22.478	NS
Percent Recovery			72%	76%	104%	83%	110%	20% ^(f)	90%	73%	NA
MS/MSD RPD			9%	7%	11%	14%	14%	60% ^(g)	10%	9%	NA
MS/MSD I-Stat			0.046	0.036	0.057	0.068	0.072	0.300	0.052	0.044	NA

TABLE J.15. (contd)

			<i>M. nasuta</i> Pesticides ($\mu\text{g}/\text{kg}$ dry 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
MSL Background	3	C	7.184 U	2.131 U	2.131 U	2.131 U	6.774 U	2.131 U	1.407 U	0.772 U	21.314 U
Background MS	3	C	23.578	24.228	44.876	33.259	24.177	11.364	20.721	20.891	NM
Concentration Recovered			23.578	24.228	44.876	33.259	24.177	11.364	20.721	20.891	NA
Spike Amount			23.529	23.529	23.529	23.529	23.529	23.529	23.529	23.529	NS
Percent Recovery			100%	103%	191%(f)	141%(f)	103%	48%	88%	89%	NA
MSL Background	3	C	7.184 U	2.131 U	2.131 U	2.131 U	6.774 U	2.131 U	1.407 U	0.772 U	21.314 U
Background MSD	3	C	22.878	20.633	44.653	34.123	24.200	6.872	21.945	18.060	NM
Concentration Recovered			22.878	20.633	44.653	34.123	24.200	6.872	21.945	18.060	NA
Spike Amount			24.206	24.206	24.206	24.206	24.206	24.206	24.206	24.206	NS
Percent Recovery			95%	85%	184%(f)	141%(f)	100%	28%(f)	91%	75%	NA
MS/MSD RPD			6%	19%	3%	0%	3%	52%(g)	3%	17%	NA
MS/MSD I-Stat			0.029	0.094	0.017	0.001	0.014	0.260	0.015	0.087	NA
MSL Background	4	D	7.082 U	2.101 U	2.101 U	2.101 U	6.678 U	2.101 U	1.387 U	0.761 U	21.012 U
Background MS	4	D	19.830	17.703	25.706	26.164	20.316	8.341	21.323	18.617	NM
Concentration Recovered			19.830	17.703	25.706	26.164	20.316	8.341	21.323	18.617	NA
Spike Amount			23.952	23.952	23.952	23.952	23.952	23.952	23.952	23.952	NS
Percent Recovery			83%	74%	107%	109%	85%	35%(f)	89%	78%	NA
MSL Background	4	D	7.082 U	2.101 U	2.101 U	2.101 U	6.678 U	2.101 U	1.387 U	0.761 U	21.012 U
Background MSD	4	D	16.679	16.818	22.552	24.847	16.921	7.514	18.557	15.945	NM
Concentration Recovered			16.679	16.818	22.552	24.847	16.921	7.514	18.557	15.945	NA
Spike Amount			23.881	23.881	23.881	23.881	23.881	23.881	23.881	23.881	NS
Percent Recovery			70%	70%	94%	104%	71%	31%(f)	78%	67%	NA
MS/MSD RPD			17%	5%	13%	5%	18%	10%	14%	15%	NA
MS/MSD I-Stat			0.085	0.024	0.064	0.024	0.090	0.051	0.068	0.076	NA
<u>Standard Reference Material</u>											
Non-certified Value			8.0 ± 4.0	NC ^(h)	NC	NC	NC	NC	NC	NC	NC
SRM-NIST 1941	1	A	7.57 J	NA	NA	NA	NA	NA	NA	NA	NA
SRM-NIST 1941	2	B	12.95 J	NA	NA	NA	NA	NA	NA	NA	NA
SRM-NIST 1941	3	C	16.77 J	NA	NA	NA	NA	NA	NA	NA	NA
SRM-NIST 1941	4	D	18.99 J	NA	NA	NA	NA	NA	NA	NA	NA

TABLE J.15. (contd)

			<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Analytical Batch</u>	<u>Dieldrin</u>	<u>Endo-sulfan I</u>	<u>Endo-sulfan II</u>	<u>Endo-sulfan Sulfate</u>	<u>Endrin</u>	<u>Endrin aldehyde</u>	<u>Hepta-chlor</u>	<u>Hepta-chlor-epoxide</u>	<u>Toxa-phene</u>
<u>Analytical Replicates</u>											
COMP V Replicate 1	5	B	7.507 J	4.619 U	0.997 J	4.619 U	14.680 U	4.619 U	3.048 U	1.672 U	46.188 U
COMP V Replicate 2	5	B	7.322 J	3.929 U	0.652 J	3.929 U	12.489 U	3.929 U	2.593 U	1.422 U	39.294 U
COMP V Replicate 3	5	B	7.417 J	2.729 U	1.137 J	2.729 U	8.673 U	2.729 U	1.801 U	0.988 U	27.287 U
RSD			1%	NA	27%	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	2	C	11.453 U	3.398 U	3.398 U	3.398 U	10.799 U	3.398 U	2.242 U	1.230 U	33.978 U
R-AM Replicate 2	2	C	11.592 U	3.439 U	3.439 U	3.439 U	10.930 U	3.439 U	2.269 U	1.245 U	34.389 U
R-AM Replicate 3	2	C	11.129 U	3.301 U	3.301 U	3.301 U	10.493 U	3.301 U	2.179 U	1.195 U	33.016 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-PF Replicate 1	3	D	11.492 U	3.409 U	3.409 U	3.409 U	10.835 U	3.409 U	2.250 U	1.234 U	34.093 U
R-PF Replicate 2	3	D	11.186 U	3.318 U	3.318 U	3.318 U	10.547 U	3.318 U	2.190 U	1.201 U	33.185 U
R-PF Replicate 3	3	D	11.464 U	3.401 U	3.401 U	3.401 U	10.810 U	3.401 U	2.244 U	1.231 U	34.011 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
C-SB Replicate 1	4	A	9.848 U	2.921 U	2.921 U	2.921 U	9.286 U	2.921 U	1.928 U	1.058 U	29.216 U
C-SB Replicate 2	4	A	9.569 U	2.839 U	2.839 U	2.839 U	9.022 J	2.839 U	1.873 U	1.028 U	28.388 U
C-SB Replicate 3	4	A	9.152 U	2.715 U	2.715 U	2.715 U	8.629 U	2.715 U	1.792 U	0.983 U	27.152 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) U The analyte was not present above the level of the associated value.

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

(c) NM Not measured.

(d) NA Not applicable.

(e) NS Not spiked.

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

(g) Value exceeds relative precision range of 30%.

(h) NC Not certified.

TABLE J.16. Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ dry weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
COMP I	1	D	21.811 U ^(a)	21.811 U	70.323	21.811 U
COMP I	2	D	19.186 U	19.186 U	80.239	19.186 U
COMP I	3	A	18.790 U	18.790 U	82.272	18.790 U
COMP I	4	B	21.327 U	21.327 U	74.656	21.327 U
COMP I	5	A	22.834 U	22.834 U	82.577	22.834 U
COMP II	1	D	22.908 U	22.908 U	86.264	22.908 U
COMP II	2	A	19.973 U	19.973 U	106.675	19.973 U
COMP II	3	C	18.711 U	18.711 U	91.115	18.711 U
COMP II	4	D	22.495 U	22.495 U	78.429	22.495 U
COMP II	5	C	20.580 U	20.580 U	97.712	20.580 U
COMP III	1	C	21.905 U	21.905 U	64.938	21.905 U
COMP III	2	D	19.544 U	19.544 U	62.334	19.544 U
COMP III	3	A	20.177 U	20.177 U	65.176	20.177 U
COMP III	4	D	20.263 U	20.263 U	43.677	20.263 U
COMP III	5	C	19.093 U	19.093 U	57.537	19.093 U
TC-5 Upper Comp	1	C	19.956 U	19.956 U	188.164	19.956 U
TC-5 Upper Comp	2	C	19.806 U	19.806 U	184.500	19.806 U
TC-5 Upper Comp	3	C	20.754 U	20.754 U	212.688	20.754 U
TC-5 Upper Comp	4	A	20.432 U	20.432 U	142.585	20.432 U
TC-5 Upper Comp	5	A	21.912 U	21.912 U	139.686	21.912 U
COMP IV	1	C	24.554 U	24.554 U	24.554 U	24.554 U
COMP IV	2	C	19.707 U	19.707 U	40.840	19.707 U
COMP IV	3	A	17.634 U	17.634 U	39.416	17.634 U
COMP IV	4	C	35.418 U	35.418 U	35.418 U	35.418 U
COMP IV	5	A	19.160 U	19.160 U	48.761	19.160 U
COMP V	1	A	20.646 U	20.646 U	175.972	20.646 U
COMP V	2	A	20.694 U	20.694 U	163.323	20.694 U
COMP V	3	A	17.784 U	17.784 U	174.219	17.784 U
COMP V	4	D	21.625 U	21.625 U	128.288	21.625 U
COMP V Replicate 1	5	B	46.188 U	46.188 U	143.548	46.188 U
COMP V Replicate 2	5	B	39.294 U	39.294 U	156.695	39.294 U
COMP V Replicate 3	5	B	27.287 U	27.287 U	155.426	27.287 U
COMP VI	1	C	22.537 U	22.537 U	201.989	22.537 U
COMP VI	2	A	21.495 U	21.495 U	154.813	21.495 U
COMP VI	3	B	54.262 U	54.262 U	251.080	54.262 U
COMP VI	4	A	21.939 U	21.939 U	213.081	21.939 U
COMP VI	5	D	24.846 U	24.846 U	193.302	24.846 U
R-AC	1	B	18.736 U	18.736 U	94.512	18.736 U
R-AC	2	C	22.438 U	22.438 U	128.688	22.438 U
R-AC	3	C	19.922 U	19.922 U	181.823	19.922 U
R-AC	4	A	20.432 U	20.432 U	157.103	20.432 U
R-AC	5	D	21.456 U	21.456 U	85.992	21.456 U
R-AM	1	B	22.028 U	22.028 U	59.169	22.028 U
R-AM Replicate 1	2	C	33.978 U	33.978 U	80.162	33.978 U
R-AM Replicate 2	2	C	34.389 U	34.389 U	78.654	34.389 U
R-AM Replicate 3	2	C	33.016 U	33.016 U	91.345	33.016 U
R-AM	3	B	23.813 U	23.813 U	115.442	23.813 U
R-AM	4	B	43.529 U	43.529 U	118.580	43.529 U
R-AM	5	B	22.172 U	22.172 U	66.193	22.172 U

TABLE J.16. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PCBs ($\mu\text{g}/\text{kg}$ dry weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
R-BF	1	D	24.933 U	24.933 U	69.236	24.933 U
R-BF	2	B	17.630 U	17.630 U	115.933	17.630 U
R-BF	3	B	19.615 U	19.615 U	114.900	19.615 U
R-BF	4	A	23.177 U	23.177 U	106.710	23.177 U
R-BF	5	A	17.842 U	17.842 U	91.766	17.842 U
R-OS	1	B	19.712 U	19.712 U	25.119	19.712 U
R-OS	2	D	20.211 U	20.211 U	20.211 U	20.211 U
R-OS	3	B	20.327 U	20.327 U	22.374	20.327 U
R-OS	4	D	19.150 U	19.150 U	27.999	19.150 U
R-OS	5	C	18.434 U	18.434 U	18.434 U	18.434 U
R-PF	1	C	21.858 U	21.858 U	21.858 U	21.858 U
R-PF	2	C	20.956 U	20.956 U	38.246	20.956 U
R-PF Replicate 1	3	D	34.093 U	34.093 U	34.093 U	34.093 U
R-PF Replicate 2	3	D	33.185 U	33.185 U	33.185 U	33.185 U
R-PF Replicate 3	3	D	34.011 U	34.011 U	34.011 U	34.011 U
R-PF	4	D	25.216 U	25.216 U	32.682	25.216 U
R-PF	5	A	19.636 U	19.636 U	51.277	19.636 U
C-SB	1	C	17.709 U	17.709 U	42.084	17.709 U
C-SB	2	O	22.417 U	22.417 U	31.549	22.417 U
C-SB	3	B	21.238 U	21.238 U	38.957	21.238 U
C-SB Replicate 1	4	A	29.216 U	29.216 U	35.074	29.216 U
C-SB Replicate 2	4	A	28.388 U	28.388 U	37.273	28.388 U
C-SB Replicate 3	4	A	27.152 U	27.152 U	37.331	27.152 U
C-SB	5	D	23.797 U	23.797 U	33.199	23.797 U
C-NE	1	B	20.280 U	20.280 U	41.367	20.280 U
C-NE	2	B	21.353 U	21.353 U	42.943	21.353 U
C-NE	3	B	18.014 U	18.014 U	47.330	18.014 U
C-NE	4	B	21.672 U	21.672 U	48.628	21.672 U
C-NE	5	B	18.795 U	18.795 U	49.805	18.795 U
MSL Background	1	A	19.400 U	19.400 U	19.400 U	19.400 U
MSL Background	2	B	21.251 U	21.251 U	22.598	21.251 U
MSL Background	3	C	21.314 U	21.314 U	21.314 U	21.314 U
MSL Background	4	D	21.012 U	21.012 U	21.012 U	21.012 U
MSL Background	5	D	20.999 U	20.999 U	34.739	20.999 U

(a) U The analyte was not present above the level of the associated value.

TABLE J.17. Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ wet weight)			
				Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL ^(a)				20.0	20.0	20.0	20.0
Achieved DL High				7.023	7.023	4.723	7.023
Achieved DL Low				2.244	2.244	2.728	2.244
COMP I	1	D	10.850	2.366 U ^(b)	2.366 U	7.630	2.366 U
COMP I	2	D	12.311	2.362 U	2.362 U	9.878	2.362 U
COMP I	3	A	12.576	2.363 U	2.363 U	10.347	2.363 U
COMP I	4	B	10.945	2.334 U	2.334 U	8.171	2.334 U
COMP I	5	A	12.424	2.837 U	2.837 U	10.259	2.837 U
COMP II	1	D	9.869	2.261 U	2.261 U	8.513	2.261 U
COMP II	2	A	11.861	2.369 U	2.369 U	12.653	2.369 U
COMP II	3	C	12.662	2.369 U	2.369 U	11.537	2.369 U
COMP II	4	D	10.515	2.365 U	2.365 U	8.247	2.365 U
COMP II	5	C	10.906	2.244 U	2.244 U	10.656	2.244 U
COMP III	1	C	10.740	2.353 U	2.353 U	6.974	2.353 U
COMP III	2	D	12.021	2.349 U	2.349 U	7.493	2.349 U
COMP III	3	A	11.733	2.367 U	2.367 U	7.647	2.367 U
COMP III	4	D	11.688	2.368 U	2.368 U	5.105	2.368 U
COMP III	5	C	12.222	2.334 U	2.334 U	7.032	2.334 U
TC-5 Upper Comp	1	C	11.764	2.348 U	2.348 U	22.136	2.348 U
TC-5 Upper Comp	2	C	11.717	2.321 U	2.321 U	21.618	2.321 U
TC-5 Upper Comp	3	C	11.416	2.369 U	2.369 U	24.280	2.369 U
TC-5 Upper Comp	4	A	12.421	2.538 U	2.538 U	17.710	2.538 U
TC-5 Upper Comp	5	A	10.782	2.363 U	2.363 U	15.061	2.363 U
COMP IV	1	C	9.621	2.362 U	2.362 U	2.362 U	2.362 U
COMP IV	2	C	11.926	2.350 U	2.350 U	4.871	2.350 U
COMP IV	3	A	13.027	2.297 U	2.297 U	5.135	2.297 U
COMP IV	4	C	13.336	4.723 U	4.723 U	4.723 U	4.723 U
COMP IV	5	A	12.307	2.358 U	2.358 U	6.001	2.358 U
COMP V	1	A	11.436	2.361 U	2.361 U	20.124	2.361 U
COMP V	2	A	13.284	2.749 U	2.749 U	21.696	2.749 U
COMP V	3	A	13.303	2.366 U	2.366 U	23.176	2.366 U
COMP V	4	D	10.903	2.358 U	2.358 U	13.987	2.358 U
COMP V Replicate 1	5	B	12.388	5.722 U	5.722 U	17.783	5.722 U
COMP V Replicate 2	5	B	12.388	4.868 U	4.868 U	19.411	4.868 U
COMP V Replicate 3	5	B	12.388	3.380 U	3.380 U	19.254	3.380 U
COMP VI	1	C	10.468	2.359 U	2.359 U	21.144	2.359 U
COMP VI	2	A	11.022	2.369 U	2.369 U	17.063	2.369 U
COMP VI	3	B	12.942	7.023 U	7.023 U	32.495	7.023 U
COMP VI	4	A	10.775	2.364 U	2.364 U	22.959	2.364 U
COMP VI	5	D	9.478	2.355 U	2.355 U	18.321	2.355 U
R-AC	1	B	12.409	2.325 U	2.325 U	11.728	2.325 U
R-AC	2	C	10.536	2.364 U	2.364 U	13.559	2.364 U
R-AC	3	C	11.771	2.345 U	2.345 U	21.402	2.345 U
R-AC	4	A	11.562	2.362 U	2.362 U	18.164	2.362 U
R-AC	5	D	11.023	2.365 U	2.365 U	9.479	2.365 U
R-AM	1	B	10.052	2.214 U	2.214 U	5.948	2.214 U
R-AM Replicate 1	2	C	10.333	3.511 U	3.511 U	8.283	3.511 U
R-AM Replicate 2	2	C	10.333	3.553 U	3.553 U	8.127	3.553 U

TABLE J.17. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ wet weight)			
				Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
R-AM Replicate 3	2	C	10.333	3.412 U	3.412 U	9.439	3.412 U
R-AM	3	B	12.305	2.930 U	2.930 U	14.205	2.930 U
R-AM	4	B	12.397	5.396 U	5.396 U	14.700	5.396 U
R-AM	5	B	10.438	2.314 U	2.314 U	6.909	2.314 U
R-BF	1	D	11.127	2.774 U	2.774 U	7.704	2.774 U
R-BF	2	B	13.418	2.366 U	2.366 U	15.556	2.366 U
R-BF	3	B	12.068	2.367 U	2.367 U	13.866	2.367 U
R-BF	4	A	10.122	2.346 U	2.346 U	10.801	2.346 U
R-BF	5	A	12.830	2.289 U	2.289 U	11.774	2.289 U
R-OS	1	B	12.064	2.378 U	2.378 U	3.030	2.378 U
R-OS	2	D	11.528	2.330 U	2.330 U	2.330 U	2.330 U
R-OS	3	B	11.559	2.350 U	2.350 U	2.586	2.350 U
R-OS	4	D	12.326	2.360 U	2.360 U	3.451	2.360 U
R-OS	5	C	12.736	2.348 U	2.348 U	2.348 U	2.348 U
R-PF	1	C	10.779	2.356 U	2.356 U	2.356 U	2.356 U
R-PF	2	C	11.263	2.360 U	2.360 U	4.308	2.360 U
R-PF Replicate 1	3	D	10.404	3.547 U	3.547 U	3.547 U	3.547 U
R-PF Replicate 2	3	D	10.404	3.453 U	3.453 U	3.453 U	3.453 U
R-PF Replicate 3	3	D	10.404	3.539 U	3.539 U	3.539 U	3.539 U
R-PF	4	D	9.333	2.353 U	2.353 U	3.050	2.353 U
R-PF	5	A	12.220	2.400 U	2.400 U	6.266	2.400 U
C-SB	1	C	12.453	2.205 U	2.205 U	5.241	2.205 U
C-SB	2	D	10.395	2.330 U	2.330 U	3.280	2.330 U
C-SB	3	B	10.960	2.328 U	2.328 U	4.270	2.328 U
C-SB Replicate 1	4	A	11.334	3.311 U	3.311 U	3.975	3.311 U
C-SB Replicate 2	4	A	11.334	3.217 U	3.217 U	4.225	3.217 U
C-SB Replicate 3	4	A	11.334	3.077 U	3.077 U	4.231	3.077 U
C-SB	5	D	9.851	2.344 U	2.344 U	3.270	2.344 U
C-NE	1	B	11.637	2.360 U	2.360 U	4.814	2.360 U
C-NE	2	B	10.398	2.220 U	2.220 U	4.465	2.220 U
C-NE	3	B	13.083	2.357 U	2.357 U	6.192	2.357 U
C-NE	4	B	10.829	2.347 U	2.347 U	5.266	2.347 U
C-NE	5	B	12.591	2.366 U	2.366 U	6.271	2.366 U
MSL Background	1	A	12.160	2.359 U	2.359 U	2.359 U	2.359 U
MSL Background	2	B	11.185	2.377 U	2.377 U	2.528	2.377 U
MSL Background	3	C	10.935	2.331 U	2.331 U	2.331 U	2.331 U
MSL Background	4	D	11.079	2.328 U	2.328 U	2.328 U	2.328 U
MSL Background	5	D	11.176	2.347 U	2.347 U	3.882	2.347 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

TABLE J.18. Quality Control Data for Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ dry weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<u>Method Blank</u>						
Blank	1	A	20.978 U ^(a)	20.978 U	20.978 U	20.978 U
Blank	2	B	28.559 U	28.559 U	28.559 U	28.559 U
Blank	3	C	20.479 U	20.479 U	20.479 U	20.479 U
Blank	4	D	20.598 U	20.598 U	20.598 U	20.598 U
<u>Matrix Spikes</u>						
MSL Background	1	A	19.400 U	19.400 U	19.400 U	19.400 U
Background MS	1	A	NM ^(b)	NM	662.871	NM
Concentration Recovered			NA ^(c)	NA	662.871	NA
Spike Amount			NS ^(d)	NS	546.597	NS
Percent Recovery			NA	NA	121% ^(e)	NA
MSL Background	1	A	19.400 U	19.400 U	19.400 U	19.400 U
Background MSD	1	A	NM	NM	673.581	NM
Concentration Recovered			NA	NA	673.581	NA
Spike Amount			NS	NS	546.597 ^(e)	NS
Percent Recovery			NA	NA	123% ^(e)	NA
MS/MSD RPD			NA	NA	2%	NA
MS/MSD I-Stat			NA	NA	0.008	NA
MSL Background	2	B	21.251 U	21.251 U	22.598	21.251 U
Background MS	2	B	NM	NM	846.425	NM
Concentration Recovered			NA	NA	823.827	NA
Spike Amount			NS	NS	607.718	NS
Percent Recovery			NA	NA	136% ^(e)	NA
MSL Background	2	B	21.251 U	21.251 U	22.598	21.251 U
Background MSD	2	B	NM	NM	815.759	NM
Concentration Recovered			NA	NA	793.161	NA
Spike Amount			NS	NS	561.956 ^(e)	NS
Percent Recovery			NA	NA	141% ^(e)	NA
MS/MSD RPD			NA	NA	4%	NA
MS/MSD I-Stat			NA	NA	0.020	NA
MSL Background	3	C	21.314 U	21.314 U	21.314 U	21.314 U
Background MS	3	C	NM	NM	659.04	NM
Concentration Recovered			NA	NA	659.04	NA
Spike Amount			NS	NS	588.235	NS
Percent Recovery			NA	NA	112%	NA
MSL Background	3	C	21.314 U	21.314 U	21.314 U	21.314 U
Background MSD	3	C	NM	NM	694.211	NM
Concentration Recovered			NA	NA	694.211	NA
Spike Amount			NS	NS	605.144	NS
Percent Recovery			NA	NA	115%	NA
MS/MSD RPD			NA	NA	2%	NA
MS/MSD I-Stat			NA	NA	0.012	NA

TABLE J.18. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasua</i> PCBs ($\mu\text{g}/\text{kg}$ dry weight)			
			Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
MSL Background	4	D	21.012 U	21.012 U	21.012 U	21.012 U
Background MS	4	D	NM	NM	633.08	NM
Concentration Recovered			NA	NA	633.08	NA
Spike Amount			NS	NS	598.802	NS
Percent Recovery			NA	NA	105%	NA
MSL Background	4	D	21.012 U	21.012 U	21.012 U	21.012 U
Background MSD	4	D	NM	NM	641.432	NM
Concentration Recovered			NA	NA	641.432	NA
Spike Amount			NS	NS	597.015	NS
Percent Recovery			NA	NA	107%	NA
MS/MSD RPD			NA	NA	2%	NA
MS/MSD I-Stat			NA	NA	0.008	NA
<u>Standard Reference Material</u>						
No Certified values for PCBs						
<u>Analytical Replicates</u>						
COMP V Replicate 1	5	B	46.188 U	46.188 U	143.548	46.188 U
COMP V Replicate 2	5	B	39.294 U	39.294 U	156.695	39.294 U
COMP V Replicate 3	5	B	27.287 U	27.287 U	155.426	27.287 U
RSD			NA	NA	5%	NA
R-AM Replicate 1	2	C	33.978 U	33.978 U	80.162	33.978 U
R-AM Replicate 2	2	C	34.389 U	34.389 U	78.654	34.389 U
R-AM Replicate 3	2	C	33.016 U	33.016 U	91.345	33.016 U
RSD			NA	NA	8%	NA
R-PF Replicate 1	3	D	34.093 U	34.093 U	34.093 U	34.093 U
R-PF Replicate 2	3	D	33.185 U	33.185 U	33.185 U	33.185 U
R-PF Replicate 3	3	D	34.011 U	34.011 U	34.011 U	34.011 U
RSD			NA	NA	NA	NA
C-SB Replicate 1	4	A	29.216 U	29.216 U	35.074	29.216 U
C-SB Replicate 2	4	A	28.388 U	28.388 U	37.273	28.388 U
C-SB Replicate 3	4	A	27.152 U	27.152 U	37.331	27.152 U
RSD			NA	NA	4%	NA

(a) U The analyte was not present above the level of the associated value.

(b) NM Not measured.

(c) NA Not applicable.

(d) NS Not Spiked.

(e) Recovery outside quality control range (40%-120%).

TABLE J.19. Surrogate Recoveries for Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs) in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i>	
			Surrogate Percent Recovery	
			DBOFB	TCN
COMP I	1	D	73.958	89.862
COMP I	2	D	44.052	57.056
COMP I	3	A	74.311	101.509
COMP I	4	B	93.979	106.291
COMP I	5	A	80.131	106.685
COMP II	1	D	77.673	91.675
COMP II	2	A	72.945	99.969
COMP II	3	C	66.501	68.764
COMP II	4	D	72.314	79.506
COMP II	5	C	66.809	66.244
COMP III	1	C	55.983	64.514
COMP III	2	D	67.317	78.306
COMP III	3	A	76.876	107.110
COMP III	4	D	61.257	70.445
COMP III	5	C	64.811	77.106
TC-5 Upper Comp	1	C	63.608	81.253
TC-5 Upper Comp	2	C	67.543	79.137
TC-5 Upper Comp	3	C	52.637	72.186
TC-5 Upper Comp	4	A	65.665	93.888
TC-5 Upper Comp	5	A	69.885	102.495
COMP IV	1	C	59.026	69.762
COMP IV	2	C	64.634	74.316
COMP IV	3	A	83.092	105.025
COMP IV	4	C	59.805	66.002
COMP IV	5	A	66.830	96.818
COMP V	1	A	75.840	117.362
COMP V	2	A	90.469	117.189
COMP V	3	A	75.459	108.339
COMP V	4	D	75.677	95.320
COMP V Replicate 1	5	B	97.706	103.744
COMP V Replicate 2	5	B	82.195	95.571
COMP V Replicate 3	5	B	84.010	95.385
COMP VI	1	C	56.487	76.190
COMP VI	2	A	80.613	106.862
COMP VI	3	B	87.886	116.971
COMP VI	4	A	71.986	119.622
COMP VI	5	D	40.061	57.722

TABLE J.19. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Surrogate Percent Recovery	
			DBO/FB	TCN
R-AC	1	B	92.877	98.417
R-AC	2	C	62.539	70.164
R-AC	3	C	62.284	74.313
R-AC	4	A	67.424	94.632
R-AC	5	D	72.942	83.891
R-AM	1	B	85.728	106.179
R-AM Replicate 1	2	C	56.787	60.135
R-AM Replicate 2	2	C	50.724	62.912
R-AM Replicate 3	2	C	51.339	64.821
R-AM	3	B	100.600	104.931
R-AM	4	B	67.588	104.892
R-AM	5	B	81.752	108.997
R-BF	1	D	75.820	82.407
R-BF	2	B	96.515	104.515
R-BF	3	B	93.050	95.968
R-BF	4	A	69.126	94.229
R-BF	5	A	80.330	97.490
R-OS	1	B	86.714	110.233
R-OS	2	D	46.578	65.956
R-OS	3	B	94.763	103.869
R-OS	4	D	76.732	82.497
R-OS	5	C	56.185	66.132
R-PF	1	C	59.432	69.197
R-PF	2	C	53.061	56.900
R-PF Replicate 1	3	D	57.505	69.072
R-PF Replicate 2	3	D	71.265	72.888
R-PF Replicate 3	3	D	62.892	68.938
R-PF	4	D	71.865	86.022
R-PF	5	A	66.545	93.758
C-SB	1	C	61.254	67.955
C-SB	2	D	63.942	76.852
C-SB	3	B	71.885	108.790
C-SB Replicate 1	4	A	65.422	86.468
C-SB Replicate 2	4	A	67.402	89.751
C-SB Replicate 3	4	A	67.114	92.119
C-SB	5	D	77.865	89.590

TABLE J.19. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Analytical Batch</u>	<u>M. nasuta</u>	
			<u>Surrogate Percent Recovery</u>	<u>DBOFB TCN</u>
C-NE	1	B	93.084	110.167
C-NE	2	B	91.824	94.418
C-NE	3	B	92.632	105.890
C-NE	4	B	93.620	94.008
C-NE	5	B	75.419	99.739
MSL Background	1	A	75.591	103.588
MSL Background	2	B	95.127	106.594
MSL Background	3	C	56.393	69.214
MSL Background	4	D	36.791 ^(a)	49.650
MSL Background	5	D	45.415	65.707
<u>Quality Control Data</u>				
<u>Method Blank</u>				
Blank	1	A	18.689 ^(a)	22.536 ^(a)
Blank	2	B	29.412 ^(a)	38.543 ^(a)
Blank	3	C	22.702 ^(a)	21.231 ^(a)
Blank	4	D	18.566 ^(a)	19.728 ^(a)
<u>Matrix Spikes</u>				
MSL Background MS	1	A	69	87
MSL Background MSD	1	A	65	81
MS/MSD RPD			2	2
MS/MSD I-STAT			0.03	0.04
MSL Background MS	2	B	79	109
MSL Background MSD	2	B	84	119
MS/MSD RPD			2	2
MS/MSD I-STAT			0.03	0.04
MSL Background MS	3	C	89	88
MSL Background MSD	3	C	74	78
MS/MSD RPD			2	5
MS/MSD I-STAT			0.03	0.09
MSL Background MS	4	D	67	74
MSL Background MSD	4	D	61	70
MS/MSD RPD			2	1
MS/MSD I-STAT			0.05	0.03

TABLE J.19. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Analytical Batch</u>	<i>M. nasuta</i> <u>Surrogate Percent Recovery</u>	
			<u>DBOFB</u>	<u>TCN</u>
<u>Standard Reference Material</u>				
No Certified Values for PCBs and Pesticides				
<u>Analytical Replicate</u>				
COMP V Replicate 1	5	8	97.706	103.744
COMP V Replicate 2	5	8	82.195	95.571
COMP V Replicate 3	5	B	84.010	95.385
RSD			10	5
R-AM Replicate 1	2	C	56.787	60.135
R-AM Replicate 2	2	C	50.724	62.912
R-AM Replicate 3	2	C	51.339	64.821
RSD			6	4
R-PF Replicate 1	3	D	57.505	69.072
R-PF Replicate 2	3	D	71.265	72.888
R-PF Replicate 3	3	D	62.892	68.938
RSD			11	3
C-SB Replicate 1	4	A	65.422	86.468
C-SB Replicate 2	4	A	67.402	89.751
C-SB Replicate 3	4	A	67.114	92.119
RSD			2	3

(a) Recovery outside quality control range (40%-120%).

TABLE J.20. Metals, Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Metals (mg/kg dry weight)									
			Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP I	1	B	0.556	26.0	0.110	1.65	18.10	0.061	4.99	1.31	2.00	92.6
COMP I	2	B	0.748	34.0	0.149	1.83	19.10	0.054	3.03	1.36	1.97	85.1
COMP I	3	A	0.143	30.7	0.153	1.00	17.40	0.101	3.19	1.57	1.56	90.5
COMP I	4	A	0.381	30.5	0.136	4.93	22.50	0.109	6.42	2.08	1.45	117.7
COMP I	5	A	0.457	36.8	0.294	2.78	24.20	0.103	3.20	2.02	1.78	112.9
COMP II	1	B	0.694	28.4	0.139	2.45	28.00	0.077	5.32	1.61	1.19	109.0
COMP II Replicate 1	2	A	0.302	27.0	0.131	1.43	15.30	0.064	4.04	1.61	1.53	99.7
COMP II Replicate 2	2	A	0.190	26.8	0.153	0.45	14.50	0.062	3.68	1.90	1.48	96.6
COMP II Replicate 3	2	A	0.282	26.5	0.156	1.32	13.81	0.063	4.23	1.75	1.80	98.0
COMP II	3	B	0.184	31.9	0.182	1.35	15.40	0.074	3.60	1.27	1.56	88.1
COMP II	4	B	0.942	31.4	0.288	1.93	18.60	0.075	3.99	1.78	1.95	125.6
COMP II	5	A	0.304	30.4	0.155	2.64	17.40	0.064	5.90	2.63	0.92	115.4
COMP III	1	B	0.548	36.1	0.166	2.08	20.70	0.039	6.32	1.27	2.03	119.8
COMP III	2	B	0.925	37.0	0.321	2.90	20.10	0.057	5.52	2.12	1.30	137.4
COMP III	3	A	0.475	32.6	0.317	2.01	24.60	0.120	5.81	1.85	1.81	120.7
COMP III	4	B	0.427	31.7	0.215	3.77	18.10	0.050	4.83	1.24	1.05	115.2
COMP III	5	B	0.299	30.3	0.167	2.20	14.60	0.057	4.77	1.29	1.30	122.4
TC-5 Upper Comp	1	A	0.154	35.3	0.288	4.03	21.70	0.120	6.26	2.34	1.80	117.3
TC-5 Upper Comp	2	B	0.307	31.5	0.295	2.52	14.07	0.066	3.62	2.09	1.73	127.1
TC-5 Upper Comp	3	B	0.241	29.0	0.250	2.04	13.74	0.074	4.89	1.78	1.28	117.7
TC-5 Upper Comp	4	A	0.374	35.9	0.260	1.98	19.20	0.147	5.03	2.32	1.40	120.0
TC-5 Upper Comp	5	A	0.095	34.5	0.233	2.00	20.80	0.105	7.25	2.13	1.46	154.8
COMP IV	1	B	0.409	24.6	0.273	2.78	17.80	0.093	5.67	1.51	1.24	116.6
COMP IV	2	B	0.981	31.4	0.136	3.35	23.50	0.038	7.50	1.46	1.60	94.4
COMP IV	3	A	0.512	33.2	0.223	2.34	15.60	0.058	5.63	1.77	1.11	124.2
COMP IV	4	B	0.503	28.6	0.108	2.96	21.70	0.041	3.74	1.04	1.13	84.2
COMP IV	5	A	0.143	28.0	0.060	1.68	12.36	0.038	3.74	1.32	1.24	103.9
COMP V	1	A	0.100	22.4	0.244	1.63	15.80	0.108	6.09	1.78	1.61	99.0
COMP V	2	A	0.458	37.5	0.295	3.04	25.00	0.134	6.42	2.90	2.12	212.0
COMP V	3	A	0.144	38.9	0.220	2.28	23.10	0.142	8.12	2.18	1.97	130.4
COMP V	4	B	0.941	36.2	0.226	2.05	18.20	0.061	2.99	1.74	1.58	119.8
COMP V Replicate 1	5	A	0.099	22.2	0.144	2.29	13.78	0.077	4.37	2.22	1.57	113.1
COMP V Replicate 2	5	A	0.160	22.7	0.092	2.75	14.00	0.079	3.95	2.00	1.57	116.5
COMP V Replicate 3	5	A	0.070	22.1	0.153	1.57	14.70	0.085	4.38	2.05	1.22	113.3
COMP VI	1	B	0.462	25.2	0.154	2.82	17.90	0.064	4.37	2.05	1.21	116.3
COMP VI	2	A	0.682	28.1	0.148	1.89	25.60	0.113	7.68	2.61	1.22	119.8
COMP VI	3	A	0.718	33.8	0.309	3.20	21.90	0.108	7.10	2.59	1.78	149.8
COMP VI	4	A	0.546	31.1	0.331	1.16	24.30	0.124	4.79	2.85	1.66	137.0
COMP VI	5	B	0.703	34.3	0.124	1.61	18.90	0.060	4.08	1.48	1.99	87.5
R-AC	1	A	0.296	26.6	0.120	2.59	16.30	0.069	3.89	1.73	1.55	130.1
R-AC	2	B	0.851	34.6	0.196	2.75	16.70	0.067	6.14	1.85	1.59	103.6
R-AC	3	A	0.216	20.1	0.399	3.14	14.30	0.066	7.25	2.60	1.90	117.2
R-AC	4	B	0.304	30.3	0.086	1.62	18.70	0.084	5.04	1.75	1.81	130.2
R-AC	5	B	0.675	30.4	0.167	1.79	21.70	0.038	3.34	1.29	1.95	98.6
R-AM	1	A	0.582	25.3	0.362	3.15	17.10	0.077	4.85	1.82	1.26	124.1
R-AM	2	B	0.273	24.7	0.276	1.66	15.60	0.066	3.62	1.36	1.65	154.3
R-AM	3	A	0.194	39.4	0.258	1.16	16.00	0.087	4.50	1.67	1.73	156.2
R-AM	4	A	0.124	29.4	0.201	3.65	21.00	0.104	5.08	1.91	2.19	134.3
R-AM	5	A	0.351	24.5	0.169	1.68	18.60	0.086	4.65	1.33	1.54	95.9

TABLE J.20. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>M. nasuta</i> Metals (mg/kg dry weight)									
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-BF	1	B	0.583	22.9	0.345	1.96	17.10	0.073	4.47	1.64	1.83	119.2
R-BF	2	A	0.117	29.1	0.271	1.45	17.10	0.119	6.56	2.20	1.64	165.5
R-BF	3	A	0.079	33.0	0.288	2.10	16.70	0.097	4.91	2.56	1.07	114.7
R-BF	4	A	0.261	27.1	0.240	2.06	21.90	0.106	4.99	1.91	2.05	135.2
R-BF	5	A	0.174	29.3	0.153	2.18	14.90	0.109	4.91	1.83	1.42	97.2
R-OS	1	A	0.354	31.6	0.285	2.43	13.64	0.075	6.81	1.59	1.71	93.0
R-OS	2	B	0.813	30.9	0.160	2.46	16.20	0.057	5.19	1.15	1.48	78.2
R-OS	3	A	0.971	24.4	0.194	3.65	16.70	0.062	4.94	1.34	1.69	114.9
R-OS	4	B	0.162	22.6	0.301	2.51	11.88	0.090	6.24	1.10	2.10	102.6
R-OS	5	B	0.212	25.4	0.169	2.50	15.10	0.046	4.90	0.92	1.26	95.7
R-PF	1	B	0.220	25.9	0.305	2.90	17.20	0.059	4.71	1.16	1.16	103.6
R-PF	2	B	0.536	31.4	0.338	2.28	12.85	0.062	3.76	1.19	1.29	98.5
R-PF Replicate 1	3	B	0.109	22.7	0.203	3.60	12.52	0.065	5.65	1.04	0.67	105.9
R-PF Replicate 2	3	B	0.128	22.9	0.160	3.83	12.20	0.066	4.73	1.10	1.50	103.8
R-PF Replicate 3	3	B	0.112	22.3	0.235	3.16	12.52	0.064	4.26	1.07	1.71	105.8
R-PF	4	B	0.846	31.9	0.535	2.84	20.70	0.067	4.99	1.38	1.45	140.8
R-PF	5	A	0.099	33.7	0.311	3.23	19.10	0.127	5.79	1.22	1.94	161.7
C-SB Replicate 1	1	B	0.286	32.7	0.090	1.78	14.00	0.065	3.79	1.28	1.91	98.3
C-SB Replicate 2	1	B	0.377	32.7	0.157	1.79	14.70	0.062	4.16	1.28	1.36	98.0
C-SB Replicate 3	1	B	0.350	31.9	0.169	1.58	14.80	0.067	4.72	1.33	0.98	98.8
C-SB	2	B	0.949	30.7	0.201	1.54	19.50	0.067	3.12	1.50	1.53	138.5
C-SB	3	A	0.160	34.8	0.143	1.57	38.60	0.100	3.85	1.58	1.73	119.7
C-SB	4	A	0.260	25.4	0.342	1.35	17.30	0.064	3.01	1.79	1.85	130.9
C-SB	5	B	0.288	29.1	0.121	1.71	16.80	0.054	4.84	1.35	1.90	85.6
C-NE	1	A	0.327	35.0	0.288	1.29	24.30	0.101	4.43	1.90	1.44	124.6
C-NE	2	A	0.320	23.4	0.356	2.59	15.30	0.076	4.23	1.10	1.38	103.5
C-NE	3	A	0.255	34.7	0.320	1.54	23.10	0.132	4.87	1.69	1.98	162.1
C-NE	4	A	0.182	28.9	0.212	1.74	18.50	0.102	3.25	0.92	1.24	131.5
C-NE	5	A	0.474	28.4	0.301	1.70	18.50	0.098	6.10	1.60	2.42	152.4
MSL Background	1	B	0.748	31.5	0.363	2.00	21.10	0.082	5.06	2.41	1.47	140.7
MSL Background	2	B	1.087	29.8	0.188	1.04	27.00	0.070	2.59	2.32	1.76	134.2
MSL Background	3	B	1.080	29.9	0.374	0.70	24.70	0.092	3.62	2.26	1.33	127.1
MSL Background	4	B	0.592	28.7	0.487	8.17	16.40	0.054	3.38	1.96	1.04	133.9
MSL Background	5	B	0.839	31.1	0.184	1.12	27.30	0.056	2.80	2.98	1.62	127.2

(a) U The analyte was not present above the level of the associated value.

TABLE J.21. Metals, Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment		Analytical	Percent	<i>M. nasuta</i> Metals (mg/kg wet weight)									
Treatment	Replicate	Batch	Dry Weight	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL ^(a)				1.0	1.0	0.1	1.0	1.0	0.02	1.0	1.0	0.5	1.0
Achieved DL				0.007	1.0	0.05	0.08	1.0	0.00012	1.0	0.01	0.5	1.0
COMP I	1	B	12.89	0.072	3.4	0.014	0.21	2.33	0.008	0.64	0.17	0.26	11.9
COMP I	2	B	13.41	0.100	4.6	0.020	0.25	2.56	0.007	0.41	0.18	0.26	11.4
COMP I	3	A	12.93	0.018	4.0	0.020	0.13	2.25	0.013	0.41	0.20	0.20	11.7
COMP I	4	A	11.93	0.045	3.6	0.016	0.59	2.68	0.013	0.77	0.25	0.17	14.0
COMP I	5	A	13.88	0.063	5.1	0.041	0.39	3.36	0.014	0.44	0.28	0.25	15.7
COMP II	1	B	11.34	0.079	3.2	0.016	0.28	3.18	0.009	0.60	0.18	0.13	12.4
COMP II Replicate 1	2	A	13.02	0.039	3.5	0.017	0.19	1.99	0.008	0.53	0.21	0.20	13.0
COMP II Replicate 2	2	A	13.02	0.025	3.5	0.020	0.06	1.89	0.008	0.48	0.25	0.19	12.6
COMP II Replicate 3	2	A	13.02	0.037	3.5	0.020	0.17	1.80	0.008	0.55	0.23	0.23	12.8
COMP II	3	B	12.91	0.024	4.1	0.023	0.17	1.99	0.010	0.46	0.16	0.20	11.4
COMP II	4	B	12.37	0.117	3.9	0.036	0.24	2.30	0.009	0.49	0.22	0.24	15.5
COMP II	5	A	11.08	0.034	3.4	0.017	0.29	1.93	0.007	0.65	0.29	0.10	12.8
COMP III	1	B	12.12	0.066	4.4	0.020	0.25	2.51	0.005	0.77	0.15	0.25	14.5
COMP III	2	B	12.18	0.113	4.5	0.039	0.35	2.45	0.007	0.67	0.26	0.16	16.7
COMP III	3	A	13.73	0.065	4.5	0.044	0.28	3.38	0.016	0.80	0.25	0.25	16.6
COMP III	4	B	12.67	0.054	4.0	0.027	0.48	2.29	0.006	0.61	0.16	0.13	14.6
COMP III	5	B	13.04	0.039	4.0	0.022	0.29	1.90	0.007	0.62	0.17	0.17	16.0
TC-5 Upper Comp	1	A	13.23	0.020	4.7	0.038	0.53	2.87	0.016	0.83	0.31	0.24	15.5
TC-5 Upper Comp	2	B	12.51	0.038	3.9	0.037	0.32	1.76	0.008	0.45	0.26	0.22	15.9
TC-5 Upper Comp	3	B	12.58	0.030	3.6	0.031	0.26	1.73	0.009	0.62	0.22	0.16	14.8
TC-5 Upper Comp	4	A	12.55	0.047	4.5	0.033	0.25	2.41	0.018	0.63	0.29	0.18	15.1
TC-5 Upper Comp	5	A	11.45	0.011	4.0	0.027	0.23	2.38	0.012	0.83	0.24	0.17	17.7
COMP IV	1	B	11.09	0.045	2.7	0.030	0.31	1.97	0.010	0.63	0.17	0.14	12.9
COMP IV	2	B	12.93	0.127	4.1	0.018	0.43	3.04	0.005	0.97	0.19	0.21	12.2
COMP IV	3	A	13.51	0.069	4.5	0.030	0.32	2.11	0.008	0.76	0.24	0.15	16.8
COMP IV	4	B	13.58	0.068	3.9	0.015	0.40	2.95	0.006	0.51	0.14	0.15	11.4
COMP IV	5	A	13.89	0.020	3.9	0.008	0.23	1.72	0.005	0.52	0.18	0.17	14.4
COMP V	1	A	12.15	0.012	2.7	0.030	0.20	1.92	0.013	0.74	0.22	0.20	12.0
COMP V	2	A	13.65	0.063	5.1	0.040	0.41	3.41	0.018	0.88	0.40	0.29	28.9
COMP V	3	A	14.17	0.020	5.5	0.031	0.32	3.27	0.020	1.15	0.31	0.28	18.5
COMP V	4	B	11.83	0.111	4.3	0.027	0.24	2.15	0.007	0.35	0.21	0.19	14.2
COMP V Replicate 1	5	A	12.54	0.012	2.8	0.018	0.29	1.73	0.010	0.55	0.28	0.20	14.2
COMP V Replicate 2	5	A	12.54	0.020	2.8	0.012	0.34	1.76	0.010	0.50	0.25	0.20	14.6
COMP V Replicate 3	5	A	12.54	0.009	2.8	0.019	0.20	1.84	0.011	0.55	0.26	0.15	14.2

TABLE J.21. (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
COMP VI	1	B	11.33	0.052	2.9	0.017	0.32	2.03	0.007	0.50	0.23	0.14	13.2
COMP VI	2	A	16.25	0.111	4.6	0.024	0.31	4.16	0.018	1.25	0.42	0.20	19.5
COMP VI	3	A	12.86	0.092	4.3	0.040	0.41	2.82	0.014	0.91	0.33	0.23	19.3
COMP VI	4	A	12.27	0.067	3.8	0.041	0.14	2.98	0.015	0.59	0.35	0.20	16.8
COMP VI	5	B	11.91	0.084	4.1	0.015	0.19	2.25	0.007	0.49	0.18	0.24	10.4
R-AC	1	A	13.43	0.040	3.6	0.016	0.35	2.19	0.009	0.52	0.23	0.21	17.5
R-AC	2	B	11.50	0.098	4.0	0.023	0.32	1.92	0.008	0.71	0.21	0.18	11.9
R-AC	3	A	11.67	0.025	2.3	0.047	0.37	1.67	0.008	0.85	0.30	0.22	13.7
R-AC	4	B	9.43	0.029	2.9	0.008	0.15	1.76	0.008	0.48	0.17	0.17	12.3
R-AC	5	B	13.97	0.094	4.2	0.023	0.25	3.03	0.005	0.47	0.18	0.27	13.8
R-AM	1	A	11.22	0.065	2.8	0.041	0.35	1.92	0.009	0.54	0.20	0.14	13.9
R-AM	2	B	11.61	0.032	2.9	0.032	0.19	1.81	0.008	0.42	0.16	0.19	17.9
R-AM	3	A	13.58	0.026	5.4	0.035	0.16	2.17	0.012	0.61	0.23	0.23	21.2
R-AM	4	A	14.26	0.018	4.2	0.029	0.52	2.99	0.015	0.72	0.27	0.31	19.2
R-AM	5	A	11.36	0.040	2.8	0.019	0.19	2.11	0.010	0.53	0.15	0.17	10.9
R-BF	1	B	13.05	0.076	3.0	0.045	0.26	2.23	0.010	0.58	0.21	0.24	15.6
R-BF	2	A	13.74	0.016	4.0	0.037	0.20	2.35	0.016	0.90	0.30	0.23	22.7
R-BF	3	A	13.28	0.010	4.4	0.038	0.28	2.22	0.013	0.65	0.34	0.14	15.2
R-BF	4	A	11.62	0.030	3.1	0.028	0.24	2.54	0.012	0.58	0.22	0.24	15.7
R-BF	5	A	13.18	0.023	3.9	0.020	0.29	1.96	0.014	0.65	0.24	0.19	12.8
R-OS	1	A	12.49	0.044	3.9	0.036	0.30	1.70	0.009	0.85	0.20	0.21	11.6
R-OS	2	B	12.00	0.098	3.7	0.019	0.30	1.94	0.007	0.62	0.14	0.18	9.4
R-OS	3	A	12.23	0.119	3.0	0.024	0.45	2.04	0.008	0.60	0.16	0.21	14.1
R-OS	4	B	13.34	0.022	3.0	0.040	0.33	1.58	0.012	0.83	0.15	0.28	13.7
R-OS	5	B	13.22	0.028	3.4	0.022	0.33	2.00	0.006	0.65	0.12	0.17	12.7
R-PF	1	B	11.21	0.025	2.9	0.034	0.33	1.93	0.007	0.53	0.13	0.13	11.6
R-PF	2	B	13.61	0.073	4.3	0.046	0.31	1.75	0.008	0.51	0.16	0.18	13.4
R-PF Replicate 1	3	B	11.72	0.013	2.7	0.024	0.42	1.47	0.008	0.66	0.12	0.08 ^{u(b)}	12.4
R-PF Replicate 2	3	B	11.72	0.015	2.7	0.019	0.45	1.43	0.008	0.55	0.13	0.18	12.2
R-PF Replicate 3	3	B	11.72	0.013	2.6	0.028	0.37	1.47	0.008	0.50	0.13	0.20	12.4
R-PF	4	B	12.40	0.105	4.0	0.066	0.35	2.57	0.008	0.62	0.17	0.18	17.5
R-PF	5	A	13.22	0.013	4.5	0.041	0.43	2.53	0.017	0.77	0.16	0.26	21.4
C-SB Replicate 1	1	B	12.24	0.035	4.0	0.011	0.22	1.71	0.008	0.46	0.16	0.23	12.0
C-SB Replicate 2	1	B	12.24	0.046	4.0	0.019	0.22	1.80	0.008	0.51	0.16	0.17	12.0
C-SB Replicate 3	1	B	12.24	0.043	3.9	0.021	0.19	1.81	0.008	0.58	0.16	0.12	12.1

TABLE J.21. (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
C-SB	2	B	11.33	0.108	3.5	0.023	0.17	2.21	0.008	0.35	0.17	0.17	15.7
C-SB	3	A	13.05	0.021	4.5	0.019	0.20	5.04	0.013	0.50	0.21	0.23	15.6
C-SB	4	A	14.02	0.036	3.6	0.048	0.19	2.43	0.009	0.42	0.25	0.26	18.4
C-SB	5	B	13.47	0.039	3.9	0.016	0.23	2.26	0.007	0.65	0.18	0.26	11.5
C-NE	1	A	12.49	0.041	4.4	0.036	0.16	3.04	0.013	0.55	0.24	0.18	15.6
C-NE	2	A	11.26	0.036	2.6	0.040	0.29	1.72	0.009	0.48	0.12	0.16	11.7
C-NE	3	A	13.29	0.034	4.6	0.043	0.20	3.07	0.018	0.65	0.22	0.26	21.5
C-NE	4	A	11.54	0.021	3.3	0.024	0.20	2.13	0.012	0.38	0.11	0.14	15.2
C-NE	5	A	12.74	0.060	3.6	0.038	0.22	2.36	0.012	0.78	0.20	0.31	19.4
MSL Background	1	B	13.66	0.102	4.3	0.050	0.27	2.88	0.011	0.69	0.33	0.20	19.2
MSL Background	2	B	13.32	0.145	4.0	0.025	0.14	3.60	0.009	0.34	0.31	0.23	17.9
MSL Background	3	B	13.10	0.141	3.9	0.049	0.09	3.24	0.012	0.47	0.30	0.17	16.7
MSL Background	4	B	12.67	0.075	3.6	0.062	1.04	2.08	0.007	0.43	0.25	0.13	17.0
MSL Background	5	B	14.06	0.118	4.4	0.026	0.16	3.84	0.008	0.39	0.42	0.23	17.9

(a) OL Detection limit.

(b) U The analyte was not present above the level of the associated value.

TABLE J.22. Quality Control Data for Metals, Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment		Analytical	<i>M. nasuta</i> Metals (mg/kg dry weight)									
Treatment	Replicate	Batch	Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Method Blanks												
Blank	1	A	0.008	NM ^(a)	0.006	0.30	NM	0.0002 U ^(b)	NM	0.01	NM	NM
Blank	2	B	0.004	NM	0.035	0.25	NM	0.0000 U	NM	0.01	NM	NM
Blank	3	C	0.002	NM	0.039	0.30	NM	0.0000 U	NM	0.01	NM	NM
Blank	4	D	0.002	NM	0.038	0.30	NM	0.0023	NM	0.01	NM	NM
Matrix Spikes												
COMP II ^(c)	2	A	0.510	NM	0.190	3.39	NM	0.096	NM	1.90	NM	NM
COMP II MS	2	A	1.584	NA ^(d)	4.635	11.30	NA	0.975	NA	12.70	NA	NA
Concentration Recovered			1.073	NA	4.445	7.91	NA	0.879	NA	10.80	NA	NA
Spike Amount			2.000	NS ^(e)	5.000	10.00	NS	0.998	NS	10.00	NS	NS
Percent Recovery			54% ^(f)	NA	89%	79%	NA	88%	NA	108%	NA	NA
COMP V ^(c)	5	A	0.665	NM	0.156	2.88	NM	0.046	NM	1.42	NM	NM
COMP V MS	5	A	1.808	NA	4.563	10.83	NA	0.934	NA	14.30	NA	NA
Concentration Recovered			1.143	NA	4.407	7.95	NA	0.888	NA	12.88	NA	NA
Spike Amount			2.000	NS	5.000	10.00	NS	0.998	NS	10.00	NS	NS
Percent Recovery			57% ^(f)	NA	88%	79%	NA	89%	NA	129% ^(f)	NA	NA
C-SB ^(c)	1	B	0.197	NM	0.245	2.16	NM	0.086	NM	1.65	NM	NM
C-SB MS	1	B	2.543	NA	4.599	12.50	NA	0.920	NA	10.50	NA	NA
Concentration Recovered			2.346	NA	4.354	10.34	NA	0.834	NA	8.85	NA	NA
Spike Amount			2.000	NS	5.000	10.00	NS	0.995	NS	10.00	NS	NS
Percent Recovery			117%	NA	87%	103%	NA	84%	NA	89%	NA	NA
R-PF ^(c)	3	B	0.116	NM	0.199	3.53	NM	0.065	NM	1.07	NM	NM
R-PF MS	3	B	2.502	NA	5.148	13.00	NA	0.952	NA	9.68	NA	NA
Concentration Recovered			2.386	NA	4.949	9.47	NA	0.887	NA	8.61	NA	NA
Spike Amount			2.000	NS	5.000	10.00	NS	0.997	NS	10.00	NS	NS
Percent Recovery			119%	NA	99%	95%	NA	89%	NA	86%	NA	NA
Standard Reference Material												
Certified Value 1566a			1.68 ±0.15	14.0 ±1.2	4.15 ±0.38	1.43 ±0.46	66.3 ±4.3	0.064 ±0.0067	2.25 ±0.44	0.371 ±0.014	2.21 ±0.24	830.0 ±57.0
SRM 1566	1	A	1.980	14.67	4.500	1.65	66.5	0.054	1.47	0.37	2.40	822.0
SRM 1566	1	B	NM	13.98	NM	NM	66.0	NM	2.21	NM	2.25	809.0
SRM 1566	1	C	NM	13.72	NM	NM	63.2	NM	1.68	NM	2.16	790.0
SRM 1566	1	D	NM	14.05	NM	NM	65.8	NM	1.93	NM	2.13	823.0

TABLE J.22. (contd)

Sediment Treatment	Replicate	Analytical Batch	M. nasuta Metals (mg/kg dry weight)									
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
SRM 1566	1	E	NM	14.67	NM	NM	64.7	NM	3.03	NM	1.80	815.0
SRM 1566	2	A	1.676	14.31	4.158	1.57	63.8	0.052	2.03	0.31	2.24	816.0
SRM 1566	2	B	NM	14.84	NM	NM	65.3	NM	1.75	NM	1.99	823.0
SRM 1566	2	C	NM	14.05	NM	NM	65.6	NM	2.02	NM	2.29	818.0
SRM 1566	2	D	NM	14.78	NM	NM	64.6	NM	2.59	NM	2.35	827.0
SRM 1566	3	A	1.523	14.23	4.455	1.37	66.3	0.049	2.59	0.32	1.76	828.0
SRM 1566	3	B	NM	14.43	NM	NM	66.6	NM	1.99	NM	2.07	827.0
SRM 1566	4	A	1.686	14.25	4.095	1.33	64.8	0.058	1.76	0.38	1.95	807.0
SRM 1566	4	B	NM	14.20	NM	NM	64.2	NM	2.20	NM	1.92	799.0
SRM 1566	4	C	NM	14.62	NM	NM	63.7	NM	1.77	NM	2.14	810.0
Analytical Replicates												
COMP II Replicate 1	2	A	0.302	27.0	0.131	1.43	15.30	0.064	4.04	1.61	1.53	99.7
COMP II Replicate 2	2	A	0.190	26.8	0.153	0.45	14.50	0.062	3.68	1.90	1.48	96.6
COMP II Replicate 3	2	A	0.282	26.5	0.156	1.32	13.81	0.063	4.23	1.75	1.80	98.0
RSD			23%(g)	1%	9%	50%(g)	5%	2%	7%	8%	11%	2%
COMP V Replicate 1	5	A	0.099	22.2	0.144	2.29	13.78	0.077	4.37	2.22	1.57	113.1
COMP V Replicate 2	5	A	0.160	22.7	0.092	2.75	14.00	0.079	3.95	2.00	1.57	116.5
COMP V Replicate 3	5	A	0.070	22.1	0.153	1.57	14.70	0.085	4.38	2.05	1.22	113.3
RSD			42%(g)	1%	25%(g)	27%(g)	3%	5%	6%	6%	14%	2%
R-PF Replicate 1	3	A	0.109	22.7	0.203	3.60	12.52	0.065	5.65	1.04	0.67 U	105.9
R-PF Replicate 2	3	A	0.128	22.9	0.160	3.83	12.20	0.066	4.73	1.10	1.50	103.8
R-PF Replicate 3	3	A	0.112	22.3	0.235	3.16	12.52	0.064	4.26	1.07	1.71	105.8
RSD			9%	1%	19%	10%	1%	2%	14%	3%	43%(g)	1%
C-SB Replicate 1	1	B	0.286	32.7	0.090	1.78	14.00	0.065	3.79	1.28	1.91	98.3
C-SB Replicate 2	1	B	0.377	32.7	0.157	1.79	14.70	0.062	4.16	1.28	1.36	98.0
C-SB Replicate 3	1	B	0.350	31.9	0.169	1.58	14.80	0.067	4.72	1.33	0.98	98.8
RSD			14%	1%	31%(g)	7%	3%	4%	11%	2%	33%(g)	0%

(a) NM Not measured.

(b) U The analyte was not present above the level of the associated value.

(c) Average values are an average of the replicates.

(d) NA Not applicable.

(e) NS Not spiked.

(f) Recovery outside quality control range (75%-125%).

(g) Value exceeds relative precision range of 20%.

TABLE J.23. Butyltin Results, Dry and Wet Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Tri-pentyltin Surrogate Recovery %	Butyltin Species ($\mu\text{g}/\text{kg}$ dry weight)				Percent Dry Weight	Butyltin Species ($\mu\text{g}/\text{kg}$ wet weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin		Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
Target DL ^(a)									10	10	10	10
Achieved DL High									0.74	NA ^(b)	1.25	0.45
Achieved DL Low									0.03	NA	0.25	0.24
COMP I	1	C	42.62	4.3 U ^(c)	45.3	2.6 U	2.6 U	12.89	0.55 U	5.84	0.34 U	0.34 U
COMP I	2	F	30.19 ^(d)	4.1 U	26.1	2.5 U	2.5 U	13.41	0.55 U	3.50	0.34 U	0.34 U
COMP I	3	E	50.31	4.4 U	39.3	2.7 U	2.7 U	12.93	0.57 U	5.08	0.35 U	0.35 U
COMP I	4	B	51.75	3.8 U	46.5	2.3 U	2.3 U	11.93	0.45 U	5.55	0.27 U	0.27 U
COMP I	5	A	44.37	4.2 U	35.6	2.5 U	2.5 U	13.88	0.58 U	4.94	0.35 U	0.35 U
COMP II	1	D	45.40	3.4 U	59.1	9.2	2.1 U	11.34	0.39 U	6.70	1.04	0.24 U
COMP II	2	E	63.13	4.5 U	68.3	2.7 U	2.7 U	13.02	0.59 U	8.89	0.35 U	0.35 U
COMP II	3	C	49.02	3.7 U	64.5	9.1	2.2 U	12.91	0.48 U	8.33	1.17	0.28 U
COMP II	4	D	66.62	4.0 U	52.6	10.1 U	2.4 U	12.37	0.49 U	6.51	1.25 U	0.30 U
COMP II	5	B	50.79	4.7 U	49.4	2.8 U	2.8 U	11.08	0.52 U	5.47	0.31 U	0.31 U
COMP III	1	C	61.99	4.3 U	47.3	2.6 U	2.6 U	12.12	0.52 U	5.73	0.32 U	0.32 U
COMP III	2	F	66.90	3.9 U	72.0	14.0	2.4 U	12.18	0.48 U	8.77	1.71	0.29 U
COMP III	3	A	48.32	4.3 U	48.6	2.6 U	2.6 U	13.73	0.59 U	6.67	0.36 U	0.36 U
COMP III Replicate 1	4	D	47.30	4.3 U	44.5	2.6 U	2.6 U	12.67	0.54 U	5.64	0.33 U	0.33 U
COMP III Replicate 2	4	D	47.23	4.4 U	42.2	2.7 U	2.7 U	12.67	0.56 U	5.35	0.34 U	0.34 U
COMP III Replicate 3	4	D	45.54	4.1 U	43.2	2.5 U	2.5 U	12.67	0.52 U	5.47	0.32 U	0.32 U
COMP III	5	C	46.17	4.0 U	57.9	2.4 U	2.4 U	13.04	0.52 U	7.55	0.31 U	0.31 U
TC-5 Upper Comp	1	B	52.59	4.0 U	53.4	10.4	2.4 U	13.23	0.53 U	7.06	1.38	0.32 U
TC-5 Upper Comp	2	C	55.78	0.2 U	58.4	13.5	2.3 U	12.51	0.03 U	7.31	1.69	0.29 U
TC-5 Upper Comp Replicate 1	3	F	57.34	4.2 U	59.3	12.5	2.5 U	12.58	0.53 U	7.46	1.57	0.31 U
TC-5 Upper Comp Replicate 2	3	C	46.53	4.0 U	52.9	15.6	2.4 U	12.58	0.50 U	6.65	1.96	0.30 U
TC-5 Upper Comp Replicate 3	3	C	48.27	3.3 U	54.4	2.0 U	2.0 U	12.58	0.42 U	6.84	0.25 U	0.25 U
TC-5 Upper Comp	4	A	45.17	3.9 U	59.3	14.1	2.4 U	12.55	0.49 U	7.44	1.77	0.30 U
TC-5 Upper Comp	5	A	41.04	3.9 U	40.9	2.4 U	2.4 U	11.45	0.45 U	4.68	0.27 U	0.27 U
COMP IV	1	E	46.39	4.3 U	48.9	12.1	2.6 U	11.09	0.48 U	5.42	1.34	0.29 U
COMP IV	2	E	40.34	4.1 U	45.1	2.5 U	2.5 U	12.93	0.53 U	5.83	0.32 U	0.32 U
COMP IV	3	F	49.19	3.8 U	81.7	10.0	2.3 U	13.51	0.51 U	11.04	1.35	0.31 U
COMP IV	4	A	56.19	4.1 U	68.3	11.0	2.5 U	13.58	0.56 U	9.28	1.49	0.34 U
COMP IV	5	C	44.01	4.2 U	40.7	12.2	2.6 U	13.89	0.58 U	5.65	1.69	0.36 U

TABLE J.23. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tri-pentyltin Surrogate Recovery %	Butyltin Species ($\mu\text{g/kg}$ dry weight)				Percent Dry Weight	Butyltin Species ($\mu\text{g/kg}$ wet weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin		Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
COMP V	1	E	55.54	4.3 U	47.3	2.6 U	2.6 U	12.15	0.52 U	5.75	0.32 U	0.32 U
COMP V	2	A	50.62	4.4 U	48.4	2.6 U	2.6 U	13.65	0.60 U	6.61	0.35 U	0.35 U
COMP V	3	A	55.83	4.2 U	55.3	10.5	2.5 U	14.17	0.60 U	7.84	1.49	0.35 U
COMP V	4	C	60.50	4.3 U	47.1	2.6 U	2.6 U	11.83	0.51 U	5.57	0.31 U	0.31 U
COMP V	5	B	68.09	4.2 U	78.7	13.7	2.5 U	12.54	0.53 U	9.87	1.72	0.31 U
COMP VI	1	C	44.61	3.8 U	48.8	2.3 U	2.3 U	11.33	0.43 U	5.53	0.26 U	0.26 U
COMP VI	2	E	56.30	4.4 U	36.0	2.7 U	2.7 U	16.25	0.72 U	5.85	0.44 U	0.44 U
COMP VI	3	B	62.87	4.1 U	70.5	14.2	2.5 U	12.86	0.53 U	9.07	1.83	0.32 U
COMP VI	4	E	56.80	4.3 U	42.1	2.6 U	2.6 U	12.27	0.53 U	5.17	0.32 U	0.32 U
COMP VI	5	D	49.55	3.5 U	32.3	2.1 U	2.1 U	11.91	0.42 U	3.85	0.25 U	0.25 U
R-AC	1	E	39.51 ^(d)	4.2 U	57.8	2.5 U	2.5 U	13.43	0.56 U	7.76	0.34 U	0.34 U
R-AC	2	C	54.98	3.9 U	61.6	11.4	2.4 U	11.50	0.45 U	7.08	1.31	0.28 U
R-AC	3	B	76.85	4.3 U	93.9	15.9	2.6 U	11.67	0.50 U	10.96	1.86	0.30 U
R-AC	4	A	56.50	4.3 U	100.1	15.0	2.6 U	9.43	0.41 U	9.44	1.41	0.25 U
R-AC	5	D	79.61	5.3 U	74.3	14.7	3.2 U	13.97	0.74 U	10.38	2.05	0.45 U
R-AM	1	E	48.64	4.4 U	52.6	2.6 U	2.6 U	11.22	0.49 U	5.90	0.29 U	0.29 U
R-AM	2	F	68.91	4.0 U	94.1	16.7	2.4 U	11.61	0.46 U	10.93	1.94 U	0.28 U
R-AM	3	B	44.24	3.6 U	74.4	9.2	2.2 U	13.58	0.49 U	10.10	1.25	0.30 U
R-AM	4	B	59.82	4.3 U	69.8	9.8	2.6 U	14.26	0.61 U	9.95	1.40	0.37 U
R-AM	5	E	54.04	4.1 U	77.7	12.4	2.5 U	11.36	0.47 U	8.83	1.41	0.28 U
R-BF	1	D	43.51	4.4 U	51.0	2.6 U	2.6 U	13.05	0.57 U	6.66	0.34 U	0.34 U
R-BF	2	B	73.73	4.3 U	89.8	10.7	2.6 U	13.74	0.59 U	12.34	1.47	0.36 U
R-BF	3	B	70.75	4.4 U	83.5	16.7	2.7 U	13.28	0.58 U	11.12	2.22	0.36 U
R-BF	4	A	43.73	4.1 U	43.2	2.5 U	2.5 U	11.62	0.48 U	5.02	0.29 U	0.29 U
R-BF	5	A	42.43	4.0 U	69.4	2.4 U	2.4 U	13.18	0.53 U	9.15	0.32 U	0.32 U
R-OS	1	B	69.05	3.5 U	60.7	22.5	2.1 U	12.49	0.44 U	7.58	2.81	0.26 U
R-OS	2	F	41.96	3.8 U	30.0	10.4	2.3 U	12.00	0.46 U	3.60	1.25	0.28 U
R-OS Replicate 1	3	B	76.36	4.4 U	76.7	10.0	2.6 U	12.23	0.54 U	9.38	1.22	0.32 U
R-OS Replicate 2	3	B	46.32	4.3 U	45.4	2.6 U	2.6 U	12.23	0.53 U	5.55	0.32 U	0.32 U
R-OS Replicate 3	3	B	76.69	4.2 U	78.5	14.9	2.6 U	12.23	0.51 U	9.60	1.82	0.32 U
R-OS	4	C	46.09	4.2 U	32.2	2.5 U	2.5 U	13.34	0.56 U	4.30	0.33 U	0.33 U
R-OS	5	C	45.41	4.1 U	51.2	2.5 U	2.5 U	13.22	0.54 U	6.77	0.33 U	0.33 U

TABLE J.23. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tri-pentyltin Surrogate Recovery %	Butyltin Species ($\mu\text{g/kg}$ dry weight)				Percent Dry Weight	Butyltin Species ($\mu\text{g/kg}$ wet weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin		Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
R-PF	1	C	41.65	4.1 U	40.5	2.5 U	2.5 U	11.21	0.46 U	4.54	0.28 U	0.28 U
R-PF	2	C	58.60	5.0 U	55.0	3.1 U	3.1 U	13.61	0.68 U	7.49	0.42 U	0.42 U
R-PF	3	C	46.74	4.5 U	37.2	2.7 U	2.7 U	11.72	0.53 U	4.36	0.32 U	0.32 U
R-PF	4	F	43.79	3.7 U	26.3	2.3 U	2.3 U	12.40	0.46 U	3.26	0.29 U	0.29 U
R-PF	5	E	57.64	4.6 U	66.3	2.8 U	2.8 U	13.22	0.61 U	8.76	0.37 U	0.37 U
C-SB	1	E	43.77	3.9 U	46.2	2.4 U	2.4 U	12.24	0.48 U	5.65	0.29 U	0.29 U
C-SB	2	C	43.62	4.2 U	41.0	2.6 U	2.6 U	11.33	0.48 U	4.65	0.29 U	0.29 U
C-SB	3	B	62.40	4.1 U	80.4	2.5 U	2.5 U	13.05	0.54 U	10.49	0.33 U	0.33 U
C-SB Replicate 1	4	E	59.08	4.3 U	35.7	11.9	2.6 U	14.02	0.60 U	5.01	1.67	0.36 U
C-SB Replicate 2	4	E	68.98	4.2 U	45.6	2.5 U	2.5 U	14.02	0.59 U	6.39	0.35 U	0.35 U
C-SB Replicate 3	4	E	58.65	4.2 U	34.8	2.5 U	2.5 U	14.02	0.59 U	4.88	0.35 U	0.35 U
C-SB	5	F	70.04	4.2 U	44.1	11.4	2.5 U	13.47	0.57 U	5.94	1.54	0.34 U
C-NE	1	B	70.55	3.6 U	105.5	11.2	2.2 U	12.49	0.45 U	13.18	1.40	0.27 U
C-NE	2	B	63.02	4.3 U	82.7	14.3	2.6 U	11.26	0.48 U	9.31	1.61	0.29 U
C-NE	3	E	56.04	4.5 U	89.4	2.7 U	2.7 U	13.29	0.60 U	11.88	0.36 U	0.36 U
C-NE	4	B	70.78	4.3 U	113.1	16.6	2.6 U	11.54	0.50 U	13.05	1.92	0.30 U
C-NE	5	A	47.61	3.6 U	79.1	10.0	2.2 U	12.74	0.46 U	10.08	1.27	0.28 U
MSL Background	1	D	40.30	4.3 U	15.4	2.6 U	2.6 U	13.66	0.59 U	2.10	0.36 U	0.36 U
MSL Background	2	F	42.00	4.4 U	13.7	2.6 U	2.6 U	13.32	0.59 U	1.82	0.35 U	0.35 U
MSL Background Replicate 1	3	F	35.59 ^(d)	4.0 U	10.7	2.4 U	2.4 U	13.10	0.52 U	1.40	0.31 U	0.31 U
MSL Background Replicate 2	3	F	40.53	4.1 U	12.4	2.5 U	2.5 U	13.10	0.54 U	1.62	0.33 U	0.33 U
MSL Background Replicate 3	3	F	52.21	4.0 U	15.7	2.4 U	2.4 U	13.10	0.52 U	2.06	0.31 U	0.31 U
MSL Background	4	F	40.76	4.0 U	12.5	2.4 U	2.4 U	12.67	0.51 U	1.58	0.30 U	0.30 U
MSL Background	5	F	64.19	3.8 U	17.4	2.3 U	2.3 U	14.06	0.53 U	2.45	0.32 U	0.32 U

(a) DL Detection limit.

(b) NA Not applicable.

(c) U The analyte was not present above the level of the associated value.

(d) Recovery outside quality control range of (40%-120%).

TABLE J.24. Quality Control Data for Butyltin Results, Dry Weight, in Tissue of *M. nasuta*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Tri-pentyltin Surrogate Recovery %	Butyltin Species ($\mu\text{g/kg}$ dry weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
Method Blanks							
Blank	1	A	41.29	3.6 U ^(a)	2.7 U	2.2 U	2.2 U
Blank	1-R ^(b)	E	48.46	4.8 U	3.6 U	2.9 U	2.9 U
Blank	2	A	37.97 ^(c)	3.8 U	2.8 U	2.3 U	2.3 U
Blank	2-R	E	79.97	4.4 U	3.3 U	2.7 U	2.7 U
Blank	3	B	53.32	3.8 U	2.8 U	2.3 U	2.3 U
Blank	3-R	F	22.12 ^(c)	4.0 U	3.0 U	2.4 U	2.4 U
Blank	4	C	43.29	3.8 U	2.9 U	2.3 U	2.3 U
Blank	4-R	F	41.08	4.2 U	3.1 U	2.5 U	2.5 U
Blank	5	C	35.25 ^(c)	3.5 U	2.6 U	2.1 U	2.1 U
Blank	6	D	58.37	3.9 U	2.9 U	2.3 U	2.3 U
Blank	7	D	36.41 ^(c)	3.7 U	2.8 U	2.2 U	2.2 U
Matrix Spikes							
COMP IV	5	E	27%	4.2 U	40.7	12.2	2.6 U
COMP IV MS	5	E	NA ^(d)	692.7	457.4	457.7	93.4
Concentration Recovered			NA	692.7	416.7	445.5	93.4
Spiked Amount			NS ^(e)	1408.45	1408.45	1408.45	1408.45
Percent Recovery			NA	49%	30% ^(c)	32% ^(c)	7% ^(c)
COMP IV	5	E	41%	4.2 U	40.7	12.2	2.6 U
COMP IV MSD	5	E	NA	974.5	665.5	662	149.7
Concentration Recovered			NA	974.5	624.8	649.8	149.7
Spiked Amount			NS	1428.57	1428.57	1428.57	1428.57
Percent Recovery			NA	68%	44%	45%	10% ^(c)
MS/MSD RPD			NA	32% ^(f)	39% ^(f)	36% ^(f)	45% ^(f)
MS/MSD I-STAT			NA	0.16	0.19	0.18	0.22
R-AM	5	E	54.04	4.1 U	77.7	12.4	2.5 U
R-AM MS	5	A	56%	1037.2	1046.3	899.3	182.4
Concentration Recovered			NA	1037.2	968.6	886.9	182.4
Spiked Amount			NS	1639.34	1639.34	1639.34	1639.34
Percent Recovery			NA	63%	59%	54%	11% ^(c)
R-AM	5	E	54.04	4.1 U	77.7	12.4	2.5 U
R-AM MSD	5	A	74%	1223.1	1314.1	1179.6	198
Concentration Recovered			NA	1223.1	1236.4	1167.2	198
Spiked Amount			NS	1666.67	1666.67	1666.67	1666.67
Percent Recovery			NA	73%	74%	70%	12% ^(c)
MS/MSD RPD			7%	15%	23%	26%	7%
MS/MSD I-STAT			0.14	0.07	0.11	0.13	0.03
R-AM	1	E	48.64	4.4 U	52.6	2.6 U	2.6 U
R-AM MS	1	B	44%	1011.2	822	713	221.3
Concentration Recovered			NA	1011.2	769.4	713	221.3
Spiked Amount			NS	1694.92	1694.92	1694.92	1694.92
Percent Recovery			NA	60%	45%	42%	13% ^(c)

TABLE J.24. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tri-pentyltin Surrogate Recovery %	Butyltin Species ($\mu\text{g/kg}$ dry weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
R-AM	1	E	48.64	4.4 U	52.6	2.6 U	2.6 U
R-AM MSD	1	B	66%	982.5	1200.4	1058.9	286.2
Concentration Recovered			NA	982.5	1147.8	1058.9	286.2
Spiked Amount			NS	1724.14	1724.14	1724.14	1724.14
Percent Recovery			NA	57%	67%	61%	17%(c)
MS/MSD RPD			10%	5%	38%(f)	37%(f)	24%
MS/MSD I-STAT			0.20	0.02	0.19	0.19	0.12
COMP III	1	C	61.99	4.3 U	47.3	2.6 U	2.6 U
COMP III MS	1	C	76%	1060.6	1196.5	1042.9	244.5
Concentration Recovered			NA	1060.6	1149.2	1042.9	244.5
Spiked Amount			NS	1666.67	1666.67	1666.67	1666.67
Percent Recovery			NA	64%	69%	63%	15%(c)
COMP III	1	C	61.99	4.3 U	47.3	2.6 U	2.6 U
COMP III MSD	1	C	72%	1036.3	1353.5	1177.8	197
Concentration Recovered			NA	1036.3	1306.2	1177.8	197
Spiked Amount			NS	1694.92	1694.92	1694.92	1694.92
Percent Recovery			NA	61%	77%	69%	12%(c)
MS/MSD RPD			1%	4%	11%	10%	23%
MS/MSD I-STAT			0.03	0.02	0.06	0.05	0.12
R-PF	4	F	43.79	3.7 U	26.3	2.3 U	2.3 U
R-PF MS	4	F	49%	888.5	775.2	829.5	127.8
Concentration Recovered			NA	888.5	748.9	829.5	127.8
Spiked Amount			NS	1587.3	1587.3	1587.3	1587.3
Percent Recovery			NA	56%	47%	52%	8%(c)
R-PF	4	F	43.79	3.7 U	26.3	2.3 U	2.3 U
R-PF MSD	4	F	63%	718.3	979.9	994.5	194.7
Concentration Recovered			NA	718.3	953.6	994.5	194.7
Spiked Amount			NS	1587.3	1587.3	1587.3	1587.3
Percent Recovery			NA	45%	60%	63%	12%(c)
MS/MSD RPD			6%	21%	24%	18%	41%(f)
MS/MSD I-STAT			0.13	0.11	0.12	0.09	0.21
R-AC	5	D	79.61	5.3 U	74.3	14.7	3.2 U
R-AC MS	5	D	44%	728.2	706.4	637.7	129.9
Concentration Recovered			NA	728.2	632.1	623	129.9
Spiked Amount			NS	1408.45	1408.45	1408.45	1408.45
Percent Recovery			NA	52%	45%	44%	9%(c)
R-AC	5	D	79.61	5.3 U	74.3	14.7	3.2 U
R-AC MSD	5	D	38%	675.8	545.6	473.8	104.7
Concentration Recovered			NA	675.8	471.3	459.1	104.7
Spiked Amount			NS	1333.33	1333.33	1333.33	1333.33
Percent Recovery			NA	51%	35%(c)	34%(c)	8%(c)
MS/MSD RPD			4%	2%	24%	25%	16%
MS/MSD I-STAT			0.07	0.01	0.12	0.12	0.08

TABLE J.24. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tri- pentyltin Surrogate Recovery %	Butyltin Species ($\mu\text{g/kg dry weight}$)			
				Tetra- butyltin	Tri- butyltin	Di- butyltin	Mono- butyltin
<u>Analytical Replicates</u>							
COMP III	4	D	47.30	4.3 U	44.5	2.6 U	2.6 U
COMP III	4	D	47.23	4.4 U	42.2	2.7 U	2.7 U
COMP III	4	D	45.54	4.1 U	43.2	2.5 U	2.5 U
RSD			2%	NA	3%	NA	NA
TC-5 Upper Comp Replicate 1	3	F	57.34	4.2 U	59.3	12.5	2.5 U
TC-5 Upper Comp Replicate 2	3	C	46.53	4.0 U	52.9	15.6	2.4 U
TC-5 Upper Comp Replicate 3	3	C	48.27	3.3 U	54.4	2.0 U	2.0 U
RSD			11%	NA	6%	NA	NA
R-OS Replicate 1	3	B	76.36	4.4 U	76.7	10.0	2.6 U
R-OS Replicate 2	3	B	46.32	4.3 U	45.4	2.6 U	2.6 U
R-OS Replicate 3	3	B	76.66	4.2 U	78.5	14.9	2.6 U
RSD			26%	NA	28%	NA	NA
C-SB Replicate 1	4	E	59.08	4.3 U	35.7	11.9	2.6 U
C-SB Replicate 2	4	E	68.98	4.2 U	45.6	2.5 U	2.5 U
C-SB Replicate 3	4	E	58.65	4.2 U	34.8	2.5 U	2.5 U
RSD			9%	NA	15%	NA	NA
MSL Background Replicate 1	3	F	35.59	4.0 U	10.7	2.4 U	2.4 U
MSL Background Replicate 2	3	F	40.53	4.1 U	12.4	2.5 U	2.5 U
MSL Background Replicate 3	3	F	52.21	4.0 U	15.7	2.4 U	2.4 U
RSD			20%	NA	20%	NA	NA

- (a) U The analyte was not present above the level of the associated value.
 (b) R Sample was reanalyzed.
 (c) Recovery outside quality control range (40%-120%).
 (d) NA Not applicable.
 (e) NS Not spiked.
 (f) Value exceeds relative precision range of 30%.

APPENDIX K

TISSUE CHEMISTRY AND QUALITY ASSURANCE DATA
FOR *NEPHTYS caecoides*

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs)
LABORATORY: Battelle Ocean Sciences (Duxbury, Mass.)
MATRIX: *N. caecoides*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
8270	40% - 120%	±30%	20 µg/kg

HOLDING TIMES Samples were held frozen for up to 2 months prior to extraction and were analyzed within the EPA extract holding time of 40 days (EPA 1986). Samples were extracted in four batches.

DETECTION LIMITS Target detection limits ranged from 1.6 to 29.9 µg/kg for LPAHs and from 1.5 to 31.4 µg/kg for HPAHs. Target detection limits (20 µg/kg wet wt.) were exceeded for 11 samples due to the small quantity of available tissue for analyses.

METHOD BLANKS Four method blanks were analyzed, one with each extraction batch. Naphthalene, phenanthrene, fluoranthene, chrysene, benzo(b) fluoranthene, and pyrene were detected in all four method blanks; however, because levels were low, no data were corrected or flagged.

MATRIX SPIKES Four sets of background samples were spiked in duplicate with all 16 PAH compounds. One set of spikes was extracted with each batch for samples to assess accuracy and precision. Spike recoveries for LPAH compounds ranged from 87% to 123% with only acenaphthalene in one spike for Batch C slightly exceeding the QA/QC requirements. Relative percent differences (RPDs) between spike duplicate recoveries ranged from 0% to 4%, indicating acceptable precision of the method.

The HPAH spike recoveries ranged from 90% to 126%. Four recoveries out of eighty exceeded the upper QA/QC requirements for Batch C. The RPDs between spike recoveries ranged from 0% to 7% and were within the QA/QC requirements, indicating acceptable precision.

REPLICATES Four samples (COMP I, COMP IV, R-AM, and R-OS) were analyzed in triplicate. Precision was measured by Relative Standard Deviation (RSD) between duplicate results. The RSD values ranged from 6% to 55% for LPAHs with only one naphthalene RSD exceeding QA/QC requirements. The HPAH RSD values ranged from 2% to 21%, all within the QA/QC requirements. Overall, these measurements indicate acceptable precision of the method.

SRMs Tissue sample SRM 1974 (NIST) was analyzed once with each extraction

batch (a total of 4 analyses). This SRM is certified for 8 of the 16 PAH compounds. In general, values measured were within the certified range and all concentrations were within $\pm 30\%$ of the certified mean value with the exception of benzo(a)pyrene. No criteria was given for SRMs in the QA/QC plan; therefore, no values were flagged.

SURROGATES

Three radiolabelled PAH compounds (naphthalene d8, acenaphthene d10, and benzo(a)pyrene d12) were added as surrogates to samples prior to analysis. Recoveries for all samples were within the QA/QC requirements.

QA/QC SUMMARY

PROGRAM: Richmond Harbor Program
PARAMETER: Chlorinated Pesticides and PCBs
LABORATORY: Battelle Ocean Sciences (Duxbury, Mass.)
MATRIX: *N. caecoides*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Pesticides	8080	40% - 120%	±30%	2.0 µg/kg
PCBs	8080	40% - 120%	±30%	20 µg/kg

HOLDING TIMES

Samples were held frozen for up to 2 months prior to extraction. All sample extracts were analyzed within the EPA extract holding time of 40 days (EPA 1986).

DETECTION LIMITS

Target detection limits for pesticides (2 µg/kg wet weight, 30 µg/kg for toxaphene) were met. The PCB detection limits ranged from 4.7 to 52 µg/kg (wet weight). Target detection limits of 20 µg/kg wet weight were exceeded for 11 out of 75 samples due to limited tissue available for analysis.

METHOD BLANKS

Four method blanks were analyzed, one with each extraction batch. Beta-BHC and aldrin were found in two of the blanks at levels below the detection limits. Delta-BHC and lindane were found at levels slightly above the detection limits; however, these compounds were not flagged or blank corrected. No PCBs were detected in the method blanks.

MATRIX SPIKES

Four background samples were spiked in duplicate with 18 pesticides and 1 PCB (aroclor 1254). Pesticide spike recoveries ranged from 13% to 215%. However, the majority of the spike recoveries were within the QA/QC requirements. Spike recoveries for endosulfan II and endosulfan sulfate ranged from 125% to 174%; however, neither of these compounds were detected above detection limits or confirmed on a second column in any of the tissue samples. The recoveries of the matrix spikes would suggest that any tissue values reported would be biased high. Spike recoveries of endrin for Batches B and C ranged from 142% to 215%; however, endrin was not detected in any samples. Low spike recoveries were found for endrin aldehyde, with recoveries ranging from 13% to 65%, and again, this compound was not detected in any samples.

Relative percent differences (RPD) between spike and spike duplicates were within QA/QC requirements from 143 out 144 calculations, indicating acceptable precision for this method.

Aroclor 1254 spike recoveries ranged from 103% to 136%. Four out of the eight recoveries slightly exceeded the QA/QC requirements. These were not batch specific and do not indicate a significant bias in the data. The RPDs between spike and spike duplicate recoveries for PCBs ranged from 4% to 13%, indicating acceptable precision for the method.

REPLICATES

Four samples (COMP I, COMP IV, R-AM, and R-OS) were analyzed in triplicate. Three pesticides were detected for two of the triplicate analyses. Precision for these measurements was determined by calculating relative standard deviation (RSDs). The RSDs ranged from 4% to 22%, and were within the QA/QC requirements, indicating acceptable precision.

The PCB RSDs were measured for two of the four sets of triplicates. The RSDs were 23% and 28% and also indicate acceptable precision.

SRMs

The SRM 1974 (obtained from NIST) was analyzed four times, once with each extraction batch. No pesticide values are certified; however, consensus values were given for four pesticides.

SURROGATES

Two compounds, dibromooctafluorobiphenyl (DBOBF) and tetrachloronaphthalene (TCN), were added to all samples prior to extraction to assess the efficiency of the method. Recoveries for DBOBF were within the QA/QC requirements, with the exception of one sample (R-AM with a recovery of 122%). Recoveries for TCN ranged from 64% to 144%. A total of 31 out of 75 sample recoveries for TCN were above the QA/QC requirements. In most cases, this was due to interference of the spiked PCB congener peak, which coeluted with the surrogate. These exceedences do not reflect recovery problems associated with the sample analysis and therefore do not affect data quality.

QA/QC SUMMARY

PROGRAM Richmond Harbor Program
PARAMETER: Metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, and Zn)
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: *N. caecoides*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS

	<u>Analysis Method</u>	<u>QA/QC Document</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Arsenic	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg
Cadmium	ICP-MS	MSL-M-33	75% - 125%	±20%	0.1 mg/kg
Chromium	ICP-MS	PNL-SP-19	75% - 125%	±20%	1.0 mg/kg
Copper	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg
Lead	ICP-MS	PNL-SP-19	75% - 125%	±20%	1.0 mg/kg
Mercury	CVAA	MSL-M-11	75% - 125%	±20%	0.02 mg/kg
Nickel	ICP-MS	PNL-SP-19	75% - 125%	±20%	1.0 mg/kg
Selenium	XRF	PNL-SP-19	75% - 125%	±20%	0.5 mg/kg
Silver	ICP-MS	MSL-M-33	75% - 125%	±20%	1.0 mg/kg
Zinc	XRF	PNL-SP-19	NA	±20%	1.0 mg/kg

HOLDING TIMES

Recommended holding times for metals in tissues based on the 1991 Implementation Manual (EPA/USACE 1991) are 6 months frozen (< 20° C) for all metals except Hg, which is 28 days after receipt at the MSL. *N. caecoides* samples for this project were held frozen for up to 4 weeks and were then freeze dried and stored for up to 3 months in sealed containers. Holding times have not been established for samples held freeze dried; however, standard reference material (SRM) prepared by the U.S. National Institute of Standards and Technology (NIST) such as SRM 1566a (oyster tissue), which is freeze dried, has been issued for up to 10 years without changes to the certified concentrations, including those for Hg.

N. caecoides were digested in two batches for metals analyzed by AA and ICP/MS. The QA/QC samples were analyzed at a minimum of 1 per 20. Samples analyzed by XRF were not treated prior to XRF analysis (other than freeze drying and grinding). All analytical measurements occurred in single batches and were generally performed at a frequency of 1 per 20 samples.

DETECTION LIMITS

Detection limits, based on dry weight concentrations, were acceptable for all metals.

METHOD BLANKS

Four method blanks were analyzed with *N. caecoides* samples for this project 1 per 20 samples). Low levels of Ag, Cd, Cr, Ni, and Pb were found in blanks; sample metals analyzed by AA or ICP-MS (Ag, Cd, Cr, Ni, and Pb) were corrected for concentrations contained in the blanks. Method blanks are not applicable to metals analyzed by XRF.

MATRIX SPIKES

Four samples (COMP V, C-NE, COMP II, and R-PF) were spiked in duplicate

with metals analyzed by AA or ICP-MS (Ag, Cd, Cr, Hg, Ni, and Pb). Spikes were analyzed a minimum of 1 in 20 samples and recoveries ranged from 58% to 121%. Cd, Cu, Ni, and Pb recoveries for one spike duplicate were below the QA/QC requirements. Replicate and SRM results for these metals were within all QA/QC guidelines and indicate that these spike recoveries do not reflect a bias in the data. Cd, however, in one spike was recovered at 185% and was probably double spiked, which would affect data quality.

Relative precision difference values between spike and spike duplicate recoveries ranged from 1% to 43%. Most values were within precision guidelines of $\pm 20\%$. Overall, RPDs between spikes and spike duplicates indicate acceptable accuracy of the method.

SRMs

The SRM 1566a, oyster tissue, was obtained from the NIST. This SRM was analyzed by AA or ICP/MS at a minimum of 1 per 20 samples, and more frequently (1 per 5 samples) for XRF analyses. Cr, Hg, and Ni values exceeded the certified range for the initial SRM analyzed. Experience has shown that Hg values are routinely lower than the certified range. Eight of the 32 Se measurements for the SRM (performed by XRF) were outside of the certified range. These exceedences indicate slightly more variability in XRF measurement of Se than other metals; however, other QA/QC measurements for this metal (i.e., spikes and replicates) are acceptable, indicating that the variability may be a result of non-homogeneity of the SRM rather than an analytical bias.

REPLICATES

Five samples (TC-5 Upper Comp, R-PF, R-AM, R-OS, and C-SB) were analyzed in triplicate for all metals. Precision was measured by Relative Standard Deviation (RSD) between replicate results. The RSDs ranged from 1% to 42%. Four metals, As, Cd, Hg, and Se, exceeded the precision guideline in one of the four sets of triplicates. Silver exceeded the precision guideline for three of five triplicate analyses, suggesting that silver analyses may be more variable and less precise than the other metals.

SURROGATES

NOT APPLICABLE

QA/QC SUMMARY

PROGRAM Richmond Harbor Program
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory
MATRIX: *N. caecoides*
SAMPLE NUMBER: 75

QA/QC REQUIREMENTS

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Monobutyltin	MSL-M-4	-	±30%	10 µg/kg
Dibutyltin	MSL-M-4	40% - 120%	±30%	10 µg/kg
Tributyltin	MSL-M-4	40% - 120%	±30%	10 µg/kg

HOLDING TIMES

No holding times have been established for butyltins in tissues. Samples were kept frozen, extracted in four batches, and analyzed within 2 months of receipt at the laboratory.

DETECTION LIMITS

Detection limits ranged from 4.2 to 51.7 µg/kg wet wt and exceeded the target detection limits (10 µg/kg wet wt) for the majority of samples analyzed due to limited tissue available for extraction.

METHOD BLANKS

Four method blanks were analyzed, one per extraction batch. Butyltins were not detected in the method blanks with the exception of monobutyltin, which was observed below the detection limit in the blank from Batch C.

MATRIX SPIKES

Four background samples were spiked in duplicate to assess the accuracy and precision of the method. One set of spike and spike duplicate analyses was performed with each extraction batch. Although tri-, di-, and monobutyltins were used as spiking compounds, recovery and precision criteria are provided for the tri- and dibutyltins only. Recoveries for TBT ranged from 22% to 112%. Recoveries for DBT ranged from 57% to 96%. Four spike recoveries for TBT were below the QA/QC requirements.

Relative percent differences (RPD) were compared between spike and spike duplicate recoveries to assess precision. The RPD values for tributyltin ranged from 18% to 39% and dibutyltin RPDs ranged from 2% to 12%. Seven out of eight RPDs were within the QA/QC requirements. In general, the precision of the analyses, based on spike duplicate recovery data, was acceptable.

SRMs

NOT APPLICABLE

REPLICATES

Four samples (COMP I, TC-5 Upper Comp, COMP VI, and R-PC) were analyzed in triplicate, one per each extraction batch. Precision between triplicate analyses was measured by Relative Standard Deviation (RSD). One RSD value was calculated for TBT at 47% (other RSDs could not be calculated due to undetected values). Precision, based on the triplicate data available, appear to be low; this is due to the fact that the levels detected in the samples were near or below the detection limits.

SURROGATES

Tripropyltin was added as a surrogate to each sample prior to extraction to assess extraction efficiency. Percent recoveries ranged from 0% to 283% . Approximately 45% of the recoveries were outside of the QA/QC requirements. The cause of the variability of the surrogate recoveries appears to be a problem with the surrogate compound itself, rather than with the analysis. Recoveries for this compound in the past have been low and quite variable and may be due to the relatively high volatility of this compound compared to tri- and dibutyltins. This surrogate does not reflect the behavior of the butyltin compounds of interest; therefore, a more representative compound, triphenyltin, is currently being implemented to assess the efficiency of the extraction and analysis. Because of limited tissue amounts, no re-extractions could be performed.

TABLE K.1. Total Polynuclear Aromatic Hydrocarbons (PAHs), Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> ($\mu\text{g/kg}$ dry weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP I	1	D	16.00	97.23	793.32	890.55
COMP I	2	D	15.28	60.50	169.97	230.47
COMP I	3	A	16.50 ^(a)	40.32	36.43	76.75
COMP I	4	B	17.16	37.65	74.24	111.89
COMP I Replicate 1	5	A	17.54	115.86	692.10	807.96
COMP I Replicate 2	5	A	17.54	685.63	10604.51	11290.14
COMP I Replicate 3	5	A	17.54	40.93	238.17	279.10
COMP II	1	D	15.12	27.96	50.62	78.58
COMP II	2	A	17.08	56.61	37.43	94.04
COMP II	3	C	17.30	39.46	215.23	254.69
COMP II	4	D	15.82	32.00	78.73	110.73
COMP II	5	C	16.64	38.41	256.92	295.33
COMP III	1	C	14.77	48.33	232.09	280.42
COMP III	2	D	16.64	50.39	120.08	170.47
COMP III	3	A	15.35	39.93	36.68	76.61
COMP III	4	D	16.35	74.08	44.04	118.12
COMP III	5	C	15.26	41.56	223.76	265.32
TC-5 Upper Comp	1	C	15.40	90.88	76.97	167.84
TC-5 Upper Comp	2	C	15.92	54.62	90.99	145.61
TC-5 Upper Comp	3	C	16.93	56.21	100.97	157.18
TC-5 Upper Comp	4	A	15.87	59.55	37.11	96.66
TC-5 Upper Comp	5	A	16.58	129.47	455.31	584.78
COMP IV	1	C	16.16	46.49	25.52	72.01
COMP IV Replicate 1	2	C	16.46	60.44	275.50	335.94
COMP IV Replicate 2	2	C	16.46	76.29	62.94	139.23
COMP IV Replicate 3	2	C	16.46	67.96	44.97	112.93
COMP IV	3	A	11.15	116.68	115.45	232.12
COMP IV	4	C	16.04	94.28	474.78	569.07
COMP IV	5	A	13.09	56.96	45.98	102.95
COMP V	1	A	15.27	73.73	124.21	197.94
COMP V	2	A	14.83	58.04	33.59	91.63
COMP V	3	A	17.13	53.13	32.26	85.39
COMP V	4	D	15.44	69.42	250.52	319.94
COMP V	5	B	17.14	77.03	30.36	107.39
COMP VI	1	C	15.08	111.34	485.14	596.47
COMP VI	2	A	15.83	370.14	6241.10	6611.24
COMP VI	3	B	16.25	188.52	90.15	278.67
COMP VI	4	A	15.89	283.56	580.43	864.00
COMP VI	5	O	16.24	293.44	413.97	707.41
R-AC	1	B	15.84	130.46	608.97	739.43
R-AC	2	C	16.14	107.47	886.10	993.57
R-AC	3	C	16.16	40.72	43.81	84.53
R-AC	4	A	13.29	356.44	8445.67	8802.10
R-AC	5	D	16.75	40.69	115.32	156.01
R-AM	1	B	17.29	121.01	98.99	220.00
R-AM	2	C	16.62	44.44	68.44	112.88
R-AM	3	B	16.26	49.14	202.65	251.79

TABLE K.1. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> ($\mu\text{g/kg}$ dry weight)		
				Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
R-AM Replicate 1	4	B	16.61	42.20	44.76	86.96
R-AM Replicate 2	4	B	16.61	39.19	30.85	70.04
R-AM Replicate 3	4	B	16.61	92.02	894.54	986.56
R-AM	5	B	11.30	76.90	343.56	420.46
R-BF	1	D	16.72	53.71	45.17	98.89
R-BF	2	B	13.79	105.08	1028.17	1133.25
R-BF	3	B	15.57	43.99	91.91	135.90
R-BF	4	A	15.24	49.56	42.38	91.94
R-BF	5	A	16.05	31.05	23.38	54.43
R-OS	1	B	15.79	435.69	6038.41	6474.10
R-OS Replicate 1	2	D	16.53	81.59	54.43	136.03
R-OS Replicate 2	2	D	16.53	78.80	32.08	110.87
R-OS Replicate 3	2	D	16.53	95.32	36.45	131.77
R-OS	3	B	15.02	30.83	37.62	68.45
R-OS	4	D	17.85	32.94	32.82	65.76
R-OS	5	C	17.02	27.90	22.97	50.87
R-PF	1	C	13.90	37.62	56.71	94.32
R-PF	2	C	13.46	42.75	286.79	329.53
R-PF	3	O	16.88	37.81	86.25	124.06
R-PF	4	D	16.74	38.76	78.95	117.70
R-PF	5	A	16.47	25.20	31.68	56.88
C-SB	1	C	14.29	33.33	34.95	68.28
C-SB	2	D	16.03	533.97	10924.42	11458.39
C-SB	3	B	15.65	32.75	59.78	92.53
C-SB	4	A	16.06	54.89	130.42	185.32
C-SB	5	D	16.46	85.34	123.89	209.23
C-NE	1	B	15.94	86.91	135.67	222.58
C-NE	2	B	18.40	99.51	337.13	436.64
C-NE	3	B	16.01	52.51	57.71	110.22
C-NE	4	B	15.81	52.45	35.63	88.08
C-NE	5	B	15.28	51.72	39.62	91.35
MSL Background	1	E	19.82	41.98	31.08	73.06
MSL Background	2	E	19.82	47.07	30.63	77.70
MSL Background	3	E	19.82	48.94	27.95	76.89
MSL Background	4	E	19.82	42.79	27.09	69.88
MSL Background	5	E	19.82	44.75	33.20	77.95

(a) Percent dry weight averaged from the other four Replicates of COMP I.

TABLE K.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Dry Weight, in Tissue of *A?c?ecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)					
				Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
COMP I	1	D	16.00	15.31 J ^(a)	40.50 U ^(b)	21.88 U	6.63 J	15.88 J	17.94 U
COMP I	2	D	15.28	35.14	3.08 J	7.98 J	8.84 J	27.03	4.84 J
COMP I	3	A	16.50 ^(c)	15.82 J	31.03 U	16.73 U	18.12 U	16.18	13.76 U
COMP I	4	B	17.16	139.10	109.85 U	59.32 U	14.04 J	28.21 J	7.17 J
COMP I Replicate 1	5	A	17.54	48.57 J	120.47 U	65.05 U	11.86 J	30.44 J	53.31 U
COMP I Replicate 2	5	A	17.54	33.58 J	110.83 U	59.86 U	64.82 U	21.04 J	49.09 U
COMP I Replicate 3	5	A	17.54	34.72 J	81.64 U	44.13 U	47.72 U	21.49 J	36.15 U
COMP II	1	D	15.12	22.35 J	25.99 U	6.15 J	6.15 J	18.12	2.12 J
COMP II	2	A	17.08	11.71 J	49.00 U	26.46 U	7.38 J	15.93 J	2.63 J
COMP II	3	C	17.30	10.75 J	26.71 U	4.22 J	6.65 J	19.60	2.77 J
COMP II	4	D	15.82	42.16	35.52 U	6.19 J	7.77 J	25.47	3.73 J
COMP II	5	C	16.64	10.94 J	27.04 U	4.15 J	6.25 J	16.77	2.58 J
COMP III	1	C	14.77	19.43 J	37.64 U	4.13 J	6.91 J	17.60	1.49 J
COMP III	2	D	16.84	9.92 J	31.37 U	16.95 U	4.87 J	16.05	13.88 U
COMP III	3	A	15.35	19.15 J	28.08 U	15.18 U	5.60 J	15.18	12.44 U
COMP III	4	D	16.35	8.56 J	29.36 U	15.84 U	4.71 J	11.93 J	12.97 U
COMP III	5	C	15.26	14.88 J	38.07 U	3.47 J	6.55 J	16.32 J	0.98 J
TC-5 Upper Comp	1	C	15.40	28.44 J	51.75 U	5.32 J	11.56 J	52.86	9.29 J
TC-5 Upper Comp	2	C	15.92	14.32 J	30.46 U	16.46 U	11.18 J	56.16	10.36 J
TC-5 Upper Comp	3	C	16.93	14.24 J	41.64 U	4.84 J	13.11 J	61.84	11.05 J
TC-5 Upper Comp	4	A	15.87	16.07 J	43.86 U	23.69 U	11.15 J	58.03	11.97 J
TC-5 Upper Comp	5	A	16.58	50.18 J	143.85 U	77.68 U	84.14 U	54.10 J	11.58 J
COMP IV	1	C	16.16	14.17 J	29.70 U	3.47 J	5.45 J	16.34	1.30 J
COMP IV Replicate 1	2	C	16.46	39.55 J	126.12 U	6.74 J	11.79 J	23.51 J	55.83 U
COMP IV Replicate 2	2	C	16.46	46.42 J	160.02 U	86.45 U	12.76 J	19.62 J	70.84 U
COMP IV Replicate 3	2	C	16.46	50.61 J	112.52 U	6.68 J	11.60 J	26.43 J	49.82 U
COMP IV	3	A	11.15	36.05 J	80.36 U	43.41 U	10.58 J	27.44 J	35.61 U
COMP IV	4	C	16.04	9.98 J	35.60 U	2.81 J	5.17 J	13.09 J	15.77 U
COMP IV	5	A	13.09	26.97 J	75.86 U	40.95 U	7.79 J	21.85 J	33.61 U
COMP V	1	A	15.27	23.77 J	33.66 U	18.21 U	19.71 U	19.71	4.85 J
COMP V	2	A	14.83	12.41 J	40.05 U	21.65 U	4.99 J	19.42	4.11 J
COMP V	3	A	17.13	12.67 J	24.28 U	13.13 U	6.89 J	17.22	4.79 J
COMP V	4	D	15.44	13.28 J	38.02 U	20.53 U	5.57 J	21.50	2.40 J
COMP V	5	B	17.14	22.52	21.47 U	4.03 J	6.07 J	22.35	5.48 J

TABLE K.2. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	<i>N. caecoides</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)					
				Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
COMP VI	1	C	15.08	14.06 J	1.79 J	3.12 J	6.37 J	17.64 J	6.17 J
COMP VI	2	A	15.83	11.43 J	30.70 U	16.55 U	5.94 J	17.44	3.60 J
COMP VI	3	B	16.25	34.28 J	34.71 U	18.77 U	7.63 J	23.82	3.69 J
COMP VI	4	A	15.89	19.76 J	35.81 U	19.32 U	20.96 U	19.70	15.86 U
COMP VI	5	D	16.24	59.73 J	107.70 U	58.19 U	9.73 J	25.68 J	4.37 J
R-AC	1	B	15.84	49.37	47.92 U	12.18 J	24.37 J	238.45	45.77
R-AC	2	C	16.14	41.45 J	105.27 U	20.38 J	33.09 J	291.39	49.38
R-AC	3	C	16.16	17.14 J	2.78 J	14.17 J	26.67	236.70	58.97
R-AC	4	A	13.29	32.88 J	44.09 U	42.59	59.67	454.78	95.71
R-AC	5	D	16.75	8.48 J	27.28 U	32.06	39.88	377.01	76.54
R-AM	1	B	17.29	33.02	29.15 U	15.73 U	9.14 J	60.27	8.91 J
R-AM	2	C	16.62	12.39 J	1.81 J	4.45 J	8.24 J	41.88	8.12 J
R-AM	3	B	16.26	21.53 J	24.17 U	5.66 J	7.81 J	50.37	8.92 J
R-AM Replicate 1	4	B	16.61	190.01	115.47 U	62.37 U	9.39 J	68.45	15.71 J
R-AM Replicate 2	4	B	16.61	190.91	176.52 U	95.36 U	103.19 U	83.14	19.39 J
R-AM Replicate 3	4	B	16.61	53.16 J	63.21 U	34.14 U	8.97 J	59.78	8.55 J
R-AM	5	B	11.30	28.76 J	38.05 U	8.50 J	9.82 J	67.52	14.87 J
R-BF	1	D	16.72	16.21 J	45.04 U	24.34 U	5.68 J	16.87 J	19.92 U
R-BF	2	B	13.79	75.63	63.23 U	34.16 U	11.39 J	25.45 J	4.21 J
R-BF	3	B	15.57	33.78	31.92 U	17.21 U	8.48 J	25.43	6.04 J
R-BF	4	A	15.24	20.14 J	39.76 U	21.52 U	6.50 J	20.80	2.95 J
R-BF	5	A	16.05	11.96 J	38.38 U	20.75 U	7.41 J	36.76	4.36 J
R-OS	1	B	15.79	24.64 J	28.50 U	15.39 U	4.94 J	15.20	1.71 J
R-OS Replicate 1	2	D	16.53	28.25 J	96.01 U	51.85 U	7.08 J	17.18 J	42.47 U
R-OS Replicate 2	2	D	16.53	28.86 J	77.86 U	42.04 U	7.99 J	13.37 J	2.24 J
R-OS Replicate 3	2	D	16.53	29.52 J	94.13 U	50.82 U	8.35 J	13.85 J	41.68 U
R-OS	3	B	15.02	39.01	31.49 U	7.39 J	5.59 J	22.17	2.86 J
R-OS	4	D	17.85	11.54 J	29.08 U	15.69 U	5.04 J	11.32 J	12.89 U
R-OS	5	C	17.02	13.10 J	29.85 U	3.06 J	5.93 J	15.69	1.41 J
R-PF	1	C	13.90	50.07	37.34 U	11.87 J	11.01 J	45.40	2.66 J
R-PF	2	C	13.46	16.20 J	43.68 U	4.38 J	8.62 J	22.88	1.63 J
R-PF	3	D	16.88	9.30 J	28.32 U	4.09 J	5.15 J	14.40	12.56 U
R-PF	4	D	16.74	9.32 J	24.37 U	4.54 J	5.26 J	14.22	10.75 U
R-PF	5	A	16.47	14.39 J	36.31 U	19.61 U	6.19 J	18.46	1.28 J

TABLE K.2. (contd)

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
C-SB	1	C	14.29	14.70 J	35.13 U	4.20 J	6.79 J	17.21	1.54 J
C-SB	2	D	16.03	12.16 J	32.69 U	5.18 J	5.93 J	14.35 J	14.47 U
C-SB	3	B	15.65	44.35	37.12 U	20.06 U	6.84 J	20.89	4.22 J
C-SB	4	A	16.06	12.52 J	25.03 U	13.51 U	14.63 U	15.44	11.08 U
C-SB	5	D	16.46	10.33 J	27.04 U	3.04 J	4.56 J	12.94	1.88 J
C-NE	1	B	15.94	23.40	22.58 U	4.39 J	6.02 J	23.15	9.97 U
C-NE	2	B	18.40	22.77 J	22.99 U	4.57 J	6.85 J	23.86	10.16 U
C-NE	3	B	16.01	28.61	26.05 U	5.87 J	7.06 J	24.48	1.94 J
C-NE	4	B	15.81	22.07 J	29.48 U	15.94 U	6.20 J	24.86	13.03 U
C-NE	5	B	15.28	25.92 J	33.57 U	18.13 U	7.53 J	26.11	14.86 U
MSL Background	1	E	19.82	13.02 J	13.32 U	2.77 J	7.16 J	16.95	2.07 J
MSL Background	2	E	19.82	17.71	13.37 U	2.72 J	6.46 J	18.37 J	1.82 J
MSL Background	3	E	19.82	17.86	13.37 U	2.47 J	6.61 J	18.57	3.43 J
MSL Background	4	E	19.82	15.19	13.47 U	2.27 J	6.56 J	16.85	1.92 J
MSL Background	5	E	19.82	13.98	13.37 U	2.47 J	7.06 J	19.27	1.97 J

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) U The analyte was not present above the level of the associated value.
 (c) Percent dry weight was averaged from the other four replicates of COMP 1.

TABLE K.3. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

		<i>N. caecoides</i> HPAHs (Ug/kg dry weight)											
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)Fluoranthene	Benzo(k)Fluoranthene	Benzo(a)pyrene	Indeno (1,2,3-c,d)pyrene	Dibenzo (a,h)Anthracene	Benzo (g,h,i)Perylene
COMP I	1	D	16.00	17.81	57.00	29.94 U ^(a)	11.44 J ^(b)	30.56 U	25.56 U	26.63 U	31.94 U	21.75 U	43.31 U
COMP I	2	D	15.28	26.96	76.37	3.27 J	18.06	4.25 J	3.14 J	2.75 J	21.47 U	14.59 U	0.85 J
COMP I	3	A	16.50 ^(c)	18.42	47.45	22.91 J	12.85	23.39 J	19.64 J	20.42 J	24.48 U	16.67 U	33.21 U
COMP I	4	B	17.16	21.21 J	56.47 J	81.18 U	12.47 J	82.87 U	69.41 U	72.26 U	86.66 U	58.92 U	117.48 U
COMP I Replicate 1	5	A	17.54	19.95 J	46.07 J	89.05 U	10.95 J	90.88 U	76.11 U	79.30 U	95.04 U	64.65 U	128.91 U
COMP I Replicate 2	5	A	17.54	21.95 J	57.81 J	81.93 U	11.23 J	83.64 U	70.07 U	72.92 U	87.46 U	59.46 U	118.59 U
COMP I Replicate 3	5	A	17.54	23.03 J	65.28	60.38 U	12.66 J	61.63 U	51.60 U	53.76 U	64.42 U	43.84 U	87.34 U
COMP II	1	D	15.12	23.68	86.18	1.32 J	16.87	1.46 J	0.93 J	17.13 U	20.50 U	13.96 U	27.84 U
COMP II	2	A	17.08	16.69 J	45.90	0.94 J	10.71 J	37.00 U	30.97 U	32.26 U	38.70 U	26.29 U	52.46 U
COMP II	3	C	17.30	19.48	54.86	1.27 J	13.64 J	1.04 J	0.98 J	0.64 J	21.10 U	14.34 U	28.61 U
COMP II	4	D	15.82	23.45	80.09	26.30 U	17.38 J	1.90 J	1.07 J	23.39 U	28.07 U	19.09 U	38.05 U
COMP II	5	C	16.64	23.56	70.37	1.02 J	14.48	1.86 J	0.84 J	0.66 J	21.33 U	14.48 U	2.52 J
COMP III	1	C	14.77	13.20 J	20.51	0.74 J	6.30 J	1.08 J	0.54 J	24.78 U	29.65 U	20.18 U	40.28 U
COMP III	2	D	16.64	11.66 J	19.83	23.20 U	6.13 J	23.68 U	19.83 U	20.67 U	24.76 U	16.83 U	33.53 U
COMP III	3	A	15.35	11.86 J	19.02	0.52 J	5.28 J	21.17 U	17.72 U	18.44 U	22.15 U	15.05 U	30.03 U
COMP III	4	D	16.35	9.11 J	17.43	21.71 U	5.14 J	22.14 U	18.53 U	19.33 U	23.12 U	15.72 U	31.38 U
COMP III	5	C	15.26	14.29 J	21.43	0.79 J	6.55 J	0.92 J	0.79 J	25.03 U	30.01 U	20.45 U	40.76 U
TC-5 Upper Comp	1	C	15.40	219.61	505.97	20.00 J	90.26	17.27 J	7.99 J	10.52 J	2.73 J	27.79 U	11.75 J
TC-5 Upper Comp	2	C	15.92	224.18	529.59	16.71 J	86.75	15.26 J	7.47 J	7.22 J	24.06 U	16.33 U	7.35 J
TC-5 Upper Comp	3	C	16.93	258.12	575.19	24.04 J	102.54	25.22 J	9.21 J	13.17 J	4.13 J	0.95 J	15.59 J
TC-5 Upper Comp	4	A	15.87	186.26	452.30	17.58 J	81.98	15.94 J	5.73 J	8.82 J	34.59 U	23.50 U	24.70 J
TC-5 Upper Comp	5	A	16.58	162.67	395.24	18.46 J	76.66	13.15 J	6.45 J	8.38 J	113.51 U	77.20 U	11.10 J
COMP IV	1	C	16.16	9.72 J	11.70 J	0.80 J	3.77 J	0.80 J	0.62 J	19.55 U	23.45 U	15.90 J	0.50 J
COMP IV Replicate 1	2	C	16.46	13.55 J	16.83 J	93.26 U	5.41 J	95.14 U	79.71 U	82.99 U	99.51 U	67.68 U	18.65 J
COMP IV Replicate 2	2	C	16.46	12.58 J	14.34 J	118.35 U	5.16 J	120.78 U	101.15 U	105.35 U	126.25 U	85.84 U	171.20 U
COMP IV Replicate 3	2	C	16.46	14.34 J	16.77 J	83.23 U	5.35 J	84.93 U	71.14 U	74.06 U	88.82 U	60.39 U	120.41 U
COMP IV	3	A	11.15	17.94 J	20.18 J	59.46 U	5.92 J	60.63 U	50.76 U	52.91 U	63.41 U	43.14 U	86.01 U
COMP IV	4	C	16.04	8.98 J	10.60 J	26.31 U	3.18 J	0.62 J	22.51 U	23.44 U	28.05 U	19.08 U	38.09 U
COMP IV	5	A	13.09	13.06 J	18.79 J	56.07 U	5.58 J	57.22 U	47.98 U	49.96 U	59.89 U	40.72 U	81.21 U
COMP V	1	A	15.27	27.37	173.87	24.89 U	23.58	4.45 J	2.82 J	22.13 U	26.59 U	18.07 U	36.02 U
COMP V	2	A	14.83	25.42	177.21	2.02 J	24.48	3.98 J	2.29 J	26.37 U	31.63 U	21.51 U	2.76 J
COMP V	3	A	17.13	24.69	169.35	1.98 J	22.36	2.45 J	2.10 J	0.82 J	19.15 U	13.02 U	25.98 U
COMP V	4	D	15.44	32.58	209.13	28.11 U	30.63	4.21 J	4.60 J	3.11 J	2.53 J	20.40 U	40.74 U
COMP V	5	B	17.14	32.15	210.79	15.87 U	27.07	2.57 J	2.92 J	14.12 U	16.92 U	11.55 U	22.99 U

TABLE K.3. (contd)

<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ dry weight)													
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) pyrene	Indeno (1,2,3-c,d) pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
COMP VI	1	C	15.08	22.21	149.54	1.66 J	23.01	2.85 J	2.19 J	1.19 J	31.56 U	21.49 U	42.84 U
COMP VI	2	A	15.83	26.85	193.24	2.34 J	25.08	3.47 J	2.40 J	1.58 J	24.19 U	16.49 U	1.96 J
COMP VI	3	B	16.25	28.43	192.74	25.66 U	23.32	4.37 J	1.66 J	22.83 U	27.38 U	18.65 U	37.11 U
COMP VI	4	A	15.89	26.31	159.41	26.49 U	20.64	5.35 J	3.52 J	23.60 U	28.26 U	19.19 U	38.33 U
COMP VI	5	D	16.24	38.73 J	263.12	79.62 U	35.28 J	81.28 U	68.04 U	70.87 U	84.98 U	57.82 U	115.27 U
R-AC	1	B	15.84	1375.95	4497.66	45.96	248.11	30.49 J	14.84 J	17.36 J	37.82 U	25.69 U	10.73 J
R-AC	2	C	16.14	1298.57	4217.53	226.89	225.28	28.56 J	16.54 J	15.06 J	83.02 U	56.51 U	9.98 J
R-AC	3	C	16.16	2042.20	5721.66	105.63	365.04	70.17	27.29	66.77	3.40 J	0.74 J	42.76
R-AC	4	A	13.29	2400.98	7624.91	83.37	346.35	50.41	27.24 J	42.29	34.76 U	23.63 U	28.97 J
R-AC	5	D	16.75	2626.57	7477.67	119.34	409.01	112.90	105.97	48.00	21.55 U	14.63 U	24.96 J
R-AM	1	B	17.29	145.69	286.81	3.99 J	43.96	3.30 J	1.39 J	19.20 U	22.96 U	15.62 U	31.17 U
R-AM	2	C	16.62	82.07	205.60	4.93 J	46.15	1.81 J	1.38 J	0.90 J	18.65 U	12.70 U	0.72 J
R-AM	3	B	16.26	114.21	290.47	6.70 J	59.23	1.48 J	2.71 J	15.93 U	19.07 U	12.98 U	25.89 U
R-AM Replicate 1	4	B	16.61	190.55	325.71	85.37 U	64.18	87.12 U	72.97 U	75.98 U	91.09 U	61.95 U	123.54 U
R-AM Replicate 2	4	B	16.61	136.06	234.50	130.52 U	43.41 J	133.23 U	111.56 U	116.20 U	139.25 U	94.70 U	188.86 U
R-AM Replicate 3	4	B	16.61	172.49	361.29	6.92 J	61.89	4.15 J	2.23 J	41.60 U	49.91 U	33.96 U	67.67 U
R-AM	5	B	11.30	119.73	277.26	5.22 J	53.10	28.67 U	24.07 U	25.04 U	30.00 U	20.44 U	40.71 U
R-BF	1	D	16.72	19.14 J	45.45	33.31 U	14.35 J	33.97 U	28.47 U	29.67 U	35.53 U	24.16 U	48.21 U
R-BF	2	B	13.79	26.76 J	51.78	46.77 U	16.32 J	6.96 J	39.96 U	41.62 U	49.89 U	33.94 U	13.63 J
R-BF	3	B	15.57	27.62	55.68	6.42 J	19.46	5.20 J	4.95 J	4.88 J	25.18 U	17.15 U	34.10 U
R-BF	4	A	15.24	29.99	66.34	1.84 J	18.57 J	1.71 J	1.64 J	26.18 U	31.43 U	21.33 U	42.59 U
R-BF	5	A	16.05	42.06	59.25	6.23 J	26.79	10.90 J	8.79 J	25.30 U	5.79 J	3.36 J	6.79 J
R-DS	1	B	15.79	10.26 J	11.27 J	21.09 U	3.99 J	21.53 U	18.05 U	18.75 U	22.48 U	15.33 U	30.53 U
R-OS Replicate 1	2	D	16.53	15.18 J	22.26 J	70.96 U	49.73 U	72.41 U	60.68 U	63.16 U	75.74 U	51.48 U	20.27 J
R-OS Replicate 2	2	D	16.53	14.52 J	16.15 J	57.53 U	4.96 J	58.74 U	49.18 U	51.24 U	61.40 U	41.74 U	83.30 U
R-OS Replicate 3	2	D	16.53	16.09 J	16.82 J	69.57 U	6.72 J	71.02 U	59.47 U	61.95 U	74.29 U	50.51 U	100.73 U
R-OS	3	B	15.02	10.19 J	15.11 J	23.30 U	5.06 J	23.77 U	19.91 U	20.71 U	24.83 U	16.91 U	33.69 U
R-OS	4	D	17.85	8.24 J	10.81 J	21.51 U	3.92 J	21.90 U	18.38 U	19.10 U	22.91 U	15.57 U	31.09 U
R-OS	5	C	17.02	11.81 J	13.04 J	0.65 J	3.94 J	1.06 J	0.35 J	19.62 U	23.56 U	16.04 U	31.96 U
R-PF	1	C	13.90	34.89	31.08	6.69 J	11.22 J	4.89 J	2.95 J	4.46 J	29.50 U	20.07 U	2.81 J
R-PF	2	C	13.46	19.09	18.72 J	32.24 U	6.09 J	1.26 J	27.56 U	28.75 U	34.47 U	23.40 U	46.73 U
R-PF	3	D	16.88	11.97 J	16.00	20.97 U	4.86 J	21.39 U	17.89 U	18.66 U	22.33 U	15.23 U	30.33 U
R-PF	4	D	16.74	13.08	16.19	17.98 U	5.68 J	18.40 U	15.41 U	16.01 U	19.24 U	13.08 U	26.05 U
R-PF	5	A	16.47	13.66 J	16.70 J	26.84 U	4.74 J	1.34 J	22.95 U	23.92 U	28.66 U	19.49 U	38.86 U

TABLE K.3. (contd)

<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)													
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) pyrene	Indeno (1,2,3-c,d) pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
C-SB	1	C	14.29	25.05	30.16	1.40 J	9.59 J	1.12 J	0.56 J	0.56 J	27.71 U	18.82 U	37.58 U
C-SB	2	D	16.03	20.59	26.70	24.20 U	9.42 J	24.70 U	20.65 U	21.52 U	25.83 U	17.53 U	35.00 U
C-SB	3	B	15.65	25.18	28.56	27.48 U	9.20 J	27.99 U	23.45 U	24.41 U	29.27 U	19.94 U	39.74 U
C-SB	4	A	16.06	20.30	23.10	18.49 U	7.22 J	18.87 U	15.82 U	16.50 U	19.74 U	13.45 U	26.77 U
C-SB	5	D	16.46	23.27	28.13	19.99 U	8.38 J	20.41 U	17.07 U	17.80 U	21.32 U	14.52 U	28.92 U
C-NE	1	B	15.94	17.38	17.63	5.58 J	5.40 J	17.00 U	14.24 U	14.87 U	17.82 U	12.11 U	24.15 U
C-NE	2	B	18.40	12.93	14.95	17.01 U	5.71 J	17.34 U	14.57 U	15.16 U	18.15 U	12.34 U	24.62 U
C-NE	3	B	16.01	17.61	18.80	1.62 J	5.93 J	1.00 J	16.43 U	17.11 U	20.55 U	13.99 U	27.86 U
C-NE	4	B	15.81	11.76 J	14.61 J	21.82 U	5.88 J	22.26 U	18.66 U	19.42 U	23.28 U	15.81 U	31.56 U
C-NE	5	B	15.28	13.87 J	17.08 J	24.87 U	6.15 J	25.33 U	21.27 U	22.12 U	26.51 U	18.06 U	35.93 U
MSL Background	1	E	19.82	10.04	10.85	1.16 J	4.04 J	1.51 J	0.81 J	8.78 U	10.49 U	7.16 U	2.67 J
MSL Background	2	E	19.82	9.54	10.54	1.26 J	7.42	1.36 J	0.50 J	8.78 U	10.54 U	7.16 U	14.33 U
MSL Background	3	E	19.82	12.56	11.30	1.21 J	6.91 U	1.11 J	0.96 J	8.78 U	10.54 U	7.16 U	0.81 J
MSL Background	4	E	19.82	9.64	10.60	1.01 J	3.99 J	1.36 J	0.50 J	8.88 U	10.65 U	7.21 U	14.43 U
MSL Background	5	E	19.82	10.14	11.60	1.31 J	4.14 J	2.22 J	1.21 J	8.78 U	1.16 J	7.16 U	1.41 J

(a) U The analyte was not present above the level of the associated value.

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

(c) Percent dry weight was averaged from other four replicates of COMP 1.

TABLE K.4. Total Polynuclear Aromatic Hydrocarbons (PAHs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> ($\mu\text{g}/\text{kg}$ wet weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP I	1	D	6.05	13.80	19.85
COMP I	2	D	13.28	20.73	34.01
COMP I	3	A	5.28	12.99	18.27
COMP I	4	B	32.35	15.47	47.82
COMP I Replicate 1	5	A	15.94	13.50	29.44
COMP I Replicate 2	5	A	9.58	15.96	25.54
COMP I Replicate 3	5	A	9.86	17.71	27.57
COMP II	1	O	8.30	19.72	28.02
COMP II	2	A	6.43	12.68	19.11
COMP II	3	C	7.61	15.90	23.51
COMP II	4	O	13.50	19.60	33.10
COMP II	5	C	6.77	19.19	25.96
COMP III	1	C	7.32	6.26	13.58
COMP III	2	D	5.13	6.26	11.39
COMP III	3	A	6.13	5.63	11.76
COMP III	4	D	4.12	5.18	9.30
COMP III	5	C	6.44	6.83	13.27
TC-5 Upper Comp	1	C	16.55	136.46	153.01
TC-5 Upper Comp	2	C	14.65	142.41	157.06
TC-5 Upper Comp	3	C	17.79	174.07	191.86
TC-5 Upper Comp	4	A	15.43	125.90	141.33
TC-5 Upper Comp	5	A	19.21	114.75	133.96
COMP IV	1	C	6.58	7.08	13.66
COMP IV Replicate 1	2	C	13.43	8.96	22.39
COMP IV Replicate 2	2	C	12.97	5.28	18.25
COMP IV Replicate 3	2	C	15.69	6.00	21.69
COMP IV	3	A	8.26	4.91	13.17
COMP IV	4	C	4.98	3.75	8.73
COMP IV	5	A	7.41	4.90	12.31
COMP V	1	A	7.38	35.44	42.82
COMP V	2	A	6.07	35.32	41.39
COMP V	3	A	7.12	38.33	45.45
COMP V	4	O	6.60	44.28	50.88
COMP V	5	B	10.36	47.22	57.58
COMP VI	1	C	7.41	30.56	37.97
COMP VI	2	A	6.08	40.67	46.75
COMP VI	3	B	11.28	40.71	51.99

TABLE K.4. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> ($\mu\text{g/kg}$ wet weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
COMP VI	4	A	6.27	34.20	40.47
COMP VI	5	D	16.16	54.75	70.91
R-AC	1	B	58.63	988.59	1047.22
R-AC	2	C	70.32	974.60	1044.92
R-AC	3	C	57.60	1364.82	1422.42
R-AC	4	A	91.12	1409.34	1500.46
R-AC	5	D	89.44	1829.84	1919.28
R-AM	1	B	19.25	83.88	103.13
R-AM	2	C	12.78	57.10	69.88
R-AM	3	B	15.33	77.20	92.53
R-AM Replicate 1	4	B	47.10	96.41	143.51
R-AM Replicate 2	4	B	48.74	68.76	117.50
R-AM Replicate 3	4	B	21.67	101.15	122.82
R-AM	5	B	14.63	51.45	66.08
R-BF	1	D	6.48	13.20	19.68
R-BF	2	B	16.09	15.92	32.01
R-BF	3	B	11.48	19.34	30.82
R-BF	4	A	7.68	18.30	25.98
R-BF	5	A	9.71	27.28	36.99
R-OS	1	B	7.34	4.03	11.37
R-OS Replicate 1	2	D	8.68	9.54	18.22
R-OS Replicate 2	2	D	8.67	5.89	14.56
R-OS Replicate 3	2	D	8.55	6.55	15.10
R-OS	3	B	11.57	4.56	16.13
R-OS	4	D	4.98	4.10	9.08
R-OS	5	C	6.67	5.25	11.92
R-PF	1	C	16.82	13.76	30.58
R-PF	2	C	7.23	6.08	13.31
R-PF	3	D	5.56	5.54	11.10
R-PF	4	D	5.58	5.85	11.43
R-PF	5	A	6.64	6.00	12.64
C-SB	1	C	6.35	9.78	16.13
C-SB	2	D	6.03	9.09	15.12
C-SB	3	B	11.94	9.85	21.79
C-SB	4	A	4.49	8.13	12.62
C-SB	5	D	5.39	9.84	15.23
C-NE	1	B	9.08	7.33	16.41
C-NE	2	B	10.68	6.18	16.86
C-NE	3	B	10.88	7.20	18.08

TABLE K.4. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> ($\mu\text{g/kg}$ wet weight)		
			Total Low Molecular Weight PAHs	Total High Molecular Weight PAHs	Total PAHs
C-NE	4	B	8.40	5.10	13.50
C-NE	5	B	9.10	5.67	14.77
MSL Background	1	E	8.32	6.16	14.48
MSL Background	2	E	9.33	6.07	15.40
MSL Background	3	E	9.70	5.54	15.24
MSL Background	4	E	8.48	5.37	13.85
MSL Background	5	E	8.87	6.58	15.45

TABLE K.5. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

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 ^(b)	20	20	20	20	20
Achieved DL High			NA	29.32	15.84	17.14	NA	11.66
Achieved DL Low			NA	3.60	2.17	2.35	NA	1.59
COMP I	1	D	2.45 J ^(c)	6.48 U ^(d)	3.50 U	1.06 J	2.54 J	2.87 U
COMP I	2	D	5.37	0.47 J	1.22 J	1.35 J	4.13	0.74 J
COMP I	3	A	2.61 J	5.12 U	2.76 U	2.99 U	2.67	2.27 U
COMP I	4	B	23.87	18.85 U	10.18 U	2.41 J	4.84 J	1.23 J
COMP I Replicate 1	5	A	8.52 J	21.13 U	11.41 U	2.08 J	5.34 J	9.35 U
COMP I Replicate 2	5	A	5.89 J	19.44 U	10.50 U	11.37 U	3.69 J	8.61 U
COMP I Replicate 3	5	A	6.09 J	14.32 U	7.74 U	8.37 U	3.77 J	6.34 U
COMP II	1	D	3.38 J	3.93 U	0.93 J	0.93 J	2.74	0.32 J
COMP II	2	A	2.00 J	8.37 U	4.52 U	1.26 J	2.72 J	0.45 J
COMP II	3	C	1.86 J	4.62 U	0.73 J	1.15 J	3.39	0.48 J
COMP II	4	D	6.67	5.62 U	0.98 J	1.23 J	4.03	0.59 J
COMP II	5	C	1.82 J	4.50 U	0.69 J	1.04 J	2.79	0.43 J
COMP III	1	C	2.87 J	5.56 U	0.61 J	1.02 J	2.60	0.22 J
COMP III	2	D	1.65 J	5.22 U	2.82 U	0.81 J	2.67	2.31 U
COMP III	3	A	2.94 J	4.31 U	2.33 U	0.86 J	2.33	1.91 U
COMP III	4	D	1.40 J	4.80 U	2.59 U	0.77 J	1.95 J	2.12 U
COMP III	5	C	2.27 J	5.81 U	0.53 J	1.00 J	2.49 J	0.15 J
TC-5 Upper Comp	1	C	4.38 J	7.97 U	0.82 J	1.78 J	8.14	1.43 J
TC-5 Upper Comp	2	C	2.28 J	4.85 U	2.62 U	1.78 J	8.94	1.65 J
TC-5 Upper Comp	3	C	2.41 J	7.05 U	0.82 J	2.22 J	10.47	1.87 J
TC-5 Upper Comp	4	A	2.55 J	6.96 U	3.76 U	1.77 J	9.21	1.90 J
TC-5 Upper Comp	5	A	8.32 J	23.85 U	12.88 U	13.95 U	8.97 J	1.92 J
COMP IV	1	C	2.29 J	4.80 U	0.56 J	0.88 J	2.64	0.21 J
COMP IV Replicate 1	2	C	6.51 J	20.76 U	1.11 J	1.94 J	3.87 J	9.19 U
COMP IV Replicate 2	2	C	7.64 J	26.34 U	14.23 U	2.10 J	3.23 J	11.66 U
COMP IV Replicate 3	2	C	8.33 J	18.52 U	1.10 J	1.91 J	4.35 J	8.20 U
COMP IV	3	A	4.02 J	8.96 U	4.84 U	1.18 J	3.06 J	3.97 U
COMP IV	4	C	1.60 J	5.71 U	0.45 J	0.83 J	2.10 J	2.53 U
COMP IV	5	A	3.53 J	9.93 U	5.36 U	1.02 J	2.86 J	4.40 U
COMP V	1	A	3.63 J	5.14 U	2.78 U	3.01 U	3.01	0.74 J
COMP V	2	A	1.84 J	5.94 U	3.21 U	0.74 J	2.88	0.61 J
COMP V	3	A	2.17 J	4.16 U	2.25 U	1.18 J	2.95	0.82 J
COMP V	4	D	2.05 J	5.87 U	3.17 U	0.86 J	3.32	0.37 J
COMP V	5	B	3.86	3.68 U	0.69 J	1.04 J	3.83	0.94 J
COMP VI	1	C	2.12 J	0.27 J	0.47 J	0.96 J	2.66 J	0.93 J
COMP VI	2	A	1.81 J	4.86 U	2.62 U	0.94 J	2.76	0.57 J
COMP VI	3	B	5.57 J	5.64 U	3.05 U	1.24 J	3.87	0.60 J
COMP VI	4	A	3.14 J	5.69 U	3.07 U	3.33 U	3.13	2.52 U
COMP VI	5	D	9.70 J	17.49 U	9.45 U	1.58 J	4.17 J	0.71 J
R-AC	1	B	7.82	7.59 U	1.93 J	3.86 J	37.77	7.25
R-AC	2	C	6.69 J	16.99 U	3.29 J	5.34 J	47.03	7.97
R-AC	3	C	2.77 J	0.45 J	2.29 J	4.31	38.25	9.53
R-AC	4	A	4.37 J	5.86 U	5.66	7.93	60.44	12.72
R-AC	5	D	1.42 J	4.57 U	5.37	6.68	63.15	12.82

TABLE K.5. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. carcoides</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
R-AM	1	B	5.71	5.04 U	2.72 U	1.58 J	10.42	1.54 J
R-AM	2	C	2.06 J	0.30 J	0.74 J	1.37 J	6.96	1.35 J
R-AM	3	B	3.50 J	3.93 U	0.92 J	1.27 J	8.19	1.45 J
R-AM Replicate 1	4	B	31.56	19.18 U	10.36 U	1.56 J	11.37	2.61 J
R-AM Replicate 2	4	B	31.71	29.32 U	15.84 U	17.14 U	13.81	3.22 J
R-AM Replicate 3	4	B	8.83 J	10.50 U	5.67 U	1.49 J	9.93	1.42 J
R-AM	5	B	3.25 J	4.30 U	0.96 J	1.11 J	7.63	1.68 J
R-BF	1	D	2.71 J	7.53 U	4.07 U	0.95 J	2.82 J	3.33 U
R-BF	2	B	10.43	8.72 U	4.71 U	1.57 J	3.51 J	0.58 J
R-BF	3	B	5.26	4.97 U	2.68 U	1.32 J	3.96	0.94 J
R-BF	4	A	3.07 J	6.06 U	3.28 U	0.99 J	3.17	0.45 J
R-BF	5	A	1.92 J	6.16 U	3.33 U	1.19 J	5.90	0.70 J
R-OS	1	B	3.89 J	4.50 U	2.43 U	0.78 J	2.40	0.27 J
R-OS Replicate 1	2	D	4.67 J	15.87 U	8.57 U	1.17 J	2.84 J	7.02 U
R-OS Replicate 2	2	O	4.77 J	12.87 U	6.95 U	1.32 J	2.21 J	0.37 J
R-OS Replicate 3	2	O	4.88 J	15.56 U	8.40 U	1.38 J	2.29 J	6.89 U
R-OS	3	B	5.86	4.73 U	1.11 J	0.84 J	3.33	0.43 J
R-OS	4	D	2.06 J	5.19 U	2.80 U	0.90 J	2.02 J	2.30 U
R-OS	5	C	2.23 J	5.08 U	0.52 J	1.01 J	2.67	0.24 J
R-PF	1	C	6.96	5.19 U	1.65 J	1.53 J	6.31	0.37 J
R-PF	2	C	2.18 J	5.88 U	0.59 J	1.16 J	3.08	0.22 J
R-PF	3	D	1.57 J	4.78 U	0.69 J	0.87 J	2.43	2.12 U
R-PF	4	D	1.56 J	4.08 U	0.76 J	0.88 J	2.38	1.80 U
R-PF	5	A	2.37 J	5.98 U	3.23 U	1.02 J	3.04	0.21 J
C-SB	1	C	2.10 J	5.02 U	0.60 J	0.97 J	2.46	0.22 J
C-SB	2	D	1.95 J	5.24 U	0.83 J	0.95 J	2.30 J	2.32 U
C-SB	3	B	6.94	5.81 U	3.14 U	1.07 J	3.27	0.66 J
C-SB	4	A	2.01 J	4.02 U	2.17 U	2.35 U	2.48	1.78 U
C-SB	5	D	1.70 J	4.45 U	0.50 J	0.75 J	2.13	0.31 J
C-NE	1	B	3.73	3.60 U	0.70 J	0.96 J	3.69	1.59 U
C-NE	2	B	4.19 J	4.23 U	0.84 J	1.26 J	4.39	1.87 U
C-NE	3	B	4.58	4.17 U	0.94 J	1.13 J	3.92	0.31 J
C-NE	4	B	3.49 J	4.66 U	2.52 U	0.98 J	3.93	2.06 U
C-NE	5	B	3.96 J	5.13 U	2.77 U	1.15 J	3.99	2.27 U
MSL Background	1	E	2.58 J	2.64 U	0.55 J	1.42 J	3.36	0.41 J
MSL Background	2	E	3.51	2.65 U	0.54 J	1.28 J	3.64 J	0.36 J
MSL Background	3	E	3.54	2.65 U	0.49 J	1.31 J	3.68	0.68 J
MSL Background	4	E	3.01	2.67 U	0.45 J	1.3 J	3.34	0.38 J
MSL Background	5	E	2.77	2.65 U	0.49 J	1.4 J	3.82	0.39 J

(a) DL Detection limit.

(b) NA Not applicable.

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

(d) U The analyte was not present above the level of the associated value.

TABLE K.6. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

		<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)										
Sediment Treatment	Replicate	Analytical Batch	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno 1,2,3-c,d 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 High			NA ^(b)	NA	21.68	8.22	22.13	18.53	19.3	23.13	15.73	31.37
Achieved DL Low			NA	NA	2.72	1.37	3.03	2.27	1.74	2.08	1.42	2.84
COMP I	1	D	2.85	9.12	4.79 U ^(c)	1.83 J ^(d)	4.89 U	4.09 U	4.26 U	5.11 U	3.48 U	6.93 U
COMP I	2	D	4.12	11.67	0.50 J	2.76	0.65 J	0.48 J	0.42 J	3.28 U	2.23 U	0.13 J
COMP I	3	A	3.04	7.83	3.78 U	2.12 J	3.86 U	3.24 U	3.37 U	4.04 U	2.75 U	5.48 U
COMP I	4	B	3.64 J	9.69 J	13.93 U	2.14 J	14.22 U	11.91 U	12.40 U	14.87 U	10.11 U	20.16 U
COMP I Replicate 1	5	A	3.50 J	8.08 J	15.62 U	1.92 J	15.94 U	13.35 U	13.91 U	16.67 U	11.34 U	22.61 U
COMP I Replicate 2	5	A	3.85 J	10.14 J	14.37 U	1.97 J	14.67 U	12.29 U	12.79 U	15.34 U	10.43 U	20.80 U
COMP I Replicate 3	5	A	4.04 J	11.45	10.59 U	2.22 J	10.81 U	9.05 U	9.43 U	11.30 U	7.69 U	15.32 U
COMP II	1	D	3.58	13.03	0.20 J	2.55	0.22 J	0.14 J	2.59 U	3.10 U	2.11 U	4.21 U
COMP II	2	A	2.85 J	7.84	0.16 J	1.83 J	6.32 U	5.29 U	5.51 U	6.61 U	4.49 U	8.96 U
COMP II	3	C	3.37	9.49	0.22 J	2.36 J	0.18 J	0.17 J	0.11 J	3.65 U	2.48 U	4.95 U
COMP II	4	D	3.71	12.67	4.16 U	2.75 J	0.30 J	0.17 J	3.70 U	4.44 U	3.02 U	6.02 U
COMP II	5	C	3.92	11.71	0.17 J	2.41	0.31 J	0.14 J	0.11 J	3.55 U	2.41 U	0.42 J
COMP III	1	C	1.95 J	3.03	0.11 J	0.93 J	0.16 J	0.08 J	3.66 U	4.38 U	2.98 U	5.95 U
COMP III	2	D	1.94 J	3.30	3.86 U	1.02 J	3.94 U	3.30 U	3.44 U	4.12 U	2.80 U	5.58 U
COMP III	3	A	1.82 J	2.92	0.08 J	0.81 J	3.25 U	2.72 U	2.83 U	3.40 U	2.31 U	4.61 U
COMP III	4	D	1.49 J	2.85	3.55 U	0.84 J	3.62 U	3.03 U	3.16 U	3.78 U	2.57 U	5.13 U
COMP III	5	C	2.18 J	3.27	0.12 J	1.00 J	0.14 J	0.12 J	3.82 U	4.58 U	3.12 U	6.22 U
TC-5 Upper Comp	1	C	33.82	77.92	3.08 J	13.90	2.66 J	1.23 J	1.62 J	0.42 J	4.28 U	1.81 J
TC-5 Upper Comp	2	C	35.69	84.31	2.66 J	13.81	2.43 J	1.19 J	1.15 J	3.83 U	2.60 U	1.17 J
TC-5 Upper Comp	3	C	43.70	97.38	4.07 J	17.36	4.27 J	1.56 J	2.23 J	3.70 J	0.16 J	2.64 J
TC-5 Upper Comp	4	A	29.56	71.78	2.79 J	13.01	2.53 J	0.91 J	1.40 J	5.49 U	3.73 U	3.92 J
TC-5 Upper Comp	5	A	26.97	65.53	3.06 J	12.71	2.18 J	1.07 J	1.39 J	18.82 U	12.80 U	1.84 J
COMP IV	1	C	1.57 J	1.89 J	0.13 J	0.61 J	0.13 J	0.10 J	3.16 U	3.79 U	2.57 J	0.08 J
COMP IV Replicate 1	2	C	2.23 J	2.77 J	15.35 U	0.89 J	15.66 U	13.12 U	13.66 U	16.38 U	11.14 U	3.07 J
COMP IV Replicate 2	2	C	2.07 J	2.36 J	19.48 U	0.85 J	19.88 U	16.65 U	17.34 U	20.78 U	14.13 U	28.18 U
COMP IV Replicate 3	2	C	2.36 J	2.76 J	13.70 U	0.88 J	13.98 U	11.71 U	12.19 U	14.62 U	9.94 U	19.82 U
COMP IV	3	A	2.00 J	2.25 J	6.63 U	0.66 J	6.76 U	5.66 U	5.90 U	7.07 U	4.81 U	9.59 U
COMP IV	4	C	1.44 J	1.70 J	4.22 U	0.51 J	0.10 J	3.61 U	3.76 U	4.50 U	3.06 U	6.11 U
COMP IV	5	A	1.71 J	2.46 J	7.34 U	0.73 J	7.49 U	6.28 U	6.54 U	7.84 U	5.33 U	10.63 U

TABLE K.6. (contd)

		<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)										
Sediment Treatment	Replicate	Analytical Batch	Fluoranthene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) pyrene	Indeno 1,2,3-c,d pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
COMP V	1	A	4.18	26.55	3.80 U	3.60	0.68 J	0.43 J	3.38 U	4.06 U	2.76 U	5.50 U
COMP V	2	A	3.77	26.28	0.30 J	3.53	0.59 J	0.34 J	3.91 U	4.69 U	3.19 U	0.41 J
COMP V	3	A	4.23	29.01	0.34 J	3.83	0.42 J	0.36 J	0.14 J	3.28 U	2.23 U	4.45 U
COMP V	4	D	5.03	32.29	4.34 U	4.73	0.65 J	0.71 J	0.48 J	0.39 J	3.15 U	6.29 U
COMP V	5	B	5.51	36.13	2.72 U	4.64	0.44 J	0.50 J	2.42 U	2.90 U	1.98 U	3.94 U
COMP VI	1	C	3.35	22.55	0.25 J	3.47	0.43 J	0.33 J	0.18 J	4.76 U	3.24 U	6.46 U
COMP VI	2	A	4.25	30.59	0.37 J	3.97	0.55 J	0.38 J	0.25 J	3.83 U	2.61 U	0.31 J
COMP VI	3	B	4.62	31.32	4.17 U	3.79	0.71 J	0.27 J	3.71 U	4.45 U	3.03 U	6.03 U
COMP VI	4	A	4.18	25.33	4.21 U	3.28	0.85 J	0.56 J	3.75 U	4.49 U	3.05 U	6.09 U
COMP VI	5	D	6.29 J	42.73	12.93 U	5.73 J	13.20 U	11.05 U	11.51 U	13.80 U	9.39 U	18.72 U
R-AC	1	B	217.95	712.43	7.28	39.30	4.83 J	2.35 J	2.75 J	5.99 U	4.07 U	1.70 J
R-AC	2	C	209.59	680.71	36.62	36.36	4.61 J	2.67 J	2.43 J	13.40 U	9.12 U	1.61 J
R-AC	3	C	330.02	924.62	17.07	58.99	11.34	4.41	10.79	0.55 J	0.12 J	6.91
R-AC	4	A	319.09	1013.35	11.08	46.03	6.70	3.62 J	5.62	4.62 U	3.14 U	3.85 J
R-AC	5	D	439.95	1252.51	19.99	68.51	18.91	17.75	8.04	3.61 U	2.45 U	4.18 J
R-AM	1	B	25.19	49.59	0.69 J	7.60	0.57 J	0.24 J	3.32 U	3.97 U	2.70 U	5.39 U
R-AM	2	C	13.64	34.17	0.82 J	7.67	0.30 J	0.23 J	0.15 J	3.10 U	2.11 U	0.12 J
R-AM	3	B	18.57	47.23	1.09 J	9.63	0.24 J	0.44 J	2.59 U	3.10 U	2.11 U	4.21 U
R-AM Replicate 1	4	B	31.65	54.10	14.18 U	10.66	14.47 U	12.12 U	12.62 U	15.13 U	10.29 U	20.52 U
R-AM Replicate 2	4	B	22.60	38.95	21.68 U	7.21 J	22.13 U	18.53 U	19.30 U	23.13 U	15.73 U	31.37 U
R-AM Replicate 3	4	B	28.65	60.01	1.15 J	10.28	0.69 J	0.37 J	6.91 U	8.29 U	5.64 U	11.24 U
R-AM	5	B	13.53	31.33	0.59 J	6.00	3.24 U	2.72 U	2.83 U	3.39 U	2.31 U	4.60 U
R-BF	1	D	3.20 J	7.60	5.57 U	2.40 J	5.68 U	4.76 U	4.96 U	5.94 U	4.04 U	8.06 U
R-BF	2	B	3.69 J	7.14	6.45 U	2.25 J	0.96 J	5.51 U	5.74 U	6.88 U	4.68 U	1.88 J
R-BF	3	B	4.30	8.67	1.00 J	3.03	0.81 J	0.77 J	0.76 J	3.92 U	2.67 U	5.31 U
R-BF	4	A	4.57	10.11	0.28 J	2.83 J	0.26 J	0.25 J	3.99 U	4.79 U	3.25 U	6.49 U
R-BF	5	A	6.75	9.51	1.00 J	4.30	1.75 J	1.41 J	4.06 U	0.93 J	0.54 J	1.09 J
R-OS	1	B	1.62 J	1.78 J	3.33 U	0.63 J	3.40 U	2.85 U	2.96 U	3.55 U	2.42 U	4.82 U
R-OS Replicate 1	2	D	2.51 J	3.68 J	11.73 U	8.22 U	11.97 U	10.03 U	10.44 U	12.52 U	8.51 U	3.35 J
R-OS Replicate 2	2	D	2.40 J	2.67 J	9.51 U	0.82 J	9.71 U	8.13 U	8.47 U	10.15 U	6.90 U	13.77 U
R-OS Replicate 3	2	D	2.66 J	2.78 J	11.50 U	1.11 J	11.74 U	9.83 U	10.24 U	12.28 U	8.35 U	16.65 U
R-OS	3	B	1.53 J	2.27 J	3.50 U	0.76 J	3.57 U	2.99 U	3.11 U	3.73 U	2.54 U	5.06 U
R-OS	4	D	1.47 J	1.93 J	3.84 U	0.70 J	3.91 U	3.28 U	3.41 U	4.09 U	2.78 U	5.55 U
R-DS	5	C	2.01 J	2.22 J	0.11 J	0.67 J	0.18 J	0.06 J	3.34 U	4.01 U	2.73 U	5.44 U

TABLE K.6. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ wet weight)									
			Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno 1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene
R-PF	1	C	4.85	4.32	0.93 J	1.56 J	0.68 J	0.41 J	0.62 J	4.10 U	2.79 U	0.39 J
R-PF	2	C	2.57	2.52 J	4.34 U	0.82 J	0.17 J	3.71 U	3.87 U	4.64 U	3.15 U	6.29 U
R-PF	3	D	2.02 J	2.70	3.54 U	0.82 J	3.61 U	3.02 U	3.15 U	3.77 U	2.57 U	5.12 U
R-PF	4	D	2.19	2.71	3.01 U	0.95 J	3.08 U	2.58 U	2.68 U	3.22 U	2.19 U	4.36 U
R-PF	5	A	2.25 J	2.75 J	4.42 U	0.78 J	0.22 J	3.78 U	3.94 U	4.72 U	3.21 U	6.40 U
C-SB	1	C	3.58	4.31	0.20 J	1.37 J	0.16 J	0.08 J	0.08 J	3.96 U	2.69 U	5.37 U
C-SB	2	D	3.30	4.28	3.88 U	1.51 J	3.96 U	3.31 U	3.45 U	4.14 U	2.81 U	5.61 U
C-SB	3	B	3.94	4.47	4.30 U	1.44 J	4.38 U	3.67 U	3.82 U	4.58 U	3.12 U	6.22 U
C-SB	4	A	3.26	3.71	2.97 U	1.16 J	3.03 U	2.54 U	2.65 U	3.17 U	2.16 U	4.30 U
C-SB	5	D	3.83	4.63	3.29 U	1.38 J	3.36 U	2.81 U	2.93 U	3.51 U	2.39 U	4.76 U
C-NE	1	B	2.77	2.81	0.89 J	0.86 J	2.71 U	2.27 U	2.37 U	2.84 U	1.93 U	3.85 U
C-NE	2	B	2.38	2.75	3.13 U	1.05 J	3.19 U	2.68 U	2.79 U	3.34 U	2.27 U	4.53 U
C-NE	3	B	2.82	3.01	0.26 J	0.95 J	0.16 J	2.63 U	2.74 U	3.29 U	2.24 U	4.46 U
C-NE	4	B	1.86 J	2.31 J	3.45 U	0.93 J	3.52 U	2.95 U	3.07 U	3.68 U	2.50 U	4.99 U
C-NE	5	B	2.12 J	2.61 J	3.80 U	0.94 J	3.87 U	3.25 U	3.38 U	4.05 U	2.76 U	5.49 U
MSL Background	1	E	1.99	2.15	0.23 J	0.8 J	0.3 J	0.16 J	1.74 U	2.08 U	1.42 U	0.53 J
MSL Background	2	E	1.89	2.09	0.25 J	1.47	0.27 J	0.1 J	1.74 U	2.09 U	1.42 U	2.84 U
MSL Background	3	E	2.49	2.24	0.24 J	1.37 U	0.22 J	0.19 J	1.74 U	2.09 U	1.42 U	0.16 J
MSL Background	4	E	1.91	2.1	0.2 J	0.79 J	0.27 J	0.1 J	1.76 U	2.11 U	1.43 U	2.86 U
MSL Background	5	E	2.01	2.3	0.26 J	0.82 J	0.44 J	0.24 J	1.74 U	0.23 J	1.42 U	0.28 J

(a) DL Detection limit.

(b) NA Not applicable.

(c) U The analyte was not present above the level of the associated value.

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

TABLE K.7. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAHs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

		<i>N. caecoides</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	A	3.39 J ^(a)	6.64 U	3.59 U ^(b)	3.88 U	3.01 U	2.94 U
Blank	2	B	7.15	5.58 U	3.01 U	3.26 U	1.31 J	2.47 U
Blank	3	C	1.80 J	6.22 U	3.36 U	3.64 U	0.61 J	0.16 J
Blank	4	D	1.23 J	5.85 U	3.16 U	3.42 U	0.34 J	2.59 U
<u>Matrix Spikes</u>								
Background JW01	1	E	12.74	0.48 J	0.68 J	1.25 J	2.71	0.80 J
Background MS	1	A	82.57	78.94	75.13	75.82	77.47	73.82
Concentration Recovered			69.83	78.46	74.45	74.57	74.76	73.02
Spike Amount			79.88	79.88	79.88	79.88	79.88	79.88
Percent Recovery			87%	98%	93%	93%	94%	91%
Background JW01	1	E	12.73	0.48 J	0.68 J	1.25 J	2.71	0.80 J
Background MSD	1	A	83.08	77.38	75.95	76.58	78.12	74.98
Concentration Recovered			70.35	76.90	75.27	75.33	75.41	74.18
Spike Amount			79.82	79.82	79.82	79.82	79.82	79.82
Percent Recovery			88%	96%	94%	94%	94%	93%
MS/MSD RPD			1%	2%	1%	1%	1%	2%
MS/MSD I-STAT			0.004	0.010	0.006	0.005	0.004	0.008
Background JW01	2	E	12.71	0.48 J	0.68 J	1.25 J	2.71	0.80 J
Background MS	2	B	99.43	83.18	86.23	85.80	84.34	77.81
Concentration Recovered			86.72	82.70	85.55	84.55	81.63	77.01
Spike Amount			79.67	79.67	79.67	79.67	79.67	79.67
Percent Recovery			109%	104%	107%	106%	102%	97%
Background JW01	2	E	12.70	0.48 J	0.68 J	1.25 J	2.70	0.80 J
Background MSD	2	B	98.93	83.85	86.05	84.98	85.38	78.70
Concentration Recovered			86.23	83.37	85.37	83.73	82.68	77.90
Spike Amount			79.60	79.60	79.60	79.60	79.60	79.60
Percent Recovery			108%	105%	107%	105%	104%	98%
MS/MSD RPD			0%	1%	0%	1%	1%	1%
MS/MSD I-STAT			0.002	0.004	0.001	0.005	0.006	0.006
Background JW01	3	E	12.68	0.48 J	0.68 J	1.25 J	2.70	0.80 J
Background MS	3	C	93.94	98.01	85.32	90.94	94.59	92.04
Concentration Recovered			81.26	97.53	84.64	89.69	91.89	91.24
Spike Amount			79.48	79.48	79.48	79.48	79.48	79.48
Percent Recovery			102%	123% ^(c)	106%	113%	116%	115%
Background JW01	3	E	12.64	0.48 J	0.68 J	1.24 J	2.69	0.79 J
Background MSD	3	C	92.30	94.48	84.14	88.76	90.29	88.95
Concentration Recovered			79.66	94.00	83.46	87.52	87.60	88.16
Spike Amount			79.22	79.22	79.22	79.22	79.22	79.22
Percent Recovery			101%	119%	105%	110%	111%	111%
MS/MSD RPD			2%	3%	1%	2%	4%	3%
MS/MSD I-STAT			0.008	0.017	0.005	0.012	0.023	0.017

TABLE K.7. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> LPAHs ($\mu\text{g/kg}$ wet weight)					
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Background JW01	4	E	12.73	0.48 J	0.68 J	1.25 J	2.71	0.80 J
Background MS	4	D	89.36	84.72	83.23	81.57	86.37	79.80
Concentration Recovered			76.63	84.24	82.55	80.32	83.66	79.00
Spike Amount			79.78	79.78	79.78	79.78	79.78	79.78
Percent Recovery			96%	106%	103%	101%	105%	99%
Background JW01	4	E	12.42	0.47 J	0.66 J	1.22 J	2.65	0.78 J
Background MSD	4	D	86.14	80.16	81.16	79.48	83.90	77.13
Concentration Recovered			73.72	79.69	80.50	78.26	81.25	76.35
Spike Amount			77.85	77.85	77.85	77.85	77.85	77.85
Percent Recovery			95%	102%	103%	101%	104%	98%
MS/MSD RPD			1%	3%	0%	0%	0%	1%
MS/MSD 1-STAT			0.007	0.015	0.000	0.013	0.015	0.017
<u>Standard Reference Material</u>								
Certified Value			NC ^(d)	NC	NC	NC	5.6 ± 1.4	0.75 ± 0.21
SRM 1974	1	A	NA ^(e)	NA	NA	NA	4.48	0.77 J
SRM 1974	2	B	NA	NA	NA	NA	4.76	0.64 J
SRM 1974	3	C	NA	NA	NA	NA	4.74	1.12 J
SRM 1974	4	D	NA	NA	NA	NA	4.87	0.49 J
<u>Analytical Replicates</u>								
COMP I Replicate 1	5	A	8.52 J	21.13 U	11.41 U	2.08 J	5.34 J	9.35 U
COMP I Replicate 2	5	A	5.89 J	19.44 U	10.50 U	11.37 U	3.69 J	8.61 U
COMP I Replicate 3	5	A	6.09 J	14.32 U	7.74 U	8.37 U	3.77 J	6.34 U
RSD			21%	NA	NA	NA	22%	NA
COMP IV Replicate 1	2	C	6.51 J	20.76 U	1.11 J	1.94 J	3.87 J	9.19 U
COMP IV Replicate 2	2	C	7.64 J	26.34 U	14.23 U	2.10 J	3.23 J	11.66 U
COMP IV Replicate 3	2	C	8.33 J	18.52 U	1.10 J	1.91 J	4.35 J	8.20 U
RSD			12%	NA	NA	5%	15%	NA
R-AM Replicate 1	4	B	31.56	19.18 U	10.36 U	1.56 J	11.37	2.61 J
R-AM Replicate 2	4	B	31.71	29.32 U	15.84 U	17.14 U	13.81	3.22 J
R-AM Replicate 3	4	B	8.83 J	10.50 U	5.67 U	1.49 J	9.93	1.42 J
RSD			55% ^(f)	NA	NA	NA	17%	38% ^(f)
R-OS Replicate 1	2	D	4.67 J	15.87 U	8.57 U	1.17 J	2.84 J	7.02 U
R-OS Replicate 2	2	D	4.77 J	12.87 U	6.95 U	1.32 J	2.21 J	0.37 J
R-OS Replicate 3	2	D	4.88 J	15.56 U	8.40 U	1.38 J	2.29 J	6.89 U
RSD			2%	NA	NA	8%	14%	NA

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

(b) U The analyte was not present above the level of the associated value.

(c) Recovery outside quality control range (40%-120%).

(d) NC Not certified.

(e) NA Not applicable.

(f) Value exceeds relative precision range of 30%.

TABLE K.8. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAHs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

			<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ wet weight)									
Sediment Treatment	Replicate	Analytical Batch	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno 1,2,3-c,d pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
Method Blanks												
Blank	1	A	2.86 U ^(a)	1.39 J ^(b)	4.91 U	3.44 U	5.01 U	4.20 U	4.37 U	5.24 U	3.56 U	7.10 U
Blank	2	B	0.82 J	4.13	4.12 U	2.89 U	4.21 U	3.52 U	3.67 U	4.40 U	2.99 U	5.97 U
Blank	3	C	1.02 J	6.08	4.60 U	0.15 J	0.10 J	3.93 U	4.10 U	4.91 U	3.34 U	0.16 J
Blank	4	D	0.26 J	0.86 J	4.33 U	3.03 U	4.42 U	3.70 U	3.85 U	4.62 U	3.14 U	6.26 U
Matrix Spikes												
Background JW01	1	E	3.65	2.76	0.53 J	2.07 U	0.71 J	0.49 J	2.63 U	0.37 J	2.15 U	0.54 J
Background MS	1	A	82.56	81.55	79.42	79.04	74.56	74.86	73.33	81.09	78.38	73.35
Concentration Recovered			78.91	78.79	78.89	79.04	73.85	74.37	73.33	80.72	78.38	72.81
Spike Amount			79.88	79.88	79.88	79.88	79.88	79.88	79.88	79.88	79.88	79.88
Percent Recovery			99%	99%	99%	99%	92%	93%	92%	101%	98%	91%
Background JW01	1	E	3.64	2.76	0.53 J	2.07 U	0.71 J	0.49 J	2.63 U	0.37 J	2.15 U	0.54 J
Background MS0	1	A	81.75	81.91	79.66	80.34	73.30	74.52	72.57	81.66	83.67	75.71
Concentration Recovered			78.11	79.15	79.13	80.34	72.59	74.03	72.57	81.29	83.67	75.17
Spike Amount			79.82	79.82	79.82	79.82	79.82	79.82	79.82	79.82	79.82	79.82
Percent Recovery			98%	99%	99%	101%	91%	93%	91%	102%	105%	94%
MS/MSD RPD			1%	1%	0%	2%	2%	0%	1%	1%	7%	3%
MS/MSD I-STAT			0.005	0.002	0.002	0.008	0.009	0.002	0.005	0.004	0.033	0.016
Background JW01	2	E	3.64	2.76	0.53 J	2.07 U	0.71 J	0.49 J	2.63 U	0.37 J	2.15 U	0.54 J
Background MS	2	B	82.45	79.72	76.79	79.43	89.97	81.71	83.23	78.35	74.76	74.66
Concentration Recovered			78.81	76.96	76.26	79.43	89.26	81.22	83.23	77.98	74.76	74.12
Spike Amount			79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67
Percent Recovery			99%	97%	96%	100%	112%	102%	104%	98%	94%	93%
Background JW01	2	E	3.63	2.75	0.53 J	2.07 U	0.71 J	0.49 J	2.63 U	0.37 J	2.15 U	0.54 J
Background MSD	2	B	80.83	78.82	75.92	76.59	85.44	84.26	79.17	81.82	72.57	76.47
Concentration Recovered			77.20	76.07	75.39	76.59	84.73	83.77	79.17	81.45	72.57	75.93
Spike Amount			79.60	79.60	79.60	79.60	79.60	79.60	79.60	79.60	79.60	79.60
Percent Recovery			97%	96%	95%	96%	106%	105%	99%	102%	91%	95%
MS/MSD RPD			2%	1%	1%	4%	5%	3%	5%	4%	3%	3%
MS/MSD I-STAT			0.010	0.006	0.006	0.018	0.026	0.015	0.025	0.022	0.015	0.012

TABLE K.8. (contd)

			<i>N. caecoides</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)									
Sediment Treatment	Replicate	Analytical Batch	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno 1,2,3-c,d pyrene	Dibenzo(a,h)Anthracene	Benzo(g,h,i)Perylene
Background JW01	3	E	3.63	2.75	0.53 J	2.06 U	0.71 J	0.49 J	2.62 U	0.37 J	2.14 U	0.54 J
Background MS	3	C	100.81	100.59	100.21	99.90	87.68	86.53	83.30	79.55	84.10	77.68
Concentration Recovered			97.18	97.84	99.68	99.90	86.97	86.04	83.30	79.18	84.10	77.14
Spike Amount			79.48	79.48	79.48	79.48	79.48	79.48	79.48	79.48	79.48	79.48
Percent Recovery			122%(c)	123%(c)	125%(c)	126%(c)	109%	108%	105%	100%	106%	97%
Background JW01	3	E	3.62	2.74	0.53 J	2.06 U	0.71 J	0.49 J	2.61 U	0.37 J	2.14 U	0.54 J
Background MSD	3	C	96.87	96.46	96.96	96.69	86.02	88.75	83.35	81.10	79.48	77.48
Concentration Recovered			93.25	93.72	96.43	96.69	85.31	88.26	83.35	80.73	79.48	76.94
Spike Amount			79.22	79.22	79.22	79.22	79.22	79.22	79.22	79.22	79.22	79.22
Percent Recovery			118%	118%	122%(c)	122%(c)	108%	111%	105%	102%	100%	97%
MS/MSD RPD			4%	4%	3%	3%	2%	3%	0%	2%	5%	0%
MS/MSD I-STAT			0.020	0.021	0.016	0.016	0.010	0.013	0.000	0.010	0.028	0.001
Background JW01	4	E	3.64	2.70	0.53 J	2.07 U	0.71 J	0.49 J	2.63 U	0.37 J	2.15 U	0.54 J
Background MS	4	D	89.42	89.53	86.01	84.50	95.74	87.59	82.66	80.56	72.60	74.35
Concentration Recovered			85.78	86.83	85.48	84.50	95.03	87.10	82.66	80.19	72.60	73.81
Spike Amount			79.78	79.78	79.78	79.78	79.78	79.78	79.78	79.78	79.78	79.78
Percent Recovery			108%	109%	107%	106%	119%	109%	104%	101%	91%	93%
Background JW01	4	E	3.55	2.69	0.52 J	2.02 U	0.69 J	0.48 J	2.57 U	0.36 J	2.10 U	0.53 J
Background MSD	4	D	88.74	85.77	86.60	85.31	87.93	80.72	80.80	81.30	70.72	70.21
Concentration Recovered			85.19	83.08	86.08	85.31	87.24	80.24	80.80	80.94	70.72	69.68
Spike Amount			77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85
Percent Recovery			109%	107%	111%	110%	112%	103%	104%	104%	91%	90%
MS/MSD RPD			2%	2%	3%	3%	6%	6%	0%	3%	0%	3%
MS/MSD I-STAT			0.004	0.021	0.003	0.005	0.043	0.041	0.011	0.005	0.013	0.029
<u>Standard Reference Material</u>												
Certified Value			33.6 ± 5.8	34.1 ± 3.7	NC ^(d)	NC	6.5 ± 1.2	NC	2.29 ± 0.47	1.8 ± 0.33	NC	2.47 ± 0.28
SRM 1974	1	A	27.59	27.94	NA ^(e)	NA	5.16	NA	1.62 J	1.76 J	NA	2.54 J
SRM 1974	2	B	27.42	26.96	NA	NA	6.68	NA	1.36 J	1.82 J	NA	2.04 J
SRM 1974	3	C	35.22	34.89	NA	NA	6.15	NA	1.54 J	1.7 J	NA	2.32 J
SRM 1974	4	D	29.35	29.98	NA	NA	5.79	NA	1.86 J	1.6 J	NA	2.1 J

TABLE K.8. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> HPAHs ($\mu\text{g/kg}$ wet weight)									
			Fluoran- thene	Pyrene	Benzo(a) anthra- cene	Chrysene	Benzo(b) fluoran- thene	Benzo(k) fluoran- thene	Benzo(a) pyrene	Indeno 1,2,3-c,d pyrene	Dibenzo (a,h) Anthracene	Benzo (g,h,i) Perylene
Analytical Replicates												
COMP I Replicate 1	5	A	3.50 J	8.08 J	15.62 U	1.92 J	15.94 U	13.35 U	13.91 U	16.67 U	11.34 U	22.61 U
COMP I Replicate 2	5	A	3.85 J	10.14 J	14.37 U	1.97 J	14.67 U	12.29 U	12.79 U	15.34 U	10.43 U	20.80 U
COMP I Replicate 3	5	A	4.04 J	11.45	10.59 U	2.22 J	10.81 U	9.05 U	9.43 U	11.30 U	7.69 U	15.32 U
RSD			7%	17%	NA	8%	NA	NA	NA	NA	NA	NA
COMP IV Replicate 1	2	C	2.23 J	2.77 J	15.35 U	0.89 J	15.66 U	13.12 U	13.66 U	16.38 U	11.14 U	3.07 J
COMP IV Replicate 2	2	C	2.07 J	2.36 J	19.48 U	0.85 J	19.88 U	16.65 U	17.34 U	20.78 U	14.13 U	28.18 U
COMP IV Replicate 3	2	C	2.36 J	2.76 J	13.70 U	0.88 J	13.98 U	11.71 U	12.19 U	14.62 U	9.94 U	19.82 U
RSD			7%	9%	NA	2%	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	4	B	31.65	54.10	14.18 U	10.66	14.47 U	12.12 U	12.62 U	15.13 U	10.29 U	20.52 U
R-AM Replicate 2	4	B	22.60	38.95	21.68 U	7.21 J	22.13 U	18.53 U	19.30 U	23.13 U	15.73 U	31.37 U
R-AM Replicate 3	4	B	28.65	60.01	1.15 J	10.28	0.69 J	0.37 J	6.91 U	8.29 U	5.64 U	11.24 U
RSD			17%	21%	NA	20%	NA	NA	NA	NA	NA	NA
R-OS Replicate 1	2	D	2.51 J	3.68 J	11.73 U	8.22 U	11.97 U	10.03 U	10.44 U	12.52 U	8.51 U	3.35 J
R-OS Replicate 2	2	D	2.40 J	2.67 J	9.51 U	0.82 J	9.71 U	8.13 U	8.47 U	10.15 U	6.90 U	13.77 U
R-OS Replicate 3	2	D	2.66 J	2.78 J	11.50 U	1.11 J	11.74 U	9.83 U	10.24 U	12.28 U	8.35 U	16.65 U
RSD			5%	18%	NA	NA	NA	NA	NA	NA	NA	NA

(a) U The analyte was not present above the level of the associated value.

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

(c) Recovery outside quality control range (40%-120%).

(d) NC Not certified.

(e) NA Not applicable.

TABLE K.9. Surrogate Recoveries for Polynuclear Aromatic Hydrocarbons (PAHs)
Including Quality Control Data in Tissue of *N. caecoides*,
Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) pyrene d12
COMP I	1	D	64.76	69.93	66.49
COMP I	2	D	58.96	69.19	66.99
COMP I	3	A	78.35	87.12	94.32
COMP I	4	B	70.39	79.20	66.06
COMP I Replicate 1	5	A	80.10	84.50	85.26
COMP I Replicate 2	5	A	82.11	81.61	87.31
COMP I Replicate 3	5	A	77.49	79.97	85.65
COMP II	1	D	58.62	66.56	64.18
COMP II	2	A	80.95	82.84	87.41
COMP II	3	C	61.09	65.55	75.30
COMP II	4	D	67.58	69.53	68.93
COMP II	5	C	72.19	75.77	76.63
COMP III	1	C	70.39	75.34	76.95
COMP III	2	D	61.43	66.31	70.88
COMP III	3	A	79.11	86.58	89.13
COMP III	4	D	69.95	69.78	65.91
COMP III	5	C	64.78	73.34	76.61
TC-5 Upper Comp	1	C	67.65	71.20	75.77
TC-5 Upper Comp	2	C	71.85	73.51	74.38
TC-5 Upper Comp	3	C	70.03	72.64	72.38
TC-5 Upper Comp	4	A	84.13	85.76	89.05
TC-5 Upper Comp	5	A	79.98	83.11	85.54
COMP IV	1	C	65.13	66.17	74.17
COMP IV Replicate 1	2	C	70.88	73.11	74.87
COMP IV Replicate 2	2	C	68.41	71.51	74.32
COMP IV Replicate 3	2	C	73.04	77.52	78.68
COMP IV	3	A	83.40	86.94	84.59
COMP IV	4	C	64.03	69.48	73.56
COMP IV	5	A	78.20	82.52	87.64
COMP V	1	A	74.13	87.41	89.34
COMP V	2	A	82.12	85.31	89.45
COMP V	3	A	60.98	66.42	71.20
COMP V	4	D	66.39	69.58	65.47
COMP V	5	B	42.36	56.23	65.45

TABLE K.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) pyrene d12
COMP VI	1	C	64.85	73.29	74.92
COMP VI	2	A	83.20	86.20	89.71
COMP VI	3	B	56.62	67.58	43.37
COMP VI	4	A	68.48	81.64	85.39
COMP VI	5	D	60.41	67.13	59.31
R-AC	1	B	57.84	63.54	72.95
R-AC	2	C	72.21	74.16	77.47
R-AC	3	C	71.26	73.59	78.47
R-AC	4	A	80.62	86.91	91.51
R-AC	5	D	71.93	70.37	69.14
R-AM	1	B	34.73 ^(a)	37.03 ^(a)	41.97
R-AM	2	C	58.98	65.94	74.39
R-AM	3	B	50.36	64.69	77.59
R-AM Replicate 1	4	B	67.89	75.63	63.79
R-AM Replicate 2	4	B	66.83	75.12	63.03
R-AM Replicate 3	4	B	73.85	72.67	78.46
R-AM	5	B	64.77	75.60	82.79
R-BF	1	D	61.36	67.28	67.86
R-BF	2	B	70.76	81.95	73.09
R-BF	3	B	57.80	66.44	69.41
R-BF	4	A	73.57	80.29	85.12
R-BF	5	A	62.92	81.07	88.08
R-OS	1	B	64.94	72.18	76.05
R-OS Replicate 1	2	D	64.67	71.62	59.98
R-OS Replicate 2	2	D	58.34	66.24	58.92
R-OS Replicate 3	2	D	56.46	64.80	54.39
R-OS	3	B	56.07	64.83	76.13
R-OS	4	D	61.03	71.28	64.30
R-OS	5	C	63.74	66.06	77.34
R-PF	1	C	40.26	42.86	42.88
R-PF	2	C	57.07	61.53	71.30
R-PF	3	D	64.11	68.78	72.92
R-PF	4	D	58.25	67.31	73.45
R-PF	5	A	81.33	85.64	91.60
C-SB	1	C	64.62	73.52	75.51
C-SB	2	D	68.20	69.38	68.84
C-SB	3	B	53.05	66.43	75.22
C-SB	4	A	61.02	73.57	73.11
C-SB	5	D	60.65	68.61	66.07

TABLE K.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recoveries		
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) pyrene d12
C-NE	1	B	41.08	54.95	56.06
C-NE	2	B	41.98	55.33	63.45
C-NE	3	B	50.10	66.34	76.55
C-NE	4	B	50.86	64.62	73.54
C-NE	5	B	51.65	67.66	75.68
MSL Background	1	E	66	63	57
MSL Background	2	E	74	71	63
MSL Background	3	E	73	69	63
MSL Background	4	E	73	71	64
MSL Background	5	E	74	70	64
<u>Quality Control Data</u>					
<u>Method Blanks</u>					
Blank	1	A	11.37	11.78	10.62
Blank	2	B	10.44	11.06	10.42
Blank	3	C	8.94	9.28	9.00
Blank	4	D	10.47	11.18	9.84
<u>Matrix Spikes</u>					
Background MS	1	A	92	94	94
Background MSD	1	A	91	90	95
MS/MSD RPD			1	4	1
MS/MSD I-STAT			0.005	0.022	0.005
Background MS	2	B	77	78	74
Background MSD	2	B	76	77	70
MS/MSD RPD			1	1	6
MS/MSD I-STAT			0.007	0.006	0.028
Background MS	3	C	71	74	77
Background MSD	3	C	74	74	77
MS/MSD RPD			4	0	0
MS/MSD I-STAT			0.021	0.000	0.000

TABLE K.9. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate	Percent Recoveries	
			Naphtha- lene d8	Acenaph- thene d10	Benzo(a) pyrene d12
Background MS	4	D	71	75	76
Background MSD	4	D	74	76	77
MS/MSD RPD			4	1	1
MS/MSD I-STAT			0.021	0.007	0.007
<u>Analytical Replicates</u>					
COMP I Replicate 1	5	A	80.10	84.50	85.26
COMP I Replicate 2	5	A	82.11	81.61	87.31
COMP I Replicate 3	5	A	77.49	79.97	85.65
RSD			3	3	1
COMP IV Replicate 1	2	C	70.88	73.11	74.87
COMP IV Replicate 2	2	C	68.41	71.51	74.32
COMP IV Replicate 3	2	C	73.04	77.52	78.68
RSD			3	4	3
R-AM Replicate 1	4	B	67.89	75.63	63.79
R-AM Replicate 2	4	B	66.83	75.12	63.03
R-AM Replicate 3	4	B	73.85	72.67	78.46
RSD			5	2	13
R-OS Replicate 1	2	D	64.67	71.62	59.98
R-OS Replicate 2	2	D	58.34	66.24	58.92
R-OS Replicate 3	2	D	56.46	64.80	54.39
RSD			7	5	5

(a) Recovery outside quality control range (40%-120%).

TABLE K.10. Chlorinated Pesticides (alphabetical, Aldrin - 4,4-DDT), Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

				<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-ODD	4,4-DDE	4,4-DDT
COMP I	1	D	16.00	2.444 U ^(a)	2.500 U	2.500 U	2.500 U	2.500 U	71.700 U	7.394	15.050	5.263 U
COMP I	2	D	15.28	1.643 U	0.353 J ^(b)	1.682 U	1.682 U	1.682 U	48.154 U	8.652	14.097	3.534 U
COMP I	3	A	16.50 ^(d)	1.873 U	1.915 U	1.915 U	1.915 U	1.915 U	54.933 U	4.673	10.255	4.030 U
COMP I	4	B	17.16	6.626 U	6.783 U	6.783 U	6.783 U	6.783 U	194.493 U	4.575 U	12.331	14.266 U
COMP I Replicate 1	5	A	17.54	7.269 U	7.440 U	7.440 U	7.440 U	7.440 U	213.312 U	4.550 J	11.277	15.650 U
COMP I Replicate 2	5	A	17.54	6.688 U	6.847 U	6.847 U	6.847 U	6.847 U	196.271 U	3.592 J	11.899	14.396 U
COMP I Replicate 3	5	A	17.54	4.926 U	5.046 U	5.046 U	5.046 U	5.046 U	144.595 U	5.576	12.155	10.610 U
COMP II	1	D	15.12	1.567 U	0.675 JE	1.607 U	1.607 U	1.607 U	46.052 U	20.007	18.228	3.380 U
COMP II	2	A	17.08	2.957 U	3.027 U	3.027 U	3.027 U	3.027 U	86.803 U	10.439	12.225	6.370 U
COMP II	3	C	17.30	1.613 U	0.416 J	1.653 U	1.653 U	0.896 JE	47.312 U	13.954	9.653	3.468 U
COMP II	4	D	15.82	2.143 U	2.193 U	2.193 U	2.193 U	2.193 U	62.933 U	19.324	20.493	4.614 U
COMP II	5	C	16.64	1.629 U	1.052 J	1.671 U	0.349 J	0.925 JE	47.873 U	1.124 U	12.290	3.510 U
COMP III	1	C	14.77	2.268 U	0.785 J	2.322 U	2.322 U	1.043 JE	66.628 U	0.961 J	3.717	4.888 U
COMP III	2	D	16.64	1.893 U	1.935 U	1.935 U	1.935 U	1.935 U	55.541 U	5.493	7.981	4.075 U
COMP III	3	A	15.35	1.694 U	1.733 U	1.733 U	1.733 U	1.733 U	49.681 U	1.492	5.902	3.642 U
COMP III	4	D	16.35	1.768 U	1.810 U	1.810 U	1.810 U	1.810 U	51.933 U	2.404	6.801	3.810 U
COMP III	5	C	15.26	2.294 U	0.334 J	2.353 U	1.232 JE	0.911 JE	67.405 U	0.616 J	4.974	4.948 U
TC-5 Upper Comp	1	C	15.40	3.123 U	2.351 JE	3.195 U	3.195 U	1.487 JE	91.662 U	19.675	24.383	6.727 U
TC-5 Upper Comp	2	C	15.92	1.840 U	1.426 J	1.884 U	1.884 U	1.193 JE	53.989 U	20.314	18.461	3.964 U
TC-5 Upper Comp	3	C	16.93	2.516 U	1.784 J	2.575 U	2.575 U	0.880 JE	73.768 U	24.182	25.304	5.411 U
TC-5 Upper Comp	4	A	15.87	2.647 U	2.710 U	2.710 U	1.336 JE	2.710 U	77.618 U	14.594	23.094	5.696 U
TC-5 Upper Comp	5	A	16.58	8.679 U	8.890 U	8.890 U	8.890 U	8.890 U	254.759 U	15.211	25.097	18.691 U
COMP IV	1	C	16.16	1.788 U	0.439 J	1.832 U	1.832 U	0.873 JE	52.574 U	1.238 U	1.856 J	3.855 U
COMP IV Replicate 1	2	C	16.46	7.606 U	7.789 U	7.789 U	7.789 U	7.789 U	223.311 U	5.249 U	2.132 J	16.379 U
COMP IV Replicate 2	2	C	16.46	9.654 U	9.885 U	9.885 U	9.885 U	9.885 U	283.390 U	6.659 U	13.475 U	20.790 U
COMP IV Replicate 3	2	C	16.46	6.792 U	6.950 U	6.950 U	6.950 U	6.950 U	199.301 U	4.684 U	0.395 J	14.623 U
COMP IV	3	A	11.15	4.852 U	4.969 U	4.969 U	4.969 U	4.969 U	142.314 U	3.345 U	3.552 J	10.439 U
COMP IV	4	C	16.04	2.145 U	0.181 J	2.201 U	2.201 U	2.201 U	63.036 U	1.484 U	1.509 J	4.626 U
COMP IV	5	A	13.09	4.576 U	4.691 U	4.691 U	4.691 U	4.691 U	134.362 U	3.155 U	1.788 J	9.855 U
COMP V	1	A	15.27	2.030 U	2.083 U	2.083 U	2.083 U	2.083 U	59.614 U	61.559	39.817	4.375 U
COMP V	2	A	14.83	2.414 U	2.475 U	2.475 U	2.475 U	2.475 U	70.931 U	57.458	27.471	5.206 U
COMP V	3	A	17.13	1.465 U	1.500 U	1.500 U	1.500 U	0.946 JE	43.030 U	49.177	33.631	3.158 U
COMP V	4	D	15.44	2.293 U	2.351 U	2.351 U	2.351 U	2.351 U	67.370 U	114.709	65.972	4.942 U
COMP V	5	B	17.14	1.295 U	1.324 U	1.324 U	1.324 U	1.039 JE	38.028 U	97.666	35.163	2.789 U

TABLE K.10. (contd)

<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ dry weight)												
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-DDD	4,4-DDE	4,4-DDT
COMP VI	1	C	15.08	2.414 U	0.782 J	2.473 U	2.473 U	1.088 JE	70.889 U	107.633	32.798	5.199 U
COMP VI	2	A	15.83	1.851 U	0.133 JE	1.895 U	1.895 U	1.895 U	54.327 U	56.342	23.689	3.986 U
COMP VI	3	B	16.25	2.092 U	2.142 U	2.142 U	2.142 U	1.428 JE	61.458 U	143.834	38.154	4.511 U
COMP VI	4	A	15.89	2.159 U	2.215 U	2.215 U	2.215 U	2.215 U	63.411 U	67.911	37.036	4.651 U
COMP VI	5	D	16.24	6.496 U	6.656 U	6.656 U	6.656 U	6.656 U	190.739 U	151.675	54.957	13.990 U
R-AC	1	B	15.84	2.891 U	2.961 U	2.961 U	2.961 U	2.961 U	84.855 U	9.186 J	12.835	6.225 U
R-AC	2	C	16.14	6.351 U	0.155 J	6.506 U	6.506 U	6.506 U	186.394 U	4.380 U	6.437 J	13.674 U
R-AC	3	C	16.16	1.999 U	2.048 U	2.048 U	2.048 U	0.978 JE	58.645 U	5.037	7.902	4.301 U
R-AC	4	A	13.29	2.656 U	0.324 JE	2.724 U	2.724 U	2.724 U	78.051 U	4.695	10.662 E	5.726 U
R-AC	5	D	16.75	1.648 U	1.690 U	1.690 U	1.690 U	1.690 U	48.352 U	6.257	12.269	3.546 U
R-AM	1	B	17.29	1.758 U	1.799 U	1.799 U	1.799 U	1.799 U	51.579 U	1.215 U	3.725	3.783 U
R-AM	2	C	16.62	1.426 U	0.650 JE	1.456 U	1.456 U	0.746 JE	41.793 U	0.981 U	2.990	3.069 U
R-AM	3	B	16.26	1.458 U	1.494 U	1.494 U	1.494 U	0.584 JE	42.841 U	1.009 U	3.555	3.143 U
R-AM Replicate 1	4	B	16.61	6.966 U	7.134 U	7.134 U	7.134 U	7.134 U	204.485 U	4.804 U	4.214 J	15.003 U
R-AM Replicate 2	4	B	16.61	10.650 U	10.909 U	10.909 U	10.909 U	10.909 U	312.631 U	7.351 U	14.865 U	22.932 U
R-AM Replicate 3	4	B	16.61	3.817 U	3.907 U	3.907 U	3.907 U	3.907 U	111.981 U	2.631 U	3.329 J	8.212 U
R-AM	5	B	11.30	2.292 U	2.345 U	2.345 U	2.345 U	1.788 JE	67.319 U	1.584 U	7.673	4.938 U
R-BF	1	O	16.72	2.715 U	2.781 U	2.781 U	2.781 U	2.781 U	79.755 U	3.272	10.795	5.849 U
R-BF	2	B	13.79	3.814 U	3.909 U	3.909 U	3.909 U	1.827 JE	111.972 U	0.232 J	6.831	8.216 U
R-BF	3	B	15.57	1.927 U	1.972 U	1.972 U	1.972 U	0.822 JE	56.480 U	2.800	9.891	4.143 U
R-BF	4	A	15.24	2.402 U	2.461 U	2.461 U	2.461 U	2.461 U	70.472 U	4.167	10.801	5.171 U
R-BF	5	A	16.05	2.318 U	2.374 U	2.374 U	2.374 U	2.374 U	68.019 U	3.427	8.667	4.991 U
R-OS	1	B	15.79	1.723 U	1.761 U	1.761 U	1.761 U	1.355 JE	50.481 U	1.184 U	7.638	3.705 U
R-OS Replicate 1	2	O	16.53	5.789 U	5.929 U	5.929 U	5.929 U	5.929 U	169.982 U	3.993 U	13.134	12.468 U
R-OS Replicate 2	2	O	16.53	4.694 U	4.809 U	4.809 U	4.809 U	4.809 U	137.840 U	3.243 U	11.113	10.109 U
R-OS Replicate 3	2	D	16.53	5.681 U	5.814 U	5.814 U	5.814 U	5.814 U	166.691 U	3.920 U	10.430	12.226 U
R-OS	3	B	15.02	1.897 U	1.944 U	1.944 U	1.944 U	1.944 U	55.772 U	1.312 U	7.011	4.095 U
R-OS	4	O	17.85	1.754 U	1.793 U	1.793 U	1.793 U	1.793 U	51.468 U	1.210 U	7.961	3.776 U
R-OS	5	C	17.02	1.804 U	0.082 J	1.845 U	1.845 U	1.069 JE	52.861 U	1.240 U	5.535	3.878 U
R-PF	1	C	13.90	2.252 U	2.309 U	2.309 U	1.194 J	1.417 JE	66.144 U	1.554 U	8.288	4.849 U
R-PF	2	C	13.46	2.637 U	0.386 JE	2.697 U	2.697 U	1.352 JE	77.303 U	1.820 U	8.418	5.669 U
R-PF	3	O	16.88	1.712 U	1.754 U	1.754 U	1.754 U	1.754 U	50.190 U	1.179 U	12.050	3.679 U
R-PF	4	D	16.74	1.470 U	1.505 U	1.505 U	1.505 U	1.505 U	43.124 U	1.016 U	9.313	3.166 U
R-PF	5	A	16.47	0.152 JE	2.240 U	2.240 U	2.240 U	2.240 U	64.299 U	1.512 U	6.242	4.718 U

TABLE K.10. (contd)

<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ dry weight)												
Sediment Treatment	Replicate	Analytical Batch	Percent Dry Weight	Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-DDD	4,4-DDE	4,4-DDT
C-SB	1	C	14.29	2.120 U	2.169 U	2.169 U	0.455 JE	0.980 JE	62.204 U	1.463 U	3.268	4.563 U
C-SB	2	D	16.03	1.971 U	2.021 U	2.021 U	2.021 U	2.021 U	57.916 U	1.360 U	3.337	4.248 U
C-SB	3	B	15.65	2.243 U	2.294 U	2.294 U	2.294 U	2.294 U	65.744 U	1.546 U	4.300	4.824 U
C-SB	4	A	16.06	1.513 U	1.544 U	1.544 U	1.544 U	1.544 U	44.346 U	1.040 U	3.848	3.250 U
C-SB	5	D	16.46	1.634 U	0.158 J	1.671 U	1.671 U	1.671 U	47.892 U	1.124 U	5.626	3.512 U
C-NE	1	B	15.94	1.361 U	1.393 U	1.393 U	1.393 U	1.393 U	39.962 U	0.941 U	3.965	2.930 U
C-NE	2	B	18.40	1.386 U	1.424 U	1.424 U	1.424 U	1.424 U	40.739 U	0.957 U	4.571	2.989 U
C-NE	3	B	16.01	1.568 U	1.605 U	1.605 U	1.605 U	1.243 JE	46.077 U	1.081 U	4.266	3.379 U
C-NE	4	B	15.81	1.777 U	1.822 U	1.822 U	1.822 U	0.664 JE	52.226 U	1.227 U	5.136	3.833 U
C-NE	5	B	15.28	2.029 U	2.075 U	2.075 U	2.075 U	2.075 U	59.503 U	1.401 U	5.020	4.365 U
MSL Background	1	E	19.82	0.802 U	0.822 U	0.822 U	0.822 U	0.822 U	23.572 U	0.555 U	3.355	17.306 U
MSL Background	2	E	19.82	0.807 U	0.827 U	0.827 U	0.827 U	0.827 U	23.678 U	0.555 U	3.254	1.736 U
MSL Background	3	E	19.82	0.807 U	0.822 U	0.822 U	0.822 U	0.822 U	23.643 U	0.555 U	1.761	1.736 U
MSL Background	4	E	19.82	0.812 U	0.832 U	0.832 U	0.832 U	0.832 U	23.880 U	0.560 U	3.845	17.508 U
MSL Background	5	E	19.82	0.807 U	0.822 U	0.822 U	0.822 U	0.822 U	23.633 U	0.555 U	2.992	1.736 U

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (c) E Value an estimate; analyte not detected on confirmation column.
 (d) Percent dry weight was averaged from the other four replicates of COMP 1.

TABLE K.11. Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

<i>N. caecoides</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 I	1	D	16.00	26.088 U ^(a)	7.169 U	7.169 U	7.169 U	24.606 U	7.169 U	5.119 U	2.800 U	71.700 U
COMP I	2	D	15.28	1.806 J ^(b)	4.817 U	0.157 JE ^(c)	4.817 U	16.525 U	4.817 U	3.436 U	1.885 U	48.154 U
COMP I	3	A	16.50 ^(d)	19.988 U	5.491 U	5.491 U	2.442 JE	18.855 U	5.491 U	3.921 U	2.145 U	54.933 U
COMP I	4	B	17.16	70.775 U	19.452 U	19.452 U	19.452 U	66.748 U	19.452 U	13.881 U	7.605 U	194.493 U
COMP I Replicate 1	5	A	17.54	77.623 U	21.334 U	21.334 U	21.334 U	73.210 U	21.334 U	15.222 U	8.341 U	213.312 U
COMP I Replicate 2	5	A	17.54	71.420 U	19.629 U	19.629 U	19.629 U	67.360 U	19.629 U	14.008 U	7.674 U	196.271 U
COMP I Replicate 3	5	A	17.54	52.617 U	14.458 U	14.458 U	14.458 U	49.624 U	14.458 U	10.319 U	5.650 U	144.595 U
COMP II	1	D	15.12	3.571 J	4.603 U	4.603 U	4.603 U	15.807 U	4.603 U	3.287 U	1.799 U	46.052 U
COMP II	2	A	17.08	1.932 J	8.683 U	8.683 U	8.683 U	29.789 U	8.683 U	6.194 U	3.396 U	86.803 U
COMP II	3	C	17.30	1.416 J	4.734 U	4.734 U	4.399 JE	16.237 U	4.734 U	3.376 U	1.850 U	47.312 U
COMP II	4	D	15.82	4.001 J	6.296 U	6.296 U	6.296 U	21.599 U	6.296 U	4.494 U	2.459 U	62.933 U
COMP II	5	C	16.64	2.151 J	4.790 U	1.142 J	4.790 U	16.430 U	4.790 U	3.413 U	1.869 U	47.873 U
COMP III	1	C	14.77	24.245 U	6.662 U	6.662 U	6.662 U	22.864 U	6.662 U	4.753 U	2.607 U	66.628 U
COMP III	2	D	16.64	0.853 J	5.553 U	5.553 U	5.553 U	19.063 U	5.553 U	3.966 U	2.169 U	55.541 U
COMP III	3	A	15.35	1.075 J	4.971 U	4.971 U	4.971 U	17.049 U	4.971 U	3.544 U	1.941 U	49.681 U
COMP III	4	D	16.35	0.502 J	5.193 U	5.193 U	5.193 U	17.823 U	5.193 U	3.706 U	2.031 U	51.933 U
COMP III	5	C	15.26	24.528 U	6.743 U	6.743 U	6.743 U	23.132 U	6.743 U	4.810 U	2.634 U	67.405 U
TC-5 Upper Comp	1	C	15.40	2.195 J	9.169 U	9.169 U	1.416 JE	31.461 U	9.169 U	6.539 U	3.584 U	91.662 U
TC-5 Upper Comp	2	C	15.92	3.492 J	5.402 U	1.520 JE	5.402 U	18.530 U	5.402 U	3.851 U	2.111 U	53.989 U
TC-5 Upper Comp	3	C	16.93	4.176 J	7.377 U	7.377 U	7.437 E	25.316 U	7.377 U	5.263 U	2.882 U	73.768 U
TC-5 Upper Comp	4	A	15.87	4.197 J	3.655 JE	2.224 JE	1.235 JE	26.641 U	7.763 U	5.539 U	3.037 U	77.618 U
TC-5 Upper Comp	5	A	16.58	3.112 J	25.476 U	25.476 U	25.476 U	87.431 U	25.476 U	18.179 U	9.958 U	254.759 U
COMP IV	1	C	16.16	19.134 U	5.260 U	5.260 U	5.260 U	18.045 U	5.260 U	3.750 U	2.054 U	52.574 U
COMP IV Replicate 1	2	C	16.46	81.258 U	22.333 U	22.333 U	22.333 U	76.640 U	22.333 U	15.936 U	8.730 U	223.311 U
COMP IV Replicate 2	2	C	16.46	103.123 U	28.341 U	28.341 U	28.341 U	97.260 U	28.341 U	20.225 U	11.075 U	283.390 U
COMP IV Replicate 3	2	C	16.46	72.521 U	19.933 U	19.933 U	19.933 U	68.396 U	19.933 U	14.222 U	7.789 U	199.301 U
COMP IV	3	A	11.15	51.785 U	14.233 U	14.233 U	14.233 U	48.843 U	14.233 U	10.152 U	5.561 U	142.314 U
COMP IV	4	C	16.04	22.936 U	6.303 U	6.303 U	1.864 JE	21.633 U	6.303 U	4.501 U	2.463 U	63.036 U
COMP IV	5	A	13.09	48.892 U	13.438 U	13.438 U	13.438 U	46.112 U	13.438 U	9.587 U	5.256 U	134.362 U
COMP V	1	A	15.27	11.074 J	5.959 U	2.600 JE	5.959 U	20.458 U	5.959 U	4.257 U	2.331 U	59.614 U
COMP V	2	A	14.83	9.724 J	7.094 U	0.371 JE	7.094 U	24.343 U	5.833 J	5.064 U	2.771 U	70.931 U
COMP V	3	A	17.13	8.237 J	4.302 U	2.475 JE	4.302 U	14.764 U	4.302 U	3.071 U	1.681 U	43.030 U
COMP V	4	D	15.44	14.916 J	0.415 JE	6.736 U	6.736 U	23.122 U	6.736 U	4.806 U	2.636 U	67.370 U
COMP V	5	B	17.14	11.768 J	3.804 U	3.804 U	3.804 U	13.051 U	3.804 U	2.713 U	1.488 U	38.028 U

TABLE K.11. (contd)

<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ 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 VI	1	C	15.08	9.344 J	7.089 U	2.341 JE	7.089 U	24.330 U	7.089 U	5.060 U	2.772 U	70.889 U
COMP VI	2	A	15.83	10.859 J	1.364 JE	0.992 JE	5.433 U	18.642 U	2.021 J	3.879 U	2.123 U	54.327 U
COMP VI	3	B	16.25	13.120 J	6.148 U	0.615 JE	6.148 U	21.095 U	6.148 U	4.388 U	2.400 U	61.458 U
COMP VI	4	A	15.89	4.481 J	6.344 U	6.344 U	6.344 U	21.762 U	6.344 U	4.525 U	2.480 U	63.411 U
COMP VI	5	D	16.24	20.794 J	19.076 U	19.076 U	19.076 U	65.462 U	19.076 U	13.608 U	7.457 U	190.739 U
R-AC	1	B	15.84	30.878 U	8.485 U	8.485 U	8.485 U	29.122 U	8.485 U	6.054 U	3.314 U	84.855 U
R-AC	2	C	16.14	67.825 U	18.637 U	18.637 U	18.637 U	63.971 U	18.637 U	13.302 U	7.286 U	186.394 U
R-AC	3	C	16.16	21.343 U	5.866 U	5.866 U	5.866 U	20.124 U	5.866 U	4.183 U	0.285 JE	58.645 U
R-AC	4	A	13.29	28.405 U	7.803 U	7.803 U	7.803 U	26.787 U	7.803 U	5.568 U	3.055 U	78.051 U
R-AC	5	D	16.75	0.985 J	4.836 U	4.836 U	4.836 U	16.591 U	4.836 U	3.451 U	1.893 U	48.352 U
R-AM	1	B	17.29	18.768 U	5.159 U	5.159 U	5.159 U	17.704 U	5.159 U	3.678 U	2.019 U	51.579 U
R-AM	2	C	16.62	15.211 U	4.182 U	4.182 U	4.182 U	14.344 U	4.182 U	2.984 U	1.637 U	41.793 U
R-AM	3	B	16.26	15.590 U	4.287 U	4.287 U	4.287 U	14.705 U	4.287 U	3.057 U	1.673 U	42.841 U
R-AM Replicate 1	4	B	16.61	74.407 U	20.452 U	20.452 U	20.452 U	70.175 U	20.452 U	14.594 U	7.995 U	204.485 U
R-AM Replicate 2	4	B	16.61	113.763 U	31.264 U	31.264 U	31.264 U	107.291 U	31.264 U	22.312 U	12.222 U	312.631 U
R-AM Replicate 3	4	B	16.61	40.747 U	11.198 U	11.198 U	11.198 U	38.429 U	11.198 U	7.989 U	4.377 U	111.981 U
R-AM	5	B	11.30	24.496 U	6.735 U	6.735 U	6.735 U	23.106 U	6.735 U	4.805 U	2.628 U	67.319 U
R-BF	1	D	16.72	0.520 J	7.978 U	7.978 U	7.978 U	27.368 U	7.978 U	5.694 U	3.116 U	79.755 U
R-BF	2	B	13.79	40.747 U	11.197 U	11.197 U	11.197 U	38.426 U	11.197 U	7.991 U	4.380 U	111.972 U
R-BF	3	B	15.57	1.175 JE	5.645 U	5.645 U	5.645 U	19.383 U	5.645 U	4.033 U	2.209 U	56.480 U
R-BF	4	A	15.24	1.870 J	7.047 U	1.017 JE	7.047 U	24.186 U	7.047 U	5.026 U	2.756 U	70.472 U
R-BF	5	A	16.05	1.601 J	6.804 U	6.804 U	3.595 JE	23.340 U	6.804 U	4.854 U	2.660 U	68.019 U
R-OS	1	B	15.79	18.372 U	5.047 U	5.047 U	5.047 U	17.327 U	5.047 U	3.604 U	1.976 U	50.481 U
R-OS Replicate 1	2	D	16.53	61.857 U	16.999 U	16.999 U	16.999 U	58.336 U	16.999 U	12.129 U	6.642 U	169.982 U
R-OS Replicate 2	2	D	16.53	50.157 U	13.787 U	13.787 U	13.787 U	47.308 U	13.787 U	9.837 U	5.390 U	137.840 U
R-OS Replicate 3	2	D	16.53	60.653 U	16.667 U	16.667 U	16.667 U	57.205 U	16.667 U	11.894 U	6.515 U	166.691 U
R-OS	3	B	15.02	20.293 U	5.579 U	5.579 U	5.579 U	19.141 U	5.579 U	3.981 U	2.177 U	55.772 U
R-OS	4	D	17.85	18.728 U	5.148 U	5.148 U	5.148 U	17.664 U	5.148 U	3.675 U	2.011 U	51.468 U
R-OS	5	C	17.02	19.236 U	5.288 U	5.288 U	5.288 U	18.143 U	5.288 U	3.772 U	2.068 U	52.861 U
R-PF	1	C	13.90	24.072 U	6.612 U	6.612 U	6.612 U	22.698 U	6.612 U	4.719 U	2.583 U	66.144 U
R-PF	2	C	13.46	28.128 U	7.734 U	7.734 U	7.734 U	26.530 U	7.734 U	5.520 U	3.024 U	77.303 U
R-PF	3	D	16.88	18.264 U	5.018 U	5.018 U	5.018 U	17.227 U	5.018 U	3.584 U	1.961 U	50.190 U
R-PF	4	D	16.74	15.693 U	4.313 U	4.313 U	4.313 U	14.797 U	4.313 U	3.076 U	1.685 U	43.124 U
R-PF	5	A	16.47	23.394 U	6.430 U	6.430 U	6.430 U	22.064 U	6.430 U	4.590 U	2.514 U	64.299 U

TABLE K.11. (contd)

<i>N. caecoides</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
C-SB	1	C	14.29	22.638 U	6.221 U	6.221 U	6.221 U	21.351 U	6.221 U	4.437 U	2.435 U	62.204 U
C-SB	2	D	16.03	21.073 U	5.789 U	5.789 U	5.789 U	19.875 U	5.789 U	4.136 U	2.265 U	57.916 U
C-SB	3	B	15.65	23.923 U	6.575 U	6.575 U	6.575 U	22.562 U	6.575 U	4.690 U	2.569 U	65.744 U
C-SB	4	A	16.06	16.133 U	4.433 U	4.433 U	4.433 U	15.218 U	4.433 U	3.163 U	1.731 U	44.346 U
C-SB	5	D	16.46	17.424 U	4.787 U	4.787 U	4.787 U	16.434 U	4.787 U	3.420 U	1.871 U	47.892 U
C-NE	1	B	15.94	14.542 U	3.996 U	3.996 U	3.996 U	13.714 U	3.996 U	2.854 U	1.562 U	39.962 U
C-NE	2	B	18.40	14.826 U	4.076 U	4.076 U	4.076 U	13.984 U	4.076 U	2.908 U	1.592 U	40.739 U
C-NE	3	B	16.01	16.771 U	4.610 U	4.610 U	4.610 U	15.815 U	4.610 U	3.285 U	1.799 U	46.077 U
C-NE	4	B	15.81	19.001 U	5.225 U	5.225 U	5.225 U	17.925 U	5.225 U	3.725 U	2.043 U	52.226 U
C-NE	5	B	15.28	21.649 U	5.949 U	5.949 U	5.949 U	20.419 U	5.949 U	4.247 U	2.323 U	59.503 U
MSL Background	1	E	19.82	8.577 U	2.356 U	2.356 U	2.356 U	8.088 U	2.356 U	1.680 U	0.923 U	23.572 U
MSL Background	2	E	19.82	8.618 U	2.366 U	2.366 U	2.366 U	8.128 U	2.366 U	1.690 U	0.923 U	23.678 U
MSL Background	3	E	19.82	8.602 U	2.366 U	2.366 U	2.366 U	8.113 U	2.366 U	1.685 U	0.923 U	23.643 U
MSL Background	4	E	19.82	8.688 U	2.386 U	2.386 U	2.386 U	8.194 U	2.386 U	1.705 U	0.933 U	23.880 U
MSL Background	5	E	19.82	8.602 U	2.361 U	2.361 U	2.361 U	8.113 U	2.361 U	1.685 U	0.923 U	23.633 U

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (c) E Value an estimate; analyte not detected on confirmation column.
 (d) Percent dry weight was averaged from the other four replicates of COMP I.

TABLE K.12. Chlorinated Pesticides (alphabetical, Aldrin - 4,4-DDT), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

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	Chlordane	4,4-ODD	4,4-DDD	4,4-DDT
Target DL (a)			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Achieved DL Low			0.159	0.163	0.163	0.163	0.163	4.672	0.110	2.218	0.344
Achieved DL High			1.769	1.812	1.812	1.812	1.812	51.928	1.221	2.469	3.809
COMP I	1	D	0.391 U ^(b)	0.400 U ^(c)	0.400 U	0.400 U	0.400 U	11.472 U	1.183	2.408	0.842 U
COMP I	2	D	0.251 U	0.054 J ^(d)	0.257 U	0.257 U	0.257 U	7.358 U	1.322	2.154	0.540 U
COMP I	3	A	0.309 U	0.316 U	0.316 U	0.316 U	0.316 U	9.064 U	0.771	1.692	0.665 U
COMP I	4	B	1.137 U	1.164 U	1.164 U	1.164 U	1.164 U	33.375 U	0.785 U	2.116	2.448 U
COMP I Replicate 1	5	A	1.275 U	1.305 U	1.305 U	1.305 U	1.305 U	37.415 U	0.798 J	1.978	2.745 U
COMP I Replicate 2	5	A	1.173 U	1.201 U	1.201 U	1.201 U	1.201 U	34.426 U	0.630 J	2.087	2.525 U
COMP I Replicate 3	5	A	0.864 U	0.885 U	0.885 U	0.885 U	0.885 U	25.362 U	0.978	2.132	1.861 U
COMP II	1	D	0.237 U	0.102 JE	0.243 U	0.243 U	0.243 U	6.963 U	3.025	2.756	0.511 U
COMP II	2	A	0.505 U	0.517 U	0.517 U	0.517 U	0.517 U	14.826 U	1.783	2.088	1.088 U
COMP II	3	C	0.279 U	0.072 J	0.286 U	0.286 U	0.155 JE	8.185 U	2.414	1.670	0.600 U
COMP II	4	D	0.339 U	0.347 U	0.347 U	0.347 U	0.347 U	9.956 U	3.057	3.242	0.730 U
COMP II	5	C	0.271 U	0.175 J	0.278 U	0.058 J	0.154 JE	7.966 U	0.187 U	2.045	0.584 U
COMP III	1	C	0.335 U	0.116 J	0.343 U	0.343 U	0.154 JE	9.841 U	0.142 J	0.549	0.722 U
COMP III	2	D	0.315 U	0.322 U	0.322 U	0.322 U	0.322 U	9.242 U	0.914	1.328	0.678 U
COMP III	3	A	0.260 U	0.266 U	0.266 U	0.266 U	0.266 U	7.626 U	0.229	0.906	0.559 U
COMP III	4	D	0.289 U	0.296 U	0.296 U	0.296 U	0.296 U	8.491 U	0.393	1.112	0.623 U
COMP III	5	C	0.350 U	0.051 J	0.359 U	0.188 JE	0.139 JE	10.286 U	0.094 J	0.759	0.755 U
TC-5 Upper Comp	1	C	0.481 U	0.362 JE	0.492 U	0.492 U	0.229 JE	14.116 U	3.030	3.755	1.036 U
TC-5 Upper Comp	2	C	0.293 U	0.227 J	0.300 U	0.300 U	0.190 JE	8.595 U	3.234	2.939	0.631 U
TC-5 Upper Comp	3	C	0.426 U	0.302 J	0.436 U	0.436 U	0.149 JE	12.489 U	4.094	4.284	0.916 U
TC-5 Upper Comp	4	A	0.420 U	0.430 U	0.430 U	0.212 JE	0.430 U	12.318 U	2.316	3.665	0.904 U
TC-5 Upper Comp	5	A	1.439 U	1.474 U	1.474 U	1.474 U	1.474 U	42.239 U	2.522	4.161	3.099 U
COMP IV	1	C	0.289 U	0.071 J	0.296 U	0.296 U	0.141 JE	8.496 U	0.200 U	0.300 J	0.623 U
COMP IV Replicate 1	2	C	1.252 U	1.282 U	1.282 U	1.282 U	1.282 U	36.757 U	0.864 U	0.351 J	2.696 U
COMP IV Replicate 2	2	C	1.589 U	1.627 U	1.627 U	1.627 U	1.627 U	46.646 U	1.096 U	2.218 U	3.422 U
COMP IV Replicate 3	2	C	1.118 U	1.144 U	1.144 U	1.144 U	1.144 U	32.805 U	0.771 U	0.065 J	2.407 U
COMP IV	3	A	0.541 U	0.554 U	0.554 U	0.554 U	0.554 U	15.868 U	0.373 U	0.396 J	1.164 U
COMP IV	4	C	0.344 U	0.029 J	0.353 U	0.353 U	0.353 U	10.111 U	0.238 U	0.242 J	0.742 U
COMP IV	5	A	0.599 U	0.614 U	0.614 U	0.614 U	0.614 U	17.588 U	0.413 U	0.234 J	1.290 U

TABLE K.12. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)								4,4-DDT
			Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-DDD	4,4-DDE	
COMP V	1	A	0.310 U	0.318 U	0.318 U	0.318 U	0.318 U	9.103 U	9.400	6.080	0.668 U
COMP V	2	A	0.358 U	0.367 U	0.367 U	0.367 U	0.367 U	10.519 U	8.521	4.074	0.772 U
COMP V	3	A	0.251 U	0.257 U	0.257 U	0.257 U	0.162 JE	7.371 U	8.424	5.761	0.541 U
COMP V	4	D	0.354 U	0.363 U	0.363 U	0.363 U	0.363 U	10.402 U	17.711	10.186	0.763 U
COMP V	5	B	0.222 U	0.227 U	0.227 U	0.227 U	0.178 JE	6.518 U	16.740	6.027	0.478 U
COMP VI	1	C	0.364 U	0.118 J	0.373 U	0.373 U	0.164 JE	10.690 U	16.231	4.946	0.784 U
COMP VI	2	A	0.293 U	0.021 JE	0.300 U	0.300 U	0.300 U	8.600 U	8.919	3.750	0.631 U
COMP VI	3	B	0.340 U	0.348 U	0.348 U	0.348 U	0.232 JE	9.987 U	23.373	6.200	0.733 U
COMP VI	4	A	0.343 U	0.352 U	0.352 U	0.352 U	0.352 U	10.076 U	10.791	5.885	0.739 U
COMP VI	5	D	1.055 U	1.081 U	1.081 U	1.081 U	1.081 U	30.976 U	24.632	8.925	2.272 U
R-AC	1	B	0.458 U	0.469 U	0.469 U	0.469 U	0.469 U	13.441 U	1.455 J	2.033	0.986 U
R-AC	2	C	1.025 U	0.025 J	1.050 U	1.050 U	1.050 U	30.084 U	0.707 U	1.039 J	2.207 U
R-AC	3	C	0.323 U	0.331 U	0.331 U	0.331 U	0.158 JE	9.477 U	0.814	1.277	0.695 U
R-AC	4	A	0.353 U	0.043 JE	0.362 U	0.362 U	0.362 U	10.373 U	0.624	1.417 E	0.761 U
R-AC	5	D	0.276 U	0.283 U	0.283 U	0.283 U	0.283 U	8.099 U	1.048	2.055	0.594 U
R-AM	1	B	0.304 U	0.311 U	0.311 U	0.311 U	0.311 U	8.918 U	0.210 U	0.644	0.654 U
R-AM	2	C	0.237 U	0.108 JE	0.242 U	0.242 U	0.124 JE	6.946 U	0.163 U	0.497	0.510 U
R-AM	3	B	0.237 U	0.243 U	0.243 U	0.243 U	0.095 JE	6.966 U	0.164 U	0.578	0.511 U
R-AM Replicate 1	4	B	1.157 U	1.185 U	1.185 U	1.185 U	1.185 U	33.965 U	0.798 U	0.700 J	2.492 U
R-AM Replicate 2	4	B	1.769 U	1.812 U	1.812 U	1.812 U	1.812 U	51.928 U	1.221 U	2.469 U	3.809 U
R-AM Replicate 3	4	B	0.634 U	0.649 U	0.649 U	0.649 U	0.649 U	18.600 U	0.437 U	0.553 J	1.364 U
R-AM	5	B	0.259 U	0.265 U	0.265 U	0.265 U	0.202 JE	7.607 U	0.179 U	0.867	0.558 U
R-BF	1	D	0.454 U	0.465 U	0.465 U	0.465 U	0.465 U	13.335 U	0.547	1.805	0.978 U
R-BF	2	B	0.526 U	0.539 U	0.539 U	0.539 U	0.252 JE	15.441 U	0.032 J	0.942	1.133 U
R-BF	3	B	0.300 U	0.307 U	0.307 U	0.307 U	0.128 JE	8.794 U	0.436	1.540	0.645 U
R-BF	4	A	0.366 U	0.375 U	0.375 U	0.375 U	0.375 U	10.740 U	0.635	1.646	0.788 U
R-BF	5	A	0.372 U	0.381 U	0.381 U	0.381 U	0.381 U	10.917 U	0.550	1.391	0.801 U
R-OS	1	B	0.272 U	0.278 U	0.278 U	0.278 U	0.214 JE	7.971 U	0.187 U	1.206	0.585 U
R-OS Replicate 1	2	D	0.957 U	0.980 U	0.980 U	0.980 U	0.980 U	28.098 U	0.660 U	2.171	2.061 U
R-OS Replicate 2	2	D	0.776 U	0.795 U	0.795 U	0.795 U	0.795 U	22.785 U	0.536 U	1.837	1.671 U
R-OS Replicate 3	2	D	0.939 U	0.961 U	0.961 U	0.961 U	0.961 U	27.554 U	0.648 U	1.724	2.021 U
R-OS	3	B	0.285 U	0.292 U	0.292 U	0.292 U	0.292 U	8.377 U	0.197 U	1.053	0.615 U
R-OS	4	D	0.313 U	0.320 U	0.320 U	0.320 U	0.320 U	9.187 U	0.216 U	1.421	0.674 U
R-OS	5	C	0.307 U	0.014 J	0.314 U	0.314 U	0.182 JE	8.997 U	0.211 U	0.942	0.660 U

TABLE K.12. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ wet weight)								
			Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-DDD	4,4-DDE	4,4-DDT
R-PF	1	C	0.313 U	0.321 U	0.321 U	0.166 J	0.197 JE	9.194 U	0.216 U	1.152	0.674 U
R-PF	2	C	0.355 U	0.052 JE	0.363 U	0.363 U	0.182 JE	10.405 U	0.245 U	1.133	0.763 U
R-PF	3	D	0.289 U	0.296 U	0.296 U	0.296 U	0.296 U	8.472 U	0.199 U	2.034	0.621 U
R-PF	4	D	0.246 U	0.252 U	0.252 U	0.252 U	0.252 U	7.219 U	0.170 U	1.559	0.530 U
R-PF	5	A	0.025 JE	0.369 U	0.369 U	0.369 U	0.369 U	10.590 U	0.249 U	1.028	0.777 U
C-SB	1	C	0.303 U	0.310 U	0.310 U	0.065 JE	0.140 JE	8.889 U	0.209 U	0.467	0.652 U
C-SB	2	D	0.316 U	0.324 U	0.324 U	0.324 U	0.324 U	9.284 U	0.218 U	0.535	0.681 U
C-SB	3	B	0.351 U	0.359 U	0.359 U	0.359 U	0.359 U	10.289 U	0.242 U	0.673	0.755 U
C-SB	4	A	0.243 U	0.248 U	0.248 U	0.248 U	0.248 U	7.122 U	0.167 U	0.618	0.522 U
C-SB	5	D	0.269 U	0.026 J	0.275 U	0.275 U	0.275 U	7.883 U	0.185 U	0.926	0.578 U
C-NE	1	B	0.217 U	0.222 U	0.222 U	0.222 U	0.222 U	6.370 U	0.150 U	0.632	0.467 U
C-NE	2	B	0.255 U	0.262 U	0.262 U	0.262 U	0.262 U	7.496 U	0.176 U	0.841	0.550 U
C-NE	3	B	0.251 U	0.257 U	0.257 U	0.257 U	0.199 JE	7.377 U	0.173 U	0.683	0.541 U
C-NE	4	B	0.281 U	0.288 U	0.288 U	0.288 U	0.105 JE	8.257 U	0.194 U	0.812	0.606 U
C-NE	5	B	0.310 U	0.317 U	0.317 U	0.317 U	0.317 U	9.092 U	0.214 U	0.767	0.667 U
MSL Background	1	E	0.159 U	0.163 U	0.163 U	0.163 U	0.163 U	4.672 U	0.110 U	0.665	3.430 U
MSL Background	2	E	0.160 U	0.164 U	0.164 U	0.164 U	0.164 U	4.693 U	0.110 U	0.645	0.344 U
MSL Background	3	E	0.160 U	0.163 U	0.163 U	0.163 U	0.163 U	4.686 U	0.110 U	0.349	0.344 U
MSL Background	4	E	0.161 U	0.165 U	0.165 U	0.165 U	0.165 U	4.733 U	0.111 U	0.762	3.470 U
MSL Background	5	E	0.160 U	0.163 U	0.163 U	0.163 U	0.163 U	4.684 U	0.110 U	0.593	0.344 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

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

(d) E Value an estimate; analyte not detected on confirmation column.

TABLE K.13. Chlorinated Pesticides (alphabetical, Dieldrin - Toxaphene), Wet Weight, in Tissue of *PNcaecoides*, Richmond Harbor Program

			<i>N. caecoides</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
Target DL (a)			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	30.0
Achieved DL Low			1.700	0.467	0.467	0.467	1.603	0.467	0.333	0.183	4.672
Achieved DL High			18.896	5.193	5.193	5.493	17.821	5.193	3.706	2.030	51.928
COMP I	1	D	4.174 U ^(b)	1.147 U	1.147 U	1.147 U	3.937 U	1.147 U	0.819 U	0.448 U	11.472 U
COMP I	2	D	0.276 J ^(c)	0.736 U	0.024 JE ^(d)	0.736 U	2.525 U	0.736 U	0.525 U	0.288 U	7.358 U
COMP I	3	A	3.298 U	0.906 U	0.906 U	0.403 JE	3.111 U	0.906 U	0.647 U	0.354 U	9.064 U
COMP I	4	B	12.145 U	3.338 U	3.338 U	3.338 U	11.454 U	3.338 U	2.362 U	1.305 U	33.375 U
COMP I Replicate 1	5	A	13.615 U	3.742 U	3.742 U	3.742 U	12.841 U	3.742 U	2.670 U	1.463 U	37.415 U
COMP I Replicate 2	5	A	12.527 U	3.443 U	3.443 U	3.443 U	11.815 U	3.443 U	2.457 U	1.346 U	34.426 U
COMP I Replicate 3	5	A	9.229 U	2.536 U	2.536 U	2.536 U	8.704 U	2.536 U	1.810 U	0.991 U	25.362 U
COMP II	1	D	0.540 J	0.696 U	0.696 U	0.696 U	2.390 U	0.696 U	0.497 U	0.272 U	6.963 U
COMP II	2	A	0.330 J	1.483 U	1.483 U	1.483 U	5.088 U	1.483 U	1.058 U	0.580 U	14.826 U
COMP II	3	C	0.245 J	0.819 U	0.819 U	0.761 JE	2.809 U	0.819 U	0.584 U	0.320 U	8.185 U
COMP II	4	D	0.633 J	0.996 U	0.996 U	0.996 U	3.417 U	0.996 U	0.711 U	0.389 U	9.956 U
COMP II	5	C	0.358 J	0.797 U	0.190 J	0.797 U	2.734 U	0.797 U	0.568 U	0.311 U	7.966 U
COMP III	1	C	3.581 U	0.984 U	0.984 U	0.984 U	3.377 U	0.984 U	0.702 U	0.385 U	9.841 U
COMP III	2	D	0.142 J	0.924 U	0.924 U	0.924 U	3.172 U	0.924 U	0.660 U	0.361 U	9.242 U
COMP III	3	A	0.165 J	0.763 U	0.763 U	0.763 U	2.617 U	0.763 U	0.544 U	0.298 U	7.626 U
COMP III	4	D	0.082 J	0.849 U	0.849 U	0.849 U	2.914 U	0.849 U	0.606 U	0.332 U	8.491 U
COMP III	5	C	3.743 U	1.029 U	1.029 U	1.029 U	3.530 U	1.029 U	0.734 U	0.402 U	10.286 U
TC-5 Upper Comp	1	C	0.338 J	1.412 U	1.412 U	0.218 JE	4.845 U	1.412 U	1.007 U	0.552 U	14.116 U
TC-5 Upper Comp	2	C	0.556 J	0.860 U	0.242 JE	0.860 U	2.950 U	0.860 U	0.613 U	0.336 U	8.595 U
TC-5 Upper Comp	3	C	0.707 J	1.249 U	1.249 U	1.259 E	4.286 U	1.249 U	0.891 U	0.488 U	12.489 U
TC-5 Upper Comp	4	A	0.666 J	0.580 JE	0.353 JE	0.196 JE	4.228 U	1.232 U	0.879 U	0.482 U	12.318 U
TC-5 Upper Comp	5	A	0.516 J	4.224 U	4.224 U	4.224 U	14.496 U	4.224 U	3.014 U	1.651 U	42.239 U
COMP IV	1	C	3.092 U	0.850 U	0.850 U	0.850 U	2.916 U	0.850 U	0.606 U	0.332 U	8.496 U
COMP IV Replicate 1	2	C	13.375 U	3.676 U	3.676 U	3.676 U	12.615 U	3.676 U	2.623 U	1.437 U	36.757 U
COMP IV Replicate 2	2	C	16.974 U	4.665 U	4.665 U	4.665 U	16.009 U	4.665 U	3.329 U	1.823 U	46.646 U
COMP IV Replicate 3	2	C	11.937 U	3.281 U	3.281 U	3.281 U	11.258 U	3.281 U	2.341 U	1.282 U	32.805 U
COMP IV	3	A	5.774 U	1.587 U	1.587 U	1.587 U	5.446 U	1.587 U	1.132 U	0.620 U	15.868 U
COMP IV	4	C	3.679 U	1.011 U	1.011 U	0.299 JE	3.470 U	1.011 U	0.722 U	0.395 U	10.111 U
COMP IV	5	A	6.400 U	1.759 U	1.759 U	1.759 U	6.036 U	1.759 U	1.255 U	0.688 U	17.588 U

TABLE K.13. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</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
COMP V	1	A	1.691 J	0.910 U	0.397 JE	0.910 U	3.124 U	0.910 U	0.650 U	0.356 U	9.103 U
COMP V	2	A	1.442 J	1.052 U	0.055 JE	1.052 U	3.610 U	0.865 J	0.751 U	0.411 U	10.519 U
COMP V	3	A	1.411 J	0.737 U	0.424 JE	0.737 U	2.529 U	0.737 U	0.526 U	0.288 U	7.371 U
COMP V	4	D	2.303 J	0.064 JE	1.040 U	1.040 U	3.570 U	1.040 U	0.742 U	0.407 U	10.402 U
COMP V	5	B	2.017 J	0.652 U	0.652 U	0.652 U	2.237 U	0.652 U	0.465 U	0.255 U	6.518 U
COMP VI	1	C	1.409 J	1.069 U	0.353 JE	1.069 U	3.669 U	1.069 U	0.763 U	0.418 U	10.690 U
COMP VI	2	A	1.719 J	0.216 JE	0.157 JE	0.860 U	2.951 U	0.320 J	0.614 U	0.336 U	8.600 U
COMP VI	3	B	2.132 J	0.999 U	0.100 JE	0.999 U	3.428 U	0.999 U	0.713 U	0.390 U	9.987 U
COMP VI	4	A	0.712 J	1.008 U	1.008 U	1.008 U	3.458 U	1.008 U	0.719 U	0.394 U	10.076 U
COMP VI	5	D	3.377 J	3.098 U	3.098 U	3.098 U	10.631 U	3.098 U	2.210 U	1.211 U	30.976 U
R-AC	1	B	4.891 U	1.344 U	1.344 U	1.344 U	4.613 U	1.344 U	0.959 U	0.525 U	13.441 U
R-AC	2	C	10.947 U	3.008 U	3.008 U	3.008 U	10.325 U	3.008 U	2.147 U	1.176 U	30.084 U
R-AC	3	C	3.449 U	0.948 U	0.948 U	0.948 U	3.252 U	0.948 U	0.676 U	0.046 JE	9.477 U
R-AC	4	A	3.775 U	1.037 U	1.037 U	1.037 U	3.560 U	1.037 U	0.740 U	0.406 U	10.373 U
R-AC	5	D	0.165 J	0.810 U	0.810 U	0.810 U	2.779 U	0.810 U	0.578 U	0.317 U	8.099 U
R-AM	1	B	3.245 U	0.892 U	0.892 U	0.892 U	3.061 U	0.892 U	0.636 U	0.349 U	8.918 U
R-AM	2	C	2.528 U	0.695 U	0.695 U	0.695 U	2.384 U	0.695 U	0.496 U	0.272 U	6.946 U
R-AM	3	B	2.535 U	0.697 U	0.697 U	0.697 U	2.391 U	0.697 U	0.497 U	0.272 U	6.966 U
R-AM Replicate 1	4	B	12.359 U	3.397 U	3.397 U	3.397 U	11.656 U	3.397 U	2.424 U	1.328 U	33.965 U
R-AM Replicate 2	4	B	18.896 U	5.193 U	5.193 U	5.193 U	17.821 U	5.193 U	3.706 U	2.030 U	51.928 U
R-AM Replicate 3	4	B	6.768 U	1.860 U	1.860 U	1.860 U	6.383 U	1.860 U	1.327 U	0.727 U	18.600 U
R-AM	5	B	2.768 U	0.761 U	0.761 U	0.761 U	2.611 U	0.761 U	0.543 U	0.297 U	7.607 U
R-BF	1	D	0.087 J	1.334 U	1.334 U	1.334 U	4.576 U	1.334 U	0.952 U	0.521 U	13.335 U
R-BF	2	B	5.619 U	1.544 U	1.544 U	1.544 U	5.299 U	1.544 U	1.102 U	0.604 U	15.441 U
R-BF	3	B	0.183 JE	0.879 U	0.879 U	0.879 U	3.018 U	0.879 U	0.628 U	0.344 U	8.794 U
R-BF	4	A	0.285 J	1.074 U	0.155 JE	1.074 U	3.686 U	1.074 U	0.766 U	0.420 U	10.740 U
R-BF	5	A	0.257 J	1.092 U	1.092 U	0.577 JE	3.746 U	1.092 U	0.779 U	0.427 U	10.917 U
R-OS	1	B	2.901 U	0.797 U	0.797 U	0.797 U	2.736 U	0.797 U	0.569 U	0.312 U	7.971 U
R-OS Replicate 1	2	O	10.225 U	2.810 U	2.810 U	2.810 U	9.643 U	2.810 U	2.005 U	1.098 U	28.098 U
R-OS Replicate 2	2	D	8.291 U	2.279 U	2.279 U	2.279 U	7.820 U	2.279 U	1.626 U	0.891 U	22.785 U
R-OS Replicate 3	2	O	10.026 U	2.755 U	2.755 U	2.755 U	9.456 U	2.755 U	1.966 U	1.077 U	27.554 U
R-OS	3	B	3.048 U	0.838 U	0.838 U	0.838 U	2.875 U	0.838 U	0.598 U	0.327 U	8.377 U
R-OS	4	O	3.343 U	0.919 U	0.919 U	0.919 U	3.153 U	0.919 U	0.656 U	0.359 U	9.187 U
R-OS	5	C	3.274 U	0.900 U	0.900 U	0.900 U	3.088 U	0.900 U	0.642 U	0.352 U	8.997 U

TABLE K.13. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</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
R-PF	1	C	3.346 U	0.919 U	0.919 U	0.919 U	3.155 U	0.919 U	0.656 U	0.359 U	9.194 U
R-PF	2	C	3.786 U	1.041 U	1.041 U	1.041 U	3.571 U	1.041 U	0.743 U	0.407 U	10.405 U
R-PF	3	D	3.083 U	0.847 U	0.847 U	0.847 U	2.908 U	0.847 U	0.605 U	0.331 U	8.472 U
R-PF	4	D	2.627 U	0.722 U	0.722 U	0.722 U	2.477 U	0.722 U	0.515 U	0.282 U	7.219 U
R-PF	5	A	3.853 U	1.059 U	1.059 U	1.059 U	3.634 U	1.059 U	0.756 U	0.414 U	10.590 U
C-SB	1	C	3.235 U	0.889 U	0.889 U	0.889 U	3.051 U	0.889 U	0.634 U	0.348 U	8.889 U
C-SB	2	D	3.378 U	0.928 U	0.928 U	0.928 U	3.186 U	0.928 U	0.663 U	0.363 U	9.284 U
C-SB	3	B	3.744 U	1.029 U	1.029 U	1.029 U	3.531 U	1.029 U	0.734 U	0.402 U	10.289 U
C-SB	4	A	2.591 U	0.712 U	0.712 U	0.712 U	2.444 U	0.712 U	0.508 U	0.278 U	7.122 U
C-SB	5	D	2.868 U	0.788 U	0.788 U	0.788 U	2.705 U	0.788 U	0.563 U	0.308 U	7.883 U
C-NE	1	B	2.318 U	0.637 U	0.637 U	0.637 U	2.186 U	0.637 U	0.455 U	0.249 U	6.370 U
C-NE	2	B	2.728 U	0.750 U	0.750 U	0.750 U	2.573 U	0.750 U	0.535 U	0.293 U	7.496 U
C-NE	3	B	2.685 U	0.738 U	0.738 U	0.738 U	2.532 U	0.738 U	0.526 U	0.288 U	7.377 U
C-NE	4	B	3.004 U	0.826 U	0.826 U	0.826 U	2.834 U	0.826 U	0.589 U	0.323 U	8.257 U
C-NE	5	B	3.308 U	0.909 U	0.909 U	0.909 U	3.120 U	0.909 U	0.649 U	0.355 U	9.092 U
MSL Background	1	E	1.700 U	0.467 U	0.467 U	0.467 U	1.603 U	0.467 U	0.333 U	0.183 U	4.672 U
MSL Background	2	E	1.708 U	0.469 U	0.469 U	0.469 U	1.611 U	0.469 U	0.335 U	0.183 U	4.693 U
MSL Background	3	E	1.705 U	0.469 U	0.469 U	0.469 U	1.608 U	0.469 U	0.334 U	0.183 U	4.686 U
MSL Background	4	E	1.722 U	0.473 U	0.473 U	0.473 U	1.624 U	0.473 U	0.338 U	0.185 U	4.733 U
MSL Background	5	E	1.705 U	0.468 U	0.468 U	0.468 U	1.608 U	0.468 U	0.334 U	0.183 U	4.684 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

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

(d) E Value an estimate; analyte not detected on confirmation column.

TABLE K.14. Quality Control Data for Pesticides (alphabetical, Aldrin - 4,4-DDT), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

			<i>N. caecoides</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)								
Sediment Treatment	Replicate	Analytical Batch	Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-DDD	4,4-DDE	4,4-DDT
Method Blank											
Blank	1	A	0.401 U ^(a)	0.410 U	0.410 U	0.410 U	0.410 U	11.758 U	0.276 U	0.559 U	0.863 U
Blank	2	B	0.289 J ^(b) E ^(c)	0.345 U	0.345 U	2.190 E	0.368	9.876 U	0.232 U	0.470 U	0.725 U
Blank	3	C	0.373 JE	0.385 U	0.182 J	0.385 U	0.269 J	11.024 U	0.259 U	0.524 U	4.893 E
Blank	4	D	0.353 U	0.362 U	0.362 U	0.362 U	0.362 U	10.370 U	0.244 U	0.493 U	0.761 U
Matrix Spikes											
Background JW01	1	E	0.241 U	0.247 U	0.247 U	0.247 U	0.247 U	7.098 U ^(d)	0.167 U	0.338 U	0.521 U
Background MS	1	A	6.768	4.100	7.174	8.339	7.300	NA ^(d)	5.773	7.447	3.660
Concentration Recovered			6.768	4.100	7.174	8.339	7.300	NA	5.773	7.447	3.660
Spike Amount			7.988	7.988	7.988	7.988	7.988	NS ^(e)	7.988	7.988	7.988
Percent Recovery			85%	51%	90%	104%	91%	NA	72%	93%	46%
Background JW01	1	E	0.241 U	0.247 U	0.247 U	0.247 U	0.247 U	7.093 U	0.167 U	0.337 U	0.520 U
Background MSD	1	A	5.836	3.927	6.425	9.743	6.383	NA	5.738	6.901	3.092
Concentration Recovered			5.836	3.927	6.425	9.743	6.383	NA	5.738	6.901	3.092
Spike Amount			7.982	7.982	7.982	7.982	7.982	NS	7.982	7.982	7.982
Percent Recovery			73%	49%	80%	122% ^(f)	80%	NA	72%	86%	39% ^(f)
MS/MSD RPD			15%	4%	11%	16%	13%	NA	1%	8%	17%
MS/MSD I-STAT			0.074	0.021	0.055	0.078	0.067	NA	0.003	0.038	0.084
Background JW01	2	E	0.241 U	0.247 U	0.247 U	0.247 U	0.247 U	7.080 U	0.167 U	0.337 U	0.520 U
Background MS	2	B	7.754	5.510	7.516	8.786	7.952	NA	9.792	4.358	5.404
Concentration Recovered			7.754	5.510	7.516	8.786	7.952	NA	9.792	4.358	5.404
Spike Amount			7.967	7.967	7.967	7.967	7.967	NS	7.967	7.967	7.967
Percent Recovery			97%	69%	94%	110%	100%	NA	123% ^(f)	55%	68%
Background JW01	2	E	0.241 U	0.247 U	0.247 U	0.247 U	0.247 U	7.074 U	0.167 U	0.336 U	0.519 U
Background MSD	2	B	6.955	5.042	6.707	7.988	7.153	NA	8.332	4.756	4.522
Concentration Recovered			6.955	5.042	6.707	7.988	7.153	NA	8.332	4.756	4.522
Spike Amount			7.960	7.960	7.960	7.960	7.960	NS	7.960	7.960	7.960
Percent Recovery			87%	63%	84%	100%	90%	NA	105%	60%	57%
MS/MSD RPD			11%	9%	11%	9%	10%	NA	16%	9%	18%
MS/MSD I-STAT			0.054	0.044	0.056	0.047	0.052	NA	0.080	0.044	0.088

TABLE K.14. (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	Chlordane	4,4-DDD	4,4-DDE	4,4-DDT
Background JW01	3	E	0.240 U	0.246 U	0.246 U	0.246	0.246	7.063 U	0.166 U	0.336 U	0.518 U
Background MS	3	C	7.480	5.785	7.678	9.869	8.371	NA	10.402	4.000	6.776
Concentration Recovered			7.480	5.785	7.678	9.869	8.371	NA	10.402	4.000	6.776
Spike Amount			7.948	7.948	7.948	7.948	7.948	NS	7.948	7.948	7.948
Percent Recovery			94%	73%	97%	124 ^(f)	105%	NA	131 ^(f)	50%	85%
Background JW01	3	E	0.239 U	0.245 U	0.245 U	0.245 U	0.245 U	7.040 U	0.166 U	0.335 U	0.517 U
Background MSD	3	C	6.187	5.197	6.871	8.874	7.418	NA	8.385	3.608	5.070
Concentration Recovered			6.187	5.197	6.871	8.874	7.418	NA	8.385	3.608	5.070
Spike Amount			7.922	7.922	7.922	7.922	7.922	NS	7.922	7.922	7.922
Percent Recovery			78%	66%	87%	112%	94%	NA	106%	46%	64%
MS/MSD RPD			19%	10%	11%	10%	12%	NA	21%	10%	28%
MS/MSD I-STAT			0.093	0.052	0.054	0.051	0.059	NA	0.106	0.050	0.142
Background JW01	4	E	0.241 U	0.247 U	0.247 U	0.247 U	0.247 U	7.090 U	0.167 U	0.337 U	0.520 U
Background MS	4	D	7.565	5.853	7.670	8.782	7.847	NA	7.570	5.388	4.921
Concentration Recovered			7.565	5.853	7.670	8.782	7.847	NA	7.570	5.388	4.921
Spike Amount			7.978	7.978	7.978	7.978	7.978	NS	7.978	7.978	7.978
Percent Recovery			95%	73%	96%	110%	98%	NA	95%	68%	62%
Background JW01	4	E	0.235 U	0.241 U	0.241 U	0.241 U	0.241 U	6.918 U	0.163 U	0.329 U	0.508 U
Background MSD	4	D	6.841	5.639	7.369	8.221	7.486	NA	7.564	5.048	4.801
Concentration Recovered			6.841	5.639	7.369	8.221	7.486	NA	7.564	5.048	4.801
Spike Amount			7.785	7.785	7.785	7.785	7.785	NS	7.785	7.785	7.785
Percent Recovery			88%	72%	95%	106%	96%	NA	97%	65%	62%
MS/MSD RPD			8%	1%	2%	4%	2%	NA	2%	4%	0%
MS/MSD I-STAT			0.038	0.006	0.008	0.021	0.011	NA	0.012	0.020	0.000
<u>Standard Reference Material</u>											
Certified value			NC ^(g)	NC	NC	NC	NC	NC	10.0 ± 1.0	4.6 ± 0.2	0.25 ± 0.2
SRM 1974	1	A	NA	NA	NA	NA	NA	NA	NM ^(h)	6.070	NM
SRM 1974	2	B	NA	NA	NA	NA	NA	NA	5.600	3.880	0.330 J
SRM 1974	3	C	NA	NA	NA	NA	NA	NA	5.600	4.060	0.610
SRM 1974	4	D	NA	NA	NA	NA	NA	NA	NM	5.620	0.910

TABLE K.14. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Pesticides (µg/kg wet weight)								
			Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	4,4-DDD	4,4-ODE	4,4-DDT
<u>Analytical Replicates</u>											
COMP I Replicate 1	5	A	1.275 U	1.305 U	1.305 U	1.305 U	1.305 U	37.415 U	0.798 J	1.978	2.745 U
COMP I Replicate 2	5	A	1.173 U	1.201 U	1.201 U	1.201 U	1.201 U	34.426 U	0.630 J	2.087	2.525 U
COMP I Replicate 3	5	A	0.864 U	0.885 U	0.885 U	0.885 U	0.885 U	25.362 U	0.978	2.132	1.861 U
RSD			NA	NA	NA	NA	NA	NA	22%	4%	NA
COMP IV Replicate 1	2	C	1.252 U	1.282 U	1.282 U	1.282 U	1.282 U	36.757 U	0.864 U	0.351 J	2.696 U
COMP IV Replicate 2	2	C	1.589 U	1.627 U	1.627 U	1.627 U	1.627 U	46.646 U	1.096 U	2.218 U	3.422 U
COMP IV Replicate 3	2	C	1.118 U	1.144 U	1.144 U	1.144 U	1.144 U	32.805 U	0.771 U	0.065 J	2.407 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	4	B	1.157 U	1.185 U	1.185 U	1.185 U	1.185 U	33.965 U	0.798 U	0.700 J	2.492 U
R-AM Replicate 2	4	B	1.769 U	1.812 U	1.812 U	1.812 U	1.812 U	51.928 U	1.221 U	2.469 U	3.809 U
R-AM Replicate 3	4	B	0.634 U	0.649 U	0.649 U	0.649 U	0.649 U	18.600 U	0.437 U	0.553 J	1.364 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-OS Replicate 1	2	D	0.957 U	0.980 U	0.980 U	0.980 U	0.980 U	28.098 U	0.660 U	2.171	2.061 U
R-OS Replicate 2	2	D	0.776 U	0.795 U	0.795 U	0.795 U	0.795 U	22.785 U	0.536 U	1.837	1.671 U
R-OS Replicate 3	2	D	0.939 U	0.961 U	0.961 U	0.961 U	0.961 U	27.554 U	0.648 U	1.724	2.021 U
RSD			NA	NA	NA	NA	NA	NA	NA	12%	NA

(a) U The analyte was not present above the level of the associated value.

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

(c) E Value an estimate; analyte not detected on confirmation column.

(d) NA Not applicable.

(e) NS Not spiked.

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

(g) NC Not certified.

(h) NM Not measured.

TABLE K.15. Quality Control Data for Pesticides (alphabetical, Dieldrin - Toxaphene), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ 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
Method Blank											
Blank	1	A	4.279 U ^(a)	1.176 U	1.176 U	1.176 U	4.035 U	1.176 U	0.839 U	0.460 U	11.758 U
Blank	2	B	3.594 U	0.988 U	0.988 U	0.988 U	3.389 U	0.988 U	0.705 U	0.386 U	9.876 U
Blank	3	C	4.011 U	1.102 U	1.102 U	1.102 U	1.628 U ^(b)	1.102 U	0.787 U	0.431 U	11.024 U
Blank	4	D	3.774 U	1.037 U	1.037 U	1.037 U	3.559 U ^(c)	1.037 U	0.740 U	0.405 U	10.370 U
Matrix Spikes											
Background JW01	1	E	2.583 U	0.710 U	0.710 U	0.710 U	2.436 U	0.710 U	0.507 U	0.277 U	7.098 U ^(d)
Background MS	1	A	6.142	4.699	11.385	11.016	7.907	5.194	8.261	6.079	NA
Concentration Recovered			6.142	4.699	11.385	11.016	7.907	5.194	8.261	6.079	NA
Spike Amount			7.988	7.988	7.988	7.988	7.988	7.988	7.988	7.988	NS ^(e)
Percent Recovery			77%	59%	143% ^(f)	138% ^(f)	99%	65%	103%	76%	NA
Background JW01	1	E	2.581 U	0.710 U	0.710 U	0.710 U	2.434 U	0.710 U	0.506 U	0.277 U	7.093 U
Background MSD	1	A	5.685	6.735	9.950	10.739	7.004	4.959	7.590	5.382	NA
Concentration Recovered			5.685	6.735	9.950	10.739	7.004	4.959	7.590	5.382	NA
Spike Amount			7.982	7.982	7.982	7.982	7.982	7.982	7.982	7.982	NS
Percent Recovery			71%	84%	125% ^(f)	135% ^(f)	88%	62%	95%	67%	NA
MS/MSD RPD			8%	36% ^(g)	13%	2%	12%	5%	8%	12%	NA
MS/MSD I-STAT			0.038	0.178	0.067	0.012	0.060	0.023	0.042	0.060	NA
Background JW01	2	E	2.576 U	0.708 U	0.708 U	0.708 U	2.430 U	0.708 U	0.505 U	0.277 U	7.080 U
Background MS	2	B	7.087	6.841	12.246	10.701	14.769	2.865	8.965	7.458	NA
Concentration Recovered			7.087	6.841	12.246	10.701	14.769	2.865	8.965	7.458	NA
Spike Amount			7.967	7.967	7.967	7.967	7.967	7.967	7.967	7.967	NS
Percent Recovery			89%	86%	154% ^(f)	134% ^(f)	185% ^(f)	36% ^(f)	113%	94%	NA
Background JW01	2	E	2.574 U	0.708 U	0.708 U	0.708 U	2.427 U	0.708 U	0.505 U	0.276 U	7.074 U
Background MSD	2	B	6.016	5.818	10.372	9.337	11.343	2.173	8.180	6.249	NA
Concentration Recovered			6.016	5.818	10.372	9.337	11.343	2.173	8.180	6.249	NA
Spike Amount			7.960	7.960	7.960	7.960	7.960	7.960	7.960	7.960	NS
Percent Recovery			76%	73%	130% ^(f)	117%	142% ^(f)	27% ^(f)	103%	79%	NA
MS/MSD RPD			16%	16%	16%	14%	26%	27%	9%	18%	NA
MS/MSD I-STAT			0.081	0.080	0.082	0.068	0.131	0.137	0.045	0.088	NA

TABLE K.15. (contd)

<i>N. coecoides</i> Pesticides ($\mu\text{g/kg}$ 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
Background JW01	3	E	2.570 U	0.707 U	0.707 U	0.707 U	2.424 U	0.707 U	0.504 U	0.276 U	7.063 U
Background MS	3	C	7.408	6.617	11.722	13.865	17.087	3.492	8.533	7.579	NA
Concentration Recovered			7.408	6.617	11.072	13.865	17.087	3.492	8.533	7.579	NA
Spike Amount			7.948	7.948	7.948 (f)	7.948 (f)	7.948 (f)	7.948	7.948	7.948	NS
Percent Recovery			93%	83%	139%	174%	215%	44%	107%	95%	NA
Background JW01	3	E	2.562 U	0.704 U	0.704 U	0.704 U	2.416 U	0.704 U	0.503 U	0.275 U	7.040 U
Background MSD	3	C	6.049	5.045	9.911	12.299	13.228	2.933	7.331	5.836	NA
Concentration Recovered			6.049	5.045	9.911	12.299	13.228	2.933	7.331	5.836	NA
Spike Amount			7.922	7.922	7.922 (f)	7.922 (f)	7.922 (f)	7.922 (f)	7.922	7.922	NS
Percent Recovery			76%	64%	125%	155%	167%	37%	93%	74%	NA
MS/MSD RPD			20%	27%	11%	12%	25%	17%	15%	26%	NA
MS/MSD I-STAT			0.099	0.133	0.054	0.058	0.126	0.085	0.074	0.128	NA
Background JW01	4	E	2.580 U	0.709 U	0.709 U	0.709 U	2.433 U	0.709 U	0.506 U	0.277 U	7.090 U
Background MS	4	D	7.036	6.046	11.626	11.529	8.896	1.059	8.724	6.749	NA
Concentration Recovered			7.036	6.046	11.626	11.529	8.896	1.059	8.724	6.749	NA
Spike Amount			7.978	7.978	7.978 (f)	7.978 (f)	7.978	7.978 (f)	7.978	7.978	NS
Percent Recovery			88%	76%	146%	145%	112%	13%	109%	85%	NA
Background JW01	4	E	2.518 U	0.692 U	0.692 U	0.692 U	2.374 U	0.692 U	0.494 U	0.270 U	6.918 U
Background MSD	4	D	6.780	5.574	11.573	11.162	8.724	1.132	8.451	6.599	NA
Concentration Recovered			6.780	5.574	11.573	11.162	8.724	1.132	8.451	6.599	NA
Spike Amount			7.785	7.785	7.785 (f)	7.785 (f)	7.785	7.785 (f)	7.785	7.785	NS
Percent Recovery			87%	72%	149%	143%	112%	15%	109%	85%	NA
MS/MSD RPD			1%	6%	2%	1%	1%	9%	1%	0%	NA
MS/MSD I-STAT			0.006	0.028	0.010	0.004	0.003	0.046	0.004	0.001	NA
<u>Standard Reference Material</u>											
Certified Value			3.6 ± 0.2	NC ^(h)	NC	NC	NC	NC	NC	NC	NC
SRM 1974	1	A	1.490 J	NA	NA	NA	NA	NA	NA	NA	NA
SRM 1974	2	B	1.290 J	NA	NA	NA	NA	NA	NA	NA	NA
SRM 1974	3	C	1.270 J	NA	NA	NA	NA	NA	NA	NA	NA
SRM 1974	4	D	1.840 J	NA	NA	NA	NA	NA	NA	NA	NA

TABLE K.15. (contd)

<i>N. caecoides</i> Pesticides ($\mu\text{g/kg}$ 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>Analytical Replicates</u>											
COMP I Replicate 1	5	A	13.615 U	3.742 U	3.742 U	3.742 U	12.841 U	3.742 U	2.670 U	1.463 U	37.415 U
COMP I Replicate 2	5	A	12.527 U	3.443 U	3.443 U	3.443 U	11.815 U	3.443 U	2.457 U	1.346 U	34.426 U
COMP I Replicate 3	5	A	9.229 U	2.536 U	2.536 U	2.536 U	8.704 U	2.536 U	1.810 U	0.991 U	25.362 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
COMP IV Replicate 1	2	C	13.375 U	3.676 U	3.676 U	3.676 U	12.615 U	3.676 U	2.623 U	1.437 U	36.757 U
COMP IV Replicate 2	2	C	16.974 U	4.665 U	4.665 U	4.665 U	16.009 U	4.665 U	3.329 U	1.823 U	46.646 U
COMP IV Replicate 3	2	C	11.937 U	3.281 U	3.281 U	3.281 U	11.258 U	3.281 U	2.341 U	1.282 U	32.805 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-AM Replicate 1	4	B	12.359 U	3.397 U	3.397 U	3.397 U	11.656 U	3.397 U	2.424 U	1.328 U	33.965 U
R-AM Replicate 2	4	B	18.896 U	5.193 U	5.193 U	5.193 U	17.821 U	5.193 U	3.706 U	2.030 U	51.928 U
R-AM Replicate 3	4	B	6.768 U	1.860 U	1.860 U	1.860 U	6.383 U	1.860 U	1.327 U	0.727 U	18.600 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
R-OS Replicate 1	2	D	10.225 U	2.810 U	2.810 U	2.810 U	9.643 U	2.810 U	2.005 U	1.098 U	28.098 U
R-OS Replicate 2	2	D	8.291 U	2.279 U	2.279 U	2.279 U	7.820 U	2.279 U	1.626 U	0.891 U	22.765 U
R-OS Replicate 3	2	D	10.026 U	2.755 U	2.755 U	2.755 U	9.456 U	2.755 U	1.966 U	1.077 U	27.554 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (c) E Value an estimate: analyte not detected on confirmation column.
 (d) NA Not applicable.
 (e) NS Not spiked.
 (f) Recovery outside quality control range (40%-120%).
 (g) Value exceeds relative precision range of 30%.
 (h) NC Not certified.

TABLE K.16. Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

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 I	1	D	16.00	71.700 U ^(a)	71.700 U	86.325	71.700 U
COMP I	2	D	15.28	48.154 U	48.154 U	134.889	48.154 U
COMP I	3	A	16.50 ^(b)	54.933 U	54.933 U	54.933 U ^(c)	54.933 U
COMP I	4	B	17.16	194.493 U	194.493 U	96.929 U	194.493 U
COMP I Replicate 1	5	A	17.54	213.312 U	213.312 U	70.678 J	213.312 U
COMP I Replicate 2	5	A	17.54	196.271 U	196.271 U	111.608 J	196.271 U
COMP I Replicate 3	5	A	17.54	144.595 U	144.595 U	105.838 J	144.595 U
COMP II	1	D	15.12	46.052 U	46.052 U	144.405	46.052 U
COMP II	2	A	17.08	86.803 U	86.803 U	144.865	86.803 U
COMP II	3	C	17.30	47.312 U	47.312 U	181.416	47.312 U
COMP II	4	D	15.82	62.933 U	62.933 U	194.362	62.933 U
COMP II	5	C	16.64	47.873 U	47.873 U	196.064	47.873 U
COMP III	1	C	14.77	66.628 U	66.628 U	99.127	66.628 U
COMP III	2	D	16.64	55.541 U	55.541 U	67.464	55.541 U
COMP III	3	A	15.35	49.681 U	49.681 U	59.954	49.681 U
COMP III	4	D	16.35	51.933 U	51.933 U	66.043	51.933 U
COMP III	5	C	15.26	67.405 U	67.405 U	85.046	67.405 U
TC-5 Upper Comp	1	C	15.40	91.662 U	91.662 U	485.675	91.662 U
TC-5 Upper Comp	2	C	15.92	53.989 U	53.989 U	407.104	53.989 U
TC-5 Upper Comp	3	C	16.93	73.768 U	73.768 U	498.494	73.768 U
TC-5 Upper Comp	4	A	15.87	77.618 U	77.618 U	337.051	77.618 U
TC-5 Upper Comp	5	A	16.58	254.759 U	254.759 U	323.764	254.759 U
COMP IV	1	C	16.16	52.574 U	52.574 U	50.000 J	52.574 U
COMP IV Replicate 1	2	C	16.46	223.311 U	223.311 U	223.311 U	223.311 U
COMP IV Replicate 2	2	C	16.46	283.390 U	283.390 U	283.390 U	283.390 U
COMP IV Replicate 3	2	C	16.46	199.301 U	199.301 U	199.301 U	199.301 U
COMP IV	3	A	11.15	142.314 U	142.314 U	142.314 U	142.314 U
COMP IV	4	C	16.04	63.036 U	63.036 U	63.036 U	63.036 U
COMP IV	5	A	13.09	134.362 U	134.362 U	134.362 U	134.362 U
COMP V	1	A	15.27	59.614 U	59.614 U	375.403	59.614 U
COMP V	2	A	14.83	70.931 U	70.931 U	333.196	70.931 U
COMP V	3	A	17.13	43.030 U	43.030 U	282.703	43.030 U
COMP V	4	D	15.44	67.370 U	67.370 U	242.817	67.370 U
COMP V	5	B	17.14	38.028 U	38.028 U	354.947	38.028 U
COMP VI	1	C	15.08	70.889 U	70.889 U	369.503	70.889 U
COMP VI	2	A	15.83	54.327 U	54.327 U	338.661	54.327 U
COMP VI	3	B	16.25	61.458 U	61.458 U	338.437	61.458 U
COMP VI	4	A	15.89	63.411 U	63.411 U	310.818	63.411 U
COMP VI	5	D	16.24	190.739 U	190.739 U	456.299	190.739 U
R-AC	1	B	15.84	84.855 U	84.855 U	274.318	84.855 U
R-AC	2	C	16.14	186.394 U	186.394 U	214.572	186.394 U
R-AC	3	C	16.16	58.645 U	58.645 U	204.969	58.645 U
R-AC	4	A	13.29	78.051 U	78.051 U	78.051 U	78.051 U
R-AC	5	D	16.75	48.352 U	48.352 U	160.436	48.352 U
R-AM	1	B	17.29	51.579 U	51.579 U	51.579 U	51.579 U
R-AM	2	C	16.62	41.793 U	41.793 U	97.497	41.793 U
R-AM	3	B	16.26	42.841 U	42.841 U	97.638	42.841 U

TABLE K.16. (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
R-AM Replicate 1	4	B	16.61	204.485 U	204.485 U	132.715 J	204.485 U
R-AM Replicate 2	4	B	16.61	312.631 U	312.631 U	104.371 J	312.631 U
R-AM Replicate 3	4	B	16.61	111.981 U	111.981 U	74.485 J	111.981 U
R-AM	5	B	11.30	67.319 U	67.319 U	133.115	67.319 U
R-BF	1	D	16.72	79.755 U	79.755 U	111.417	79.755 U
R-BF	2	B	13.79	111.972 U	111.972 U	222.255	111.972 U
R-BF	3	B	15.57	56.480 U	56.480 U	132.177	56.480 U
R-BF	4	A	15.24	70.472 U	70.472 U	189.573	70.472 U
R-BF	5	A	16.05	68.019 U	68.019 U	104.125	68.019 U
R-OS	1	B	15.79	50.481 U	50.481 U	50.481 U	50.481 U
R-OS Replicate 1	2	D	16.53	169.982 U	169.982 U	169.982 U	169.982 U
R-OS Replicate 2	2	D	16.53	137.840 U	137.840 U	137.840 U	137.840 U
R-OS Replicate 3	2	D	16.53	166.691 U	166.691 U	166.691 U	166.691 U
R-OS	3	B	15.02	55.772 U	55.772 U	55.772 U	55.772 U
R-OS	4	D	17.85	51.468 U	51.468 U	51.468 U	51.468 U
R-OS	5	C	17.02	52.861 U	52.861 U	52.861 U	52.861 U
R-PF	1	C	13.90	66.144 U	66.144 U	66.144 U	66.144 U
R-PF	2	C	13.46	77.303 U	77.303 U	77.303 U	77.303 U
R-PF	3	D	16.88	50.190 U	50.190 U	50.190 U	50.190 U
R-PF	4	D	16.74	43.124 U	43.124 U	43.124 U	43.124 U
R-PF	5	A	16.47	64.299 U	64.299 U	64.299 U	64.299 U
C-SB	1	C	14.29	62.204 U	62.204 U	62.204 U	62.204 U
C-SB	2	D	16.03	57.916 U	57.916 U	57.916 U	57.916 U
C-SB	3	B	15.65	65.744 U	65.744 U	17.169 J	65.744 U
C-SB	4	A	16.06	44.346 U	44.346 U	44.346 U	44.346 U
C-SB	5	D	16.46	47.892 U	47.892 U	35.571 J	47.892 U
C-NE	1	B	15.94	39.962 U	39.962 U	39.962 U	39.962 U
C-NE	2	B	18.40	40.739 U	40.739 U	40.739 U	40.739 U
C-NE	3	B	16.01	46.077 U	46.077 U	23.348 J	46.077 U
C-NE	4	B	15.81	52.226 U	52.226 U	52.226 U	52.226 U
C-NE	5	B	15.28	59.503 U	59.503 U	57.788	59.503 U
MSL Background	1	E	19.82	23.572 U	23.572 U	23.572 U	23.572 U
MSL Background	2	E	19.82	23.678 U	23.678 U	23.678 U	23.678 U
MSL Background	3	E	19.82	23.643 U	23.643 U	23.643 U	23.643 U
MSL Background	4	E	19.82	23.880 U	23.880 U	23.880 U	23.880 U
MSL Background	5	E	19.82	23.633 U	23.633 U	23.633 U	23.633 U

(a) U The analyte was not present above the level of the associated value.

(b) Percent dry weight was averaged from the other four replicates of COMP I.

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

TABLE K.17. Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

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)			20.0	20.0	20.0	20.0
Achieved OL Low			4.672	4.672	4.672	4.672
Achieved OL High			51.928	51.928	46.646	51.928
COMP I	1	D	11.472 U ^(b)	11.472 U	13.812	11.472 U
COMP I	2	D	7.358 U	7.358 U	20.611	7.358 U
COMP I	3	A	9.064 U	9.064 U	9.064 U ^(c)	9.064 U
COMP I	4	B	33.375 U	33.375 U	16.633 J	33.375 U
COMP I Replicate 1	5	A	37.415 U	37.415 U	12.397 J	37.415 U
COMP I Replicate 2	5	A	34.426 U	34.426 U	19.576 J	34.426 U
COMP I Replicate 3	5	A	25.362 U	25.362 U	18.564 J	25.362 U
COMP II	1	D	6.963 U	6.963 U	21.834	6.963 U
COMP II	2	A	14.826 U	14.826 U	24.743	14.826 U
COMP II	3	C	8.185 U	8.185 U	31.385	8.185 U
COMP II	4	D	9.956 U	9.956 U	30.748	9.956 U
COMP II	5	C	7.966 U	7.966 U	32.625	7.966 U
COMP III	1	C	9.841 U	9.841 U	14.641	9.841 U
COMP III	2	D	9.242 U	9.242 U	11.226	9.242 U
COMP III	3	A	7.626 U	7.626 U	9.203	7.626 U
COMP III	4	D	8.491 U	8.491 U	10.798	8.491 U
COMP III	5	C	10.286 U	10.286 U	12.978	10.286 U
TC-5 Upper Comp	1	C	14.116 U	14.116 U	74.794	14.116 U
TC-5 Upper Comp	2	C	8.595 U	8.595 U	64.811	8.595 U
TC-5 Upper Comp	3	C	12.489 U	12.489 U	84.395	12.489 U
TC-5 Upper Comp	4	A	12.318 U	12.318 U	53.490	12.318 U
TC-5 Upper Comp	5	A	42.239 U	42.239 U	53.680	42.239 U
COMP IV	1	C	8.496 U	8.496 U	8.080 J	8.496 U
COMP IV Replicate 1	2	C	36.757 U	36.757 U	36.757 U	36.757 U
COMP IV Replicate 2	2	C	46.646 U	46.646 U	46.646 U	46.646 U
COMP IV Replicate 3	2	C	32.805 U	32.805 U	32.805 U	32.805 U
COMP IV	3	A	15.868 U	15.868 U	15.868 U	15.868 U
COMP IV	4	C	10.111 U	10.111 U	10.111 U	10.111 U
COMP IV	5	A	17.588 U	17.588 U	17.588 U	17.588 U
COMP V	1	A	9.103 U	9.103 U	57.324	9.103 U
COMP V	2	A	10.519 U	10.519 U	49.413	10.519 U
COMP V	3	A	7.371 U	7.371 U	48.427	7.371 U
COMP V	4	D	10.402 U	10.402 U	37.491	10.402 U
COMP V	5	B	6.518 U	6.518 U	60.838	6.518 U
COMP VI	1	C	10.690 U	10.690 U	55.721	10.690 U
COMP VI	2	A	8.600 U	8.600 U	53.610	8.600 U
COMP VI	3	B	9.987 U	9.987 U	54.996	9.987 U
COMP VI	4	A	10.076 U	10.076 U	49.389	10.076 U
COMP VI	5	D	30.976 U	30.976 U	74.103	30.976 U
R-AC	1	B	13.441 U	13.441 U	43.452	13.441 U
R-AC	2	C	30.084 U	30.084 U	34.632	30.084 U
R-AC	3	C	9.477 U	9.477 U	33.123	9.477 U
R-AC	4	A	10.373 U	10.373 U	10.373 U	10.373 U
R-AC	5	D	8.099 U	8.099 U	26.873	8.099 U

TABLE K.17. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> PC8s ($\mu\text{g}/\text{kg}$ wet weight)			
			Aroclor- 1242	Aroclor- 1248	Aroclor- 1254	Aroclor- 1260
R-AM	1	B	8.918 U	8.918 U	8.918 U	8.918 U
R-AM	2	C	6.946 U	6.946 U	16.204	6.946 U
R-AM	3	B	6.966 U	6.966 U	15.876	6.966 U
R-AM Replicate 1	4	B	33.965 U	33.965 U	22.044 J	33.965 U
R-AM Replicate 2	4	B	51.928 U	51.928 U	17.336 J	51.928 U
R-AM Replicate 3	4	B	18.600 U	18.600 U	12.372 J	18.600 U
R-AM	5	B	7.607 U	7.607 U	15.042	7.607 U
R-BF	1	D	13.335 U	13.335 U	18.629	13.335 U
R-BF	2	B	15.441 U	15.441 U	30.649	15.441 U
R-BF	3	B	8.794 U	8.794 U	20.580	8.794 U
R-BF	4	A	10.740 U	10.740 U	28.891	10.740 U
R-BF	5	A	10.917 U	10.917 U	16.712	10.917 U
R-OS	1	B	7.971 U	7.971 U	7.971 U	7.971 U
R-OS Replicate 1	2	D	28.098 U	28.098 U	28.098 U	28.098 U
R-OS Replicate 2	2	D	22.785 U	22.785 U	22.785 U	22.785 U
R-OS Replicate 3	2	D	27.554 U	27.554 U	27.554 U	27.554 U
R-OS	3	B	8.377 U	8.377 U	8.377 U	8.377 U
R-OS	4	D	9.187 U	9.187 U	9.187 U	9.187 U
R-OS	5	C	8.997 U	8.997 U	8.997 U	8.997 U
R-PF	1	C	9.194 U	9.194 U	9.194 U	9.194 U
R-PF	2	C	10.405 U	10.405 U	10.405 U	10.405 U
R-PF	3	D	8.472 U	8.472 U	8.472 U	8.472 U
R-PF	4	D	7.219 U	7.219 U	7.219 U	7.219 U
R-PF	5	A	10.590 U	10.590 U	10.590 U	10.590 U
C-SB	1	C	8.889 U	8.889 U	8.889 U	8.889 U
C-SB	2	D	9.284 U	9.284 U	9.284 U	9.284 U
C-SB	3	B	10.289 U	10.289 U	2.687 J	10.289 U
C-SB	4	A	7.122 U	7.122 U	7.122 U	7.122 U
C-SB	5	D	7.883 U	7.883 U	5.855 J	7.883 U
C-NE	1	B	6.370 U	6.370 U	6.370 U	6.370 U
C-NE	2	B	7.496 U	7.496 U	7.496 U	7.496 U
C-NE	3	B	7.377 U	7.377 U	3.738 J	7.377 U
C-NE	4	B	8.257 U	8.257 U	8.257 U	8.257 U
C-NE	5	B	9.092 U	9.092 U	8.830	9.092 U
MSL Background	1	E	4.672 U	4.672 U	4.672 U	4.672 U
MSL Background	2	E	4.693 U	4.693 U	4.693 U	4.693 U
MSL Background	3	E	4.686 U	4.686 U	4.686 U	4.686 U
MSL Background	4	E	4.733 U	4.733 U	4.733 U	4.733 U
MSL Background	5	E	4.684 U	4.684 U	4.684 U	4.684 U

(a) DL Detection limit.

(b) U The analyte was not present above the level of the associated value.

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

TABLE K.18. Quality Control Data for Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

N. caecoides PCBs (µg/kg wet weight)						
Sediment Treatment	Replicate	Analytical Batch	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
Method Blank						
Blank	1	A	11.758 U ^(a)	11.758 U	11.758 U	11.758 U
Blank	2	B	9.876 U	9.876 U	9.876 U	9.876 U
Blank	3	C	11.024 U	11.024 U	11.024 U	11.024 U
Blank	4	D	10.370 U	10.370 U	10.370 U	10.370 U
Matrix Spikes						
Background JW01	1	E	7.098 U	7.098 U	7.098 U	7.098 U
Background MS	1	A	NA ^(b)	NA	204.861	NA
Concentration Recovered			NA	NA	204.861	NA
Spike Amount			NS ^(c)	NS	199.700	NS
Percent Recovery			NA	NA	103%	NA
Background JW01	1	E	7.093 U	7.093 U	7.093 U	7.093 U
Background MSD	1	A	NA	NA	217.575	NA
Concentration Recovered			NA	NA	217.575	NA
Spike Amount			NS	NS	199.561	NS
Percent Recovery			NA	NA	109%	NA
MS/MSD RPD			NA	NA	6%	NA
MS/MSD I-STAT			NA	NA	0.030	NA
Background JW01	2	E	7.080 U	7.080 U	7.080 U	7.080 U
Background MS	2	B	NA	NA	236.945	NA
Concentration Recovered			NA	NA	236.945	NA
Spike Amount			NS	NS	199.183	NS
Percent Recovery			NA	NA	119%	NA
Background JW01	2	E	7.074 U	7.074 U	7.074 U	7.074 U
Background MSD	2	B	NA	NA	258.947	NA
Concentration Recovered			NA	NA	258.947	NA
Spike Amount			NS	NS	190.386	NS
Percent Recovery			NA	NA	136% ^(d)	NA
MS/MSD RPD			NA	NA	13%	NA
MS/MSD I-STAT			NA	NA	0.067	NA
Background JW01	3	E	7.063 U	7.063 U	7.063 U	7.063 U
Background MS	3	C	NA	NA	250.742	NA
Concentration Recovered			NA	NA	250.742	NA
Spike Amount			NS	NS	198.708	NS
Percent Recovery			NA	NA	126% ^(d)	NA
Background JW01	3	E	7.040 U	7.040 U	7.040 U	7.040 U
Background MSD	3	-C	NA	NA	233.677	NA
Concentration Recovered			NA	NA	233.677	NA
Spike Amount			NS	NS	198.059	NS
Percent Recovery			NA	NA	118%	NA
MS/MSD RPD			NA	NA	7%	NA
MS/MSD I-STAT			NA	NA	0.034	NA

TABLE K.18. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> PCBs (Ug/kg wet weight)			
			Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
Background JW01	4	E	7.090 U	7.090 U	7.090 U	7.090 U
Background MS	4	D	NA	NA	260.392	NA
Concentration Recovered			NA	NA	260.392	NA
Spike Amount			NS	NS	199.461	NS
Percent Recovery			NA	NA	131% ^(d)	NA
Background JW01	4	E	6.918 U	6.918 U	6.918 U	6.918 U
Background MSD	4	D	NA	NA	265.016	NA
Concentration Recovered			NA	NA	265.016	NA
Spike Amount			NS	NS	194.628	NS
Percent Recovery			NA	NA	136% ^(d)	NA
MS/MSD RPD			NA	NA	4%	NA
MS/MSD I-STAT			NA	NA	0.021	NA

Standard Reference Material

Certified Value	NC ^(e)	NC	NC	NC
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No certified values for PCBs

Analytical Replicates

COMP I Replicate 1	5	A	37.415 U	37.415 U	12.397 J	37.415 U
COMP I Replicate 2	5	A	34.426 U	34.426 U	19.576 J	34.426 U
COMP I Replicate 3	5	A	25.362 U	25.362 U	18.564 J	25.362 U
RSD			NA	NA	23%	NA
COMP IV Replicate 1	2	C	36.757 U	36.757 U	36.757 U	36.757 U
COMP IV Replicate 2	2	C	46.646 U	46.646 U	46.646 U	46.646 U
COMP IV Replicate 3	2	C	32.805 U	32.805 U	32.805 U	32.805 U
RSD			NA	NA	NA	NA
R-AM Replicate 1	4	B	33.965 U	33.965 U	22.044 J	33.965 U
R-AM Replicate 2	4	B	51.928 U	51.928 U	17.336 J	51.928 U
R-AM Replicate 3	4	B	18.600 U	18.600 U	12.372 J	18.600 U
RSD			NA	NA	28%	NA
R-OS Replicate 1	2	D	28.098 U	28.098 U	28.098 U	28.098 U
R-OS Replicate 2	2	D	22.785 U	22.785 U	22.785 U	22.785 U
R-OS Replicate 3	2	D	27.554 U	27.554 U	27.554 U	27.554 U
RSD			NA	NA	NA	NA

(a) U The analyte was not present above the level of the associated value.

(b) NA Not applicable.

(c) NS Not spiked.

(d) Recovery outside quality control range (40%-120%).

(e) NC Not certified.

TABLE K.19. Surrogate Recoveries for Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs), in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recovery	
			DBOBF	TCN
COMP I	1	D	79.558	82.522
COMP I	2	D	79.116	89.707
COMP I	3	A	110.055	146.418 ^(a)
COMP I	4	B	90.758	105.876
COMP I Replicate 1	5	A	114.480	135.352 ^{(a)(b)}
COMP I Replicate 2	5	A	117.448	138.770 ^{(a)(b)}
COMP I Replicate 3	5	A	112.448	130.997 ^{(a)(b)}
COMP II	1	D	78.980	91.796
COMP II	2	A	114.606	139.123 ^{(a)(b)}
COMP II	3	C	88.292	120.157 ^{(a)(b)}
COMP II	4	D	83.010	96.455
COMP II	5	C	93.231	119.465
COMP III	1	C	99.694	126.547 ^{(a)(b)}
COMP III	2	D	72.474	85.009
COMP III	3	A	121.794 ^(a)	139.737 ^{(a)(b)}
COMP III	4	D	79.156	91.813
COMP III	5	C	101.803	129.973 ^{(a)(b)}
TC-5 Upper Comp	1	C	94.693	136.485 ^{(a)(b)}
TC-5 Upper Comp	2	C	94.562	142.026 ^{(a)(b)}
TC-5 Upper Comp	3	C	91.048	132.350 ^{(a)(b)}
TC-5 Upper Comp	4	A	104.062	144.144 ^{(a)(b)}
TC-5 Upper Comp	5	A	100.990	130.839 ^{(a)(b)}
COMP IV	1	C	85.370	120.286 ^{(a)(b)}
COMP IV Replicate 1	2	C	88.202	115.337
COMP IV Replicate 2	2	C	83.045	109.794
COMP IV Replicate 3	2	C	92.556	117.926
COMP IV	3	A	110.706	133.610 ^(a)
COMP IV	4	C	105.934	123.301 ^(a)
COMP IV	5	A	110.529	138.116 ^(a)
COMP V	1	A	99.513	149.387 ^{(a)(b)}
COMP V	2	A	110.406	154.163 ^{(a)(b)}
COMP V	3	A	96.027	134.254 ^{(a)(b)}
COMP V	4	D	91.815	85.077
COMP V	5	B	79.120	117.465
COMP VI	1	C	105.831	140.119 ^{(a)(b)}
COMP VI	2	A	116.499	177.336 ^{(a)(b)}
COMP VI	3	B	90.151	116.153
COMP VI	4	A	96.399	156.501 ^{(a)(b)}
COMP VI	5	D	71.955	91.176

TABLE K.19. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recovery	
			DBOBF	TCN
R-AC	1	B	82.153	109.391
R-AC	2	C	92.926	119.690
R-AC	3	C	98.454	130.892 ^{(a)(b)}
R-AC	4	A	103.461	148.186 ^(a)
R-AC	5	D	85.729	102.436
R-AM	1	B	50.485	63.866
R-AM	2	C	84.851	114.813
R-AM	3	B	89.180	113.874
R-AM Replicate 1	4	B	84.863	104.307
R-AM Replicate 2	4	B	78.798	98.497
R-AM Replicate 3	4	B	101.092	118.056
R-AM	5	B	91.903	119.754
R-BF	1	D	77.419	84.715
R-BF	2	B	90.541	115.737
R-BF	3	B	99.397	109.551
R-BF	4	A	105.398	135.470 ^{(a)(b)}
R-BF	5	A	107.930	132.623 ^{(a)(b)}
R-OS	1	B	89.635	109.906
R-OS Replicate 1	2	D	80.542	87.989
R-OS Replicate 2	2	D	73.741	84.256
R-OS Replicate 3	2	D	71.339	80.159
R-OS	3	B	88.998	108.127
R-OS	4	D	79.790	82.199
R-OS	5	C	91.504	110.396
R-PF	1	C	48.913	69.752
R-PF	2	C	80.523	103.443
R-PF	3	D	78.791	81.126
R-PF	4	D	76.737	85.517
R-PF	5	A	116.966	137.199 ^(a)
C-SB	1	C	96.642	125.829 ^{(a)(b)}
C-SB	2	D	85.009	89.897
C-SB	3	B	90.497	107.592
C-SB	4	A	84.891	109.098
C-SB	5	D	82.063	86.285
C-NE	1	B	71.347	86.517
C-NE	2	B	73.486	92.614
C-NE	3	B	94.479	109.883
C-NE	4	B	87.336	107.508
C-NE	5	B	91.895	116.073

TABLE K.19. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate Percent Recovery	
			DBOBF	TCN
MSL Background	1	E	65.000	78.000
MSL Background	2	E	68.000	79.000
MSL Background	3	E	79.000	121.000 ^(a)
MSL Background	4	E	87.000	NA ^(c)
MSL Background	5	E	73.000	82.000
<u>Quality Control Data</u>				
<u>Method Blank</u>				
Blank	1	A	12.665	16.875
Blank	2	B	11.536	11.487
Blank	3	C	12.087	11.326
Blank	4	D	11.868	12.430
<u>Matrix Spikes</u>				
Background MS	1	A	109	123 ^{(a)(b)}
Background MSD	1	A	113	131 ^{(a)(b)}
MS/MSD RPD			4	6
MS/MSD I-STAT			0.018	0.031
Background MS	2	B	98	107
Background MSD	2	B	100	113
MS/MSD RPD			2	5
MS/MSD I-STAT			0.010	0.027
Background MS	3	C	96	108
Background MSD	3	C	98	126 ^{(a)(b)}
MS/MSD RPD			2	15
MS/MSD I-STAT			0.010	0.077
Background MS	4	D	86	97
Background MSD	4	D	86	96
MS/MSD RPD			0	1
MS/MSD I-STAT			0.000	0.005
<u>Standard Reference Material</u>				
No SRM data provided for Aroclors			NA	NA

TABLE K.19. (contd)

Sediment Treatment	Replicate	Analytical Batch	Surrogate DBOBF	Percent Recovery TCN
<u>Analytical Replicates</u>				
COMP I Replicate 1	5	A	114.480	135.352 ^{(a)(b)}
COMP I Replicate 2	5	A	117.448	138.770 ^{(a)(b)}
COMP I Replicate 3	5	A	112.448	130.997 ^{(a)(b)}
RSD			2	3
COMP IV Replicate 1	2	C	88.202	115.337
COMP IV Replicate 2	2	C	83.045	109.794
COMP IV Replicate 3	2	C	92.556	117.926
RSD			5	4
R-AM Replicate 1	4	B	84.863	104.307
R-AM Replicate 2	4	B	78.798	98.497
R-AM Replicate 3	4	B	101.092	118.056
RSD			13	9
R-OS Replicate 1	2	D	80.542	87.989
R-OS Replicate 2	2	D	73.741	84.256
R-OS Replicate 3	2	D	71.339	80.159
RSD			6	5

(a) Recovery outside quality control range (40%-120%).

(b) I Elevated surrogate percent recoveries due to coelution of PCB congener peak.

(c) NA Not applicable.

TABLE K.20. Metals, Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
		Batch	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL ^(a)			1.0	1.0	0.1	1.0	1.0	0.00012	1.0	1.0	0.5	1.0
Achieved DL			0.001	1.0	0.014	0.05	1.0	0.00015	0.006	0.001	0.5	1.0
COMP I	1	B	0.036	40.8	1.056	0.98	12.00	0.083	5.73	1.08	1.65	196.0
COMP I	2	B	0.023	33.8	1.144	0.61	13.70	0.088	4.59	1.10	1.39	207.0
COMP I	3	A	0.017	33.6	1.496	0.82	14.30	0.077	4.05	1.00	2.45	218.0
COMP I	4	A	0.056	30.8	1.091	0.68	16.90	0.058	4.34	1.05	0.95	182.3
COMP I	5	A	0.035	34.4	1.056	0.74	13.90	0.093	4.56	1.02	2.36	200.0
COMP II	1	B	0.045	26.8	0.800	0.56	13.00	0.048	6.00	1.02	0.96 ^{U(b)}	172.2
COMP II	2	A	0.037	28.9	1.267	0.22	14.30	0.084	3.64	1.11	1.69	222.0
COMP II	3	B	0.029	33.0	1.112	0.68	10.90	0.083	6.14	0.79	1.45	205.0
COMP II	4	B	0.050	37.4	1.232	0.86	17.10	0.095	6.30	1.17	1.72	229.0
COMP II	5	B	0.081	29.6	1.136	1.04	13.80	0.063	6.84	0.71	1.45	187.5
COMP III	1	B	0.027	23.4	1.096	0.66	10.05	0.080	5.79	0.71	1.79	198.0
COMP III	2	B	0.041	29.2	1.080	0.97	12.80	0.088	6.33	0.67	1.18	202.0
COMP III	3	A	0.026	32.7	0.870	0.84	10.81	0.073	4.70	0.84	1.73	184.1
COMP III	4	B	0.027	28.0	1.216	0.62	10.72	0.083	5.27	0.70	1.13	203.0
COMP III	5	B	0.029	27.4	0.920	1.15	11.40	0.072	6.40	0.78	0.99 ^U	187.5
TC-5 Upper Comp	1	B	0.093	39.4	0.928	1.11	13.50	0.069	6.53	1.09	1.90	193.6
TC-5 Upper Comp	2	B	0.036	33.4	0.840	0.90	9.08	0.063	5.94	1.76	1.70	178.7
TC-5 Upper Comp	3	B	0.024	44.1	0.770	0.89	13.30	0.058	6.10	1.26	2.18	202.0
TC-5 Upper Comp	4	A	0.059	32.8	1.399	1.92	11.57	0.063	4.55	1.23	2.28	216.0
TC-5 Upper Comp Replicate 1	5	A	0.024 ^(c)	40.3	0.924	0.97	10.88	0.066	4.29	0.97	2.81	189.7
TC-5 Upper Comp Replicate 2	5	A	NA	24.9	NA	NA	10.22	NA	NA	NA	1.28	172.5
TC-5 Upper Comp Replicate 3	5	A	NA	23.3	NA	NA	9.83	NA	NA	NA	2.30	162.8
COMP IV	1	B	0.027	30.9	1.152	0.58	11.60	0.055	5.68	0.48	0.95 ^U	182.9
COMP IV	2	B	0.042	36.4	1.032	0.78	13.80	0.076	6.10	0.73	2.08	204.0
COMP IV	3	A	0.010	22.2	1.364	0.75	10.75	0.081	4.16	0.63	2.10	186.9
COMP IV	4	B	0.029	25.8	0.764	0.53	9.71	0.069	6.69	0.52	1.04	166.1
COMP IV	5	A	0.014	25.7	1.267	0.83	11.60	0.064	4.76	0.72	1.76	207.0
COMP V	1	A	0.024	35.4	0.858	0.81	10.40	0.077	3.30	1.11	2.16	180.0
COMP V	2	A	0.027	29.4	1.514	1.02	13.20	0.059	3.80	1.31	1.41	219.0
COMP V	3	A	0.012	28.8	0.898	0.36	10.10	0.060	3.10	1.04	2.48	199.0
COMP V	4	B	0.032	31.2	0.888	0.76	11.50	0.079	5.01	1.03	1.95	178.9
COMP V	5	A	0.053	30.5	1.232	0.72	14.00	0.049	3.60	1.12	1.40	177.7

TABLE K.20. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
			Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP VI	1	B	0.029	32.7	0.976	1.46	12.20	0.075	6.62	0.97	1.72	213.0
COMP VI	2	A	0.040	31.1	1.311	0.85	13.80	0.069	3.88	1.51	2.55	227.0
COMP VI	3	A	0.051	43.8	1.426	0.65	14.00	0.070	4.44	1.41	1.11	186.6
COMP VI	4	A	0.015	28.2	1.170	0.79	11.90	0.075	4.34	1.18	1.48	195.0
COMP VI	5	B	0.038	28.2	0.952	0.70	14.10	0.056	5.13	1.12	1.54	186.2
R-AC	1	A	0.042	27.8	0.950	0.62	11.73	0.077	4.34	0.99	1.94	167.3
R-AC	2	B	0.027	32.5	0.944	0.91	11.80	0.070	5.87	0.86	2.11	207.0
R-AC	3	B	0.047	30.6	1.352	0.86	15.20	0.057	6.82	0.69	1.23	205.0
R-AC	4	A	0.039	27.3	1.302	0.67	13.80	0.057	4.13	1.14	2.09	247.0
R-AC	5	B	0.035	24.4	1.288	0.81	13.50	0.048	6.06	1.10	1.24	196.0
R-AM	1	A	0.070	24.6	1.302	0.65	17.00	0.071	4.38	0.65	1.53	198.0
R-AM	2	B	0.069	22.2	1.056	0.83	11.30	0.070	6.91	0.54	0.91 U	190.5
R-AM Replicate 1	3	A	0.031	22.2	1.170	0.79	12.78	0.068	4.33	0.65	2.08	201.0
R-AM Replicate 2	3	A	0.041	22.4	0.701	0.90	12.60	0.072	4.56	0.70	2.14	194.3
R-AM Replicate 3	3	A	0.048	22.6	1.206	0.91	12.20	0.066	5.10	0.55	1.66	192.7
R-AM	4	B	0.065	28.1	1.320	1.17	10.31	0.099	7.22	0.58	1.57	211.0
R-AM	5	A	0.035	20.0	1.197	0.69	9.20	0.080	4.65	0.68	1.87	188.0
R-BF	1	B	0.015	32.7	1.024	0.87	11.99	0.080	6.15	1.01	1.82	195.1
R-BF	2	A	0.049	26.0	1.144	0.69	11.03	0.094	3.79	1.00	1.49	170.6
R-BF	3	A	0.036	31.4	0.898	0.65	9.97	0.078	3.71	1.07	0.88 U	180.5
R-BF	4	A	0.024	27.0	0.836	1.00	9.81	0.085	3.46	1.05	2.13	186.7
R-BF	5	A	0.030	31.1	0.846	1.34	11.20	0.083	4.92	1.20	0.99 U	197.0
R-OS	1	A	0.026	18.3	0.959	0.87	10.81	0.069	3.91	0.57	1.85	182.9
R-OS	2	B	0.068	23.7	1.296	0.66	11.37	0.065	6.06	0.57	1.01	166.8
R-OS	3	A	0.033	25.0	1.170	0.54	13.80	0.083	3.58	0.61	2.11	194.4
R-OS	4	B	0.040	27.6	1.312	1.02	12.10	0.073	6.76	0.74	2.36	184.5
R-OS Replicate 1	5	B	0.045	26.0	0.928	1.08	11.23	0.077	6.26	0.51	2.03	181.7
R-OS Replicate 2	5	B	0.036	NA	1.128	1.49	NA	0.080	6.30	0.66	NA	NA
R-OS Replicate 3	5	B	0.039	NA	1.060	1.07	NA	0.084	6.44	0.68	NA	NA
R-PF	1	B	0.020	30.0	1.144	1.12	14.40	0.086	6.41	0.42	1.55	205.0
R-PF	2	B	0.020	22.4	1.056	0.88	10.90	0.067	5.32	0.44	1.35	184.9
R-PF	3	B	0.038	24.5	1.144	0.71	11.01	0.085	5.49	0.59	0.98 U	174.6
R-PF	4	B	0.036	23.6	1.088	0.95	12.30	0.065	5.50	0.68	1.60	175.7
R-PF Replicate 1	5	A	0.044	27.8	1.223	0.65	11.00	0.091	3.95	0.64	1.88	190.6
R-PF Replicate 2	5	A	0.026	27.0	1.082	0.82	10.62	0.087	3.68	0.65	2.05	186.1
R-PF Replicate 3	5	A	0.020	27.3	1.038	0.87	10.80	0.088	3.66	0.78	1.83	198.0

TABLE K.20. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
			Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
C-S8	1	B	0.027	30.2	0.757	1.06	12.90	0.060	6.56	0.58	1.47	206.0
C-SB	2	B	0.027	29.2	1.000	0.67	12.20	0.048	5.21	0.59	2.22	188.4
C-S8	3	A	0.055	25.4	1.179	0.71	13.00	0.050	3.95	0.77	2.44	175.0
C-SB	4	A	0.024	26.8	1.038	1.11	10.42	0.047	4.02	0.69	1.66	181.8
C-SB Replicate 1	5	B	0.029	24.3	1.032	1.00	12.80	0.021	5.38	0.69	1.59	184.5
C-S8 Replicate 2	5	B	0.047	23.7	0.968	1.28	12.50	0.033	5.50	0.81	1.88	183.6
C-SB Replicate 3	5	B	0.032	24.0	0.936	1.11	12.50	0.030	5.48	0.72	1.90	177.1
C-NE	1	A	0.038	22.9	1.355	0.67	14.80	0.068	4.02	0.70	0.88 U	173.9
C-NE	2	A	0.049	21.9	1.012	0.84	12.63	0.061	4.39	0.66	1.55	163.0
C-NE	3	A	0.017	24.4	1.382	0.71	13.30	0.076	4.07	0.55	1.21	175.8
C-NE	4	A	0.045	33.1	1.038	0.57	13.40	0.062	3.64	0.67	2.26	181.2
C-NE	5	A	0.026	21.5	0.968	0.78	13.10	0.077	3.25	0.51	1.27	171.0

NOTE: Background Nephtys Tissue was not analyzed for metals.

- (a) DL Detection limit.
 (b) U The analyte was not present above the level of the associated value.
 (c) NA Not applicable.

TABLE K.21. Metals, Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

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 I	1	B	16.00	0.006	6.5	0.169	0.16	1.92	0.013	0.92	0.17	0.26	31.4
COMP I	2	B	15.28	0.004	5.2	0.175	0.09	2.09	0.013	0.70	0.17	0.21	31.6
COMP I	3	A	16.50 ^(a)	0.003	5.5	0.247	0.14	2.36	0.013	0.67	0.17	0.40	36.0
COMP I	4	A	17.16	0.010	5.3	0.187	0.12	2.90	0.010	0.74	0.18	0.16	31.3
COMP I	5	A	17.54	0.006	6.0	0.185	0.13	2.44	0.016	0.80	0.18	0.41	35.1
COMP II	1	B	15.12	0.007	4.1	0.121	0.08	1.97	0.007	0.91	0.15	0.15 U ^(b)	26.0
COMP II	2	A	17.08	0.006	4.9	0.216	0.04	2.44	0.014	0.62	0.19	0.29	37.9
COMP II	3	B	17.30	0.005	5.7	0.192	0.12	1.89	0.014	1.06	0.14	0.25	35.5
COMP II	4	B	15.82	0.008	5.9	0.195	0.14	2.71	0.015	1.00	0.19	0.27	36.2
COMP II	5	B	16.64	0.013	4.9	0.189	0.17	2.30	0.010	1.14	0.12	0.24	31.2
COMP III	1	B	14.77	0.004	3.5	0.162	0.10	1.48	0.012	0.86	0.10	0.26	29.2
COMP III	2	B	16.64	0.007	4.9	0.180	0.16	2.13	0.015	1.05	0.11	0.20	33.6
COMP III	3	A	15.35	0.004	5.0	0.134	0.13	1.66	0.011	0.72	0.13	0.27	28.3
COMP III	4	B	16.35	0.004	4.6	0.199	0.10	1.75	0.014	0.86	0.11	0.18	33.2
COMP III	5	B	15.26	0.004	4.2	0.140	0.18	1.74	0.011	0.98	0.12	0.15 U	28.6
TC-5 Upper Comp	1	B	15.40	0.014	6.1	0.143	0.17	2.08	0.011	1.01	0.17	0.29	29.8
TC-5 Upper Comp	2	B	15.92	0.006	5.3	0.134	0.14	1.45	0.010	0.95	0.28	0.27	28.4
TC-5 Upper Comp	3	B	16.93	0.004	7.5	0.130	0.15	2.25	0.010	1.03	0.21	0.37	34.2
TC-5 Upper Comp	4	A	15.87	0.009	5.2	0.222	0.30	1.84	0.010	0.72	0.20	0.36	34.3
TC-5 Upper Comp Replicate 1	5	A	16.58	0.004	6.7	0.153	0.16	1.80	0.011	0.71	0.16	0.47	31.5
TC-5 Upper Comp Replicate 2	5	A	16.68	NA ^(c)	4.2	NA	NA	1.70	NA	NA	NA	0.21	28.8
TC-5 Upper Comp Replicate 3	5	A	16.58	NA	3.9	NA	NA	1.63	NA	NA	NA	0.38	27.0
COMP IV	1	B	16.16	0.004	5.0	0.186	0.09	1.87	0.009	0.92	0.08	0.15 U	29.6
COMP IV	2	B	16.46	0.007	6.0	0.170	0.13	2.27	0.013	1.00	0.12	0.34	33.6
COMP IV	3	A	11.15	0.001	2.5	0.152	0.08	1.20	0.009	0.46	0.07	0.23	20.8
COMP IV	4	B	16.04	0.005	4.1	0.123	0.09	1.56	0.011	1.07	0.08	0.17	26.6
COMP IV	5	A	13.09	0.002	3.4	0.166	0.11	1.52	0.008	0.62	0.09	0.23	27.1
COMP V	1	A	15.27	0.004	5.4	0.131	0.12	1.59	0.012	0.50	0.17	0.33	27.5
COMP V	2	A	14.83	0.004	4.4	0.225	0.15	1.96	0.009	0.56	0.19	0.21	32.5
COMP V	3	A	17.13	0.002	4.9	0.154	0.06	1.73	0.010	0.53	0.18	0.42	34.1
COMP V	4	B	15.44	0.005	4.8	0.137	0.12	1.78	0.012	0.77	0.16	0.30	27.6
COMP V	5	A	17.14	0.009	5.2	0.211	0.12	2.40	0.008	0.62	0.19	0.24	30.5
COMP VI	1	B	15.08	0.004	4.9	0.147	0.22	1.84	0.011	1.00	0.15	0.26	32.1
COMP VI	2	A	15.83	0.006	4.9	0.208	0.13	2.18	0.011	0.61	0.24	0.40	35.9
COMP VI	3	A	16.25	0.008	7.1	0.232	0.11	2.28	0.011	0.72	0.23	0.18	30.3
COMP VI	4	A	15.89	0.002	4.5	0.186	0.13	1.89	0.012	0.69	0.19	0.24	31.0
COMP VI	5	B	16.24	0.006	4.6	0.155	0.11	2.29	0.009	0.83	0.18	0.25	30.2

TABLE K.21. (contd)

Sediment Treatment	Replicate	Analytical Batch	Percent Dry weight	N. caecoides Metals (mg/kg wet weight)									
				Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-AC	1	A	15.84	0.007	4.4	0.150	0.10	1.86	0.012	0.69	0.16	0.31	26.5
R-AC	2	B	16.14	0.004	5.2	0.152	0.15	1.90	0.011	0.95	0.14	0.34	33.4
R-AC	3	B	16.16	0.008	4.9	0.218	0.14	2.46	0.009	1.10	0.11	0.20	33.1
R-AC	4	A	13.29	0.005	3.6	0.173	0.09	1.83	0.008	0.55	0.15	0.28	32.8
R-AC	5	B	16.75	0.006	4.1	0.216	0.14	2.26	0.008	1.02	0.18	0.21	32.8
R-AM	1	A	17.29	0.012	4.3	0.225	0.11	2.94	0.012	0.76	0.11	0.26	34.2
R-AM	2	B	16.62	0.011	3.7	0.176	0.14	1.88	0.012	1.15	0.09	0.15 U	31.7
R-AM Replicate 1	3	A	16.26	0.005	3.6	0.190	0.13	2.08	0.011	0.70	0.11	0.34	32.7
R-AM Replicate 2	3	A	16.26	0.007	3.6	0.114	0.15	2.05	0.012	0.74	0.11	0.35	31.6
R-AM Replicate 3	3	A	16.26	0.008	3.7	0.196	0.15	1.98	0.011	0.83	0.09	0.27	31.3
R-AM	4	B	16.61	0.011	4.7	0.219	0.19	1.71	0.016	1.20	0.10	0.26	35.0
R-AM	5	A	11.30	0.004	2.3	0.135	0.08	1.04	0.009	0.53	0.08	0.21	21.2
R-BF	1	B	16.72	0.003	5.5	0.171	0.15	2.00	0.013	1.03	0.17	0.30	32.6
R-BF	2	A	13.79	0.007	3.6	0.158	0.10	1.52	0.013	0.52	0.14	0.21	23.5
R-BF	3	A	15.57	0.006	4.9	0.140	0.10	1.55	0.012	0.58	0.17	0.14 U	28.1
R-BF	4	A	15.24	0.004	4.1	0.127	0.15	1.50	0.013	0.53	0.16	0.32	28.5
R-BF	5	A	16.05	0.005	5.0	0.136	0.22	1.80	0.013	0.79	0.19	0.16 U	31.6
R-OS	1	A	15.79	0.004	2.9	0.151	0.14	1.71	0.011	0.62	0.09	0.29	28.9
R-OS	2	B	16.53	0.011	3.9	0.214	0.11	1.88	0.011	1.00	0.09	0.17	27.6
R-OS	3	A	15.02	0.005	3.8	0.176	0.08	2.07	0.012	0.54	0.09	0.32	29.2
R-OS	4	B	17.85	0.007	4.9	0.234	0.18	2.16	0.013	1.21	0.13	0.42	32.9
R-OS Replicate 1	5	B	17.02	0.008	4.4	0.158	0.18	1.91	0.013	1.07	0.09	0.35	30.9
R-OS Replicate 2	5	B	17.02	0.006	NA	0.192	0.25	NA	0.014	1.07	0.11	NA	NA
R-OS Replicate 3	5	B	17.02	0.007	NA	0.180	0.18	NA	0.014	1.10	0.12	NA	NA
R-PF	1	B	13.90	0.003	4.2	0.159	0.16	2.00	0.012	0.89	0.06	0.22	28.5
R-PF	2	B	13.46	0.003	3.0	0.142	0.12	1.47	0.009	0.72	0.06	0.18	24.9
R-PF	3	B	16.88	0.006	4.1	0.193	0.12	1.86	0.014	0.93	0.10	0.17 U	29.5
R-PF	4	B	16.74	0.006	4.0	0.182	0.16	2.06	0.011	0.92	0.85	0.27	29.4
R-PF Replicate 1	5	A	16.47	0.007	4.6	0.201	0.11	1.81	0.015	0.65	0.11	0.31	31.4
R-PF Replicate 2	5	A	16.47	0.004	4.4	0.178	0.14	1.75	0.014	0.61	0.11	0.34	30.7
R-PF Replicate 3	5	A	16.47	0.003	4.5	0.171	0.14	1.78	0.014	0.60	0.13	0.30	32.6
C-SB	1	B	14.29	0.004	4.3	0.108	0.15	1.84	0.009	0.94	0.08	0.21	29.4
C-SB	2	B	16.03	0.004	4.7	0.160	0.11	1.96	0.008	0.84	0.09	0.36	30.2
C-SB	3	A	15.65	0.009	4.0	0.185	0.11	2.03	0.008	0.62	0.12	0.38	27.4
C-SB	4	A	16.06	0.004	4.3	0.167	0.18	1.67	0.008	0.65	0.11	0.27	29.2
C-SB Replicate 1	5	B	16.46	0.005	4.0	0.170	0.16	2.11	0.003	0.89	0.11	0.26	30.4
C-SB Replicate 2	5	B	16.46	0.008	3.9	0.159	0.21	2.06	0.005	0.91	0.13	0.31	30.2
C-SB Replicate 3	5	B	16.46	0.005	4.0	0.154	0.18	2.06	0.005	0.90	0.12	0.31	29.2

TABLE K.21. (contd)

Sediment		Analytical	Percent	<i>N. caecoides</i> Metals (mg/kg wet weight)									
Treatment	Replicate	Batch	Dry weight	Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
C-NE	1	A	15.94	0.006	3.7	0.216	0.11	2.36	0.011	0.64	0.11	0.14 U	27.7
C-NE	2	A	18.40	0.009	4.0	0.186	0.15	2.32	0.011	0.81	0.12	0.29	30.0
C-NE	3	A	16.01	0.003	3.9	0.221	0.11	2.13	0.012	0.65	0.09	0.19	28.1
C-NE	4	A	15.93	0.007	5.3	0.165	0.09	2.13	0.010	0.58	0.11	0.36	28.9
C-NE	5	A	15.28	0.004	3.3	0.148	0.12	2.00	0.012	0.50	0.08	0.19	26.1

NOTE: Background *N. caecoides* Tissue was not analyzed for metals.

- (a) Percent dry weight was averaged from the four replicates of COMP I.
 (b) U The analyte was not present above the level of the associated value.
 (c) NA Not applicable.

TABLE K.22. Quality Control Data for Metals, Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Method Blanks												
Blank	1	A	0.005	NA ^(a)	0.026	0.97	NA	0.00012 U ^(b)	0.47	0.01	NA	NA
Blank	2	A	0.001	NA	0.020	0.16	NA	0.00012 U	0.02	0.01	NA	NA
Blank	3	B	0.002	NA	0.029	0.20	NA	0.00012 U	0.01	0.01	NA	NA
Blank	4	B	0.002	NA	0.024	0.19	NA	0.00012 U	0.02	0.01	NA	NA
Matrix Spikes												
COMP V	3	A	0.012	28.8	0.898	0.36	10.10	0.060	3.10	1.04	2.48	199.0
COMP V MS	3	A	1.970	NA	7.014	12.99	NA	1.153	14.50	14.36	NA	NA
Concentration Recovered			1.958	NA	6.116	12.63	NA	1.093	11.40	13.32	NA	NA
Spike Amount			2.499	NS ^(c)	6.247	12.50	NS	1.249	12.50	12.50	NS	NS
Percent Recovery			78%	NA	98%	101%	NA	88%	91%	107%	NA	NA
COMP V	3	A	0.012	28.8	0.898	0.36	10.10	0.060	3.10	1.04	2.48	199.0
COMP V MSD	3	A	2.360	NA	7.674	14.65	NA	1.161	17.00	15.49	NA	NA
Concentration Recovered			2.348	NA	6.776	14.29	NA	1.101	13.90	14.45	NA	NA
Spike Amount			2.571	NS	6.428	12.86	NS	1.286	12.86	12.86	NS	NS
Percent Recovery			91%	NA	105%	111%	NA	86%	108%	112%	NA	NA
MS/MSD RPD			15%	NA	7%	10%	NA	2%	17%	5%	NA	NA
MS/MSD I-STAT			0.08	NA	0.04	0.05	NA	0.01	0.08	0.03	NA	NA
C-NE	1	A	0.038	22.9	1.355	0.67	14.80	0.068	4.02	0.70	0.88 U	173.9
C-NE MS	1	A	1.730	NA	6.450	10.93	NA	0.910	14.28	12.70	NA	NA
Concentration Recovered			1.692	NA	5.095	10.26	NA	0.842	10.26	12.00	NA	NA
Spike Amount			1.990	NS	4.973	9.95	NS	0.995	9.95	9.95	NS	NS
Percent Recovery			85%	NA	102%	103%	NA	85%	103%	121%	NA	NA
C-NE	1	A	0.038	22.9	1.355	0.67	14.80	0.068	4.02	0.70	0.88 U	173.9
C-NE MSD	1	A	1.690	NA	6.345	10.16	NA	0.951	12.97	12.62	NA	NA
Concentration Recovered			1.652	NA	4.990	9.49	NA	0.883	8.95	11.92	NA	NA
Spike Amount			1.999	NS	4.984	9.97	NS	0.997	9.97	9.97	NS	NS
Percent Recovery			83%	NA	100%	95%	NA	89%	90%	120%	NA	NA
MS/MSD RPD			3%	NA	2%	8%	NA	5%	14%	1%	NA	NA
MS/MSD I-STAT			0.01	NA	0.01	0.04	NA	0.02	0.07	0.00	NA	NA

K.60

TABLE K.22. (contd)

Sediment Treatment	Replicate	Analytical Batch	N. caecoides Metals (mg/kg dry weight)									
			Aq	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP II	3	B	0.029	33.0	1.112	0.68	10.90	0.083	6.14	0.79	1.45	205.0
COMP II MS ^(d)	3	B	2.189	NA	6.224	11.90	NA	1.141	17.70	12.20	NA	NA
Concentration Recovered			2.160	NA	5.112	11.22	NA	1.058	11.56	11.41	NA	NA
Spike Amount			2.417	NS	6.042	12.08	NS	1.208	12.08	12.08	NS	NS
Percent Recovery			89%	NA	85%	93%	NA	88%	96%	94%	NA	NA
COMP II	3	B	0.029	33.0	1.112	0.68	10.90	0.083	6.14	0.79	1.45	205.0
COMP II MSD ^(d)	3	B	2.394	NA	12.480	12.30	NA	1.112	17.60	13.70	NA	NA
Concentration Recovered			2.365	NA	11.368	11.62	NA	1.029	11.46	12.91	NA	NA
Spike Amount			2.452	NS	6.131	12.26	NS	1.226	12.26	12.26	NS	NS
Percent Recovery			96%	NA	185% ^(e)	95%	NA	84%	93%	105%	NA	NA
MS/MSD RPD			8%	NA	75% ^(f)	2%	NA	4%	2%	11%	NA	NA
MS/MSD I-STAT			0.04	NA	0.37	0.01	NA	0.02	0.01	0.05	NA	NA
R-PF	3	B	0.038	24.5	1.144	0.71	11.01	0.085	5.49	0.59	0.98 U	174.6
R-PF MS	3	B	1.958	NA	5.040	9.38	NA	1.255	12.60	9.55	NA	NA
Concentration Recovered			1.920	NA	3.896	8.67	NA	1.170	7.11	8.96	NA	NA
Spike Amount			2.456	NS	6.140	12.28	NS	1.228	12.28	12.28 ^(e)	NS	NS
Percent Recovery			78%	NA	63% ^(e)	71% ^(e)	NA	95%	58%	73% ^(e)	NA	NA
R-PF	3	B	0.038	24.5	1.144	0.71	11.01	0.085	5.49	0.59	0.98 U	174.6
R-PF MSD	3	B	2.726	NA	6.336	12.00	NA	1.113	18.30	13.20	NA	NA
Concentration Recovered			2.688	NA	5.192	11.29	NA	1.028	12.81	12.61	NA	NA
Spike Amount			2.234	NS	5.585	11.17	NS	1.117	11.17	11.17	NS	NS
Percent Recovery			120%	NA	93%	101%	NA	92%	115%	113%	NA	NA
MS/MSD RPD			42% ^(f)	NA	38% ^(f)	35% ^(f)	NA	3%	66% ^(f)	43% ^(f)	NA	NA
MS/MSD I-STAT			0.21	NA	0.19	0.18	NA	0.02	0.33	0.21	NA	NA
<u>Standard Reference Material</u>												
Certified Value			1.68 ±0.15	14 ±1.2	4.15 ±0.38	1.43 ±0.46	66.3 ±4.3	0.0642 ±0.0067	2.25 ±0.44	0.37 ±0.014	2.21 ±0.24	830.0 ±57.0
SRM 1566	1	A ^(g)	1.560	14.93	4.04	2.12	65.9	0.056	3.2	0.36	2.53	849.0
SRM 1566	1	B	NA	14.24	NA	NA	69.7	NA	NA	NA	1.84	862.0
SRM 1566	1	C	NA	14.93	NA	NA	65.9	NA	NA	NA	2.53	849.0
SRM 1566	1	D	NA	14.55	NA	NA	65.6	NA	NA	NA	1.84	835.0
SRM 1566	1	E	NA	15.00	NA	NA	65.6	NA	NA	NA	2.00	854.0
SRM 1566	1	F	NA	13.57	NA	NA	61.7	NA	NA	NA	2.17	785.0
SRM 1566	1	G	NA	14.31	NA	NA	66.3	NA	NA	NA	2.36	806.0
SRM 1566	1	H	NA	14.66	NA	NA	66.1	NA	NA	NA	2.45	848.0

TABLE K.22. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
SRM 1566	1	I	NA	14.61	NA	NA	66.2	NA	NA	NA	2.60	850.0
SRM 1566	1	J	NA	14.44	NA	NA	67.3	NA	NA	NA	2.01	846.0
SRM 1566	1	K	NA	14.62	NA	NA	66.8	NA	NA	NA	2.21	851.0
SRM 1566	1	L	NA	14.64	NA	NA	65.6	NA	NA	NA	2.07	839.0
SRM 1566	1	M	NA	14.69	NA	NA	66.9	NA	NA	NA	2.05	855.0
SRM 1566	1	N	NA	13.92	NA	NA	65.2	NA	NA	NA	2.94	840.0
SRM 1566	2	A	1.610	14.74	4.127	1.29	68.7	0.059	2.22	0.44	2.24	856.0
SRM 1566	2	B	NA	14.67	NA	NA	65.8	NA	NA	NA	2.29	816.0
SRM 1566	2	C	NA	14.95	NA	NA	66.8	NA	NA	NA	2.72	850.0
SRM 1566	2	D	NA	14.61	NA	NA	66.7	NA	NA	NA	2.11	849.0
SRM 1566	2	E	NA	14.56	NA	NA	68.0	NA	NA	NA	2.25	855.0
SRM 1566	2	F	NA	14.68	NA	NA	65.2	NA	NA	NA	2.44	846.0
SRM 1566	3	A	1.664	14.78	4.208	1.48	66.6	0.057	2.24	0.38	2.82	856.0
SRM 1566	3	B	NA	14.05	NA	NA	62.5	NA	NA	NA	2.04	805.0
SRM 1566	3	C	NA	13.54	NA	NA	68.3	NA	NA	NA	2.48	859.0
SRM 1566	3	D	NA	14.81	NA	NA	64.9	NA	NA	NA	2.46	852.0
SRM 1566	3	E	NA	14.63	NA	NA	64.9	NA	NA	NA	2.32	847.0
SRM 1566	3	F	NA	14.42	NA	NA	67.4	NA	NA	NA	2.14	862.0
SRM 1566	4	A	1.562	14.00	4.128	1.39	67.1	0.059	2.27	0.37	2.30	850.0
SRM 1566	4	B	NA	14.87	NA	NA	66.4	NA	NA	NA	2.55	865.0
SRM 1566	4	C	NA	13.46	NA	NA	63.0	NA	NA	NA	2.10	803.0
SRM 1566	4	D	NA	14.79	NA	NA	65.8	NA	NA	NA	2.36	840.0
SRM 1566	4	E	NA	15.19	NA	NA	66.6	NA	NA	NA	2.49	845.0
SRM 1566	4	F	NA	14.58	NA	NA	67.4	NA	NA	NA	2.74	850.0
<u>Analytical Replicates</u>												
R-PF Replicate 1	5	A	0.044	27.8	1.223	0.65	11.00	0.091	3.95	0.64	1.88	190.6
R-PF Replicate 2	5	A	0.026	27.0	1.082	0.82	10.62	0.087	3.68	0.65	2.05	186.1
R-PF Replicate 3	5	A	0.020	27.3	1.038	0.87	10.80	0.088	3.66	0.78	1.83	198.0
RSD			42%(f)	1%	9%	15%	2%	2%	4%	11%	6%	3%
TC-5 Upper Comp Replicate 1	5	A	0.024	40.3	0.924	0.97	10.88	0.066	4.29	0.97	2.81	189.7
TC-5 Upper Comp Replicate 2	5	A	NA	24.9	NA	NA	10.22	NA	NA	NA	1.28	172.5
TC-5 Upper Comp Replicate 3	5	A	NA	23.3	NA	NA	9.83	NA	NA	NA	2.30	162.8
RSD			NA	32%(f)	NA	NA	5%	NA	NA	NA	37%(f)	8%
R-AM Replicate 1	3	A	0.031	22.2	1.170	0.79	12.78	0.068	4.33	0.65	2.08	201.0
R-AM Replicate 2	3	A	0.041	22.4	0.701	0.90	12.60	0.072	4.56	0.70	2.14	194.3
R-AM Replicate 3	3	A	0.048	22.6	1.206	0.91	12.20	0.066	5.10	0.55	1.66	192.7
RSD			21%(f)	1%	27%(f)	8%	2%	4%	8%	12%	13%	2%

TABLE K.22. (contd)

Sediment Treatment	Replicate	Analytical Batch	<i>N. caecoides</i> Metals (mg/kg dry weight)									
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
R-OS Replicate 1	5	B	0.045	26.0	0.928	1.08	11.23	0.077	6.26	0.51	2.03	181.7
R-OS Replicate 2	5	B	0.036	NA	1.128	1.49	NA	0.080	6.30	0.66	NA	NA
R-OS Replicate 3	5	B	0.039	NA	1.060	1.07	NA	0.084	6.44	0.68	NA	NA
RSD			11%	NA	10%	20%	NA	4%	1%	15%	NA	NA
C-SB Replicate 1	5	B	0.029	24.3	1.032	1.00	12.80	0.021	5.38	0.69	1.59	184.5
C-SB Replicate 2	5	B	0.047	23.7	0.968	1.28	12.50	0.033	5.50	0.81	1.88	183.6
C-SB Replicate 3	5	B	0.032	24.0	0.936	1.11	12.50	0.030	5.48	0.72	1.90	177.1
RSD			27%(f)	1%	5%	12%	1%	22%(f)	1%	8%	10%	2%

- (a) NA Not applicable.
 (b) U The analyte was not present above the level of the associated value.
 (c) NS Not spiked.
 (d) COMP II MS/MSD appears to be doubled spiked with Cd.
 (e) Recovery out of quality control range of (75%-125%).
 (f) Value exceeds relative precision range of 20%.
 (g) SRM 1566-1A appears to be contaminated with Cr and Ni.

TABLE K.23. Butyltin Results, Wet and Dry Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Tri-propyltin %Surrogate	Butyltin Species ($\mu\text{g}/\text{kg}$ wet weight)				Percent Dry Weight	Butyltin Species ($\mu\text{g}/\text{kg}$ dry weight)			
				Tetra butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin		Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
Target DL (a)				10	10	10	10					
Achieved DL Low				5.211	9.847	4.636	4.2199					
Achieved DL High				27.349	51.678	24.329	22.147					
COMP I	1	D	133 ^(b)	18.744	57.094	7.899 J ^(c)	11.458 U ^(d)	16.00	117.150	356.839	49.369 J	71.613 U
COMP I	2	D	176 ^(b)	15.594	22.000 U	10.357 U	9.429 U	15.28	102.055	143.979 U	67.781 U	61.708 U
COMP I	3	A	0 ^(b)	11.915 U	22.515 U	10.599 U	9.649 U	16.50 ^(e)	72.212 U	136.455 U	64.236 U	58.479 U
COMP I Replicate 1	4	B	72	18.693 U	35.321 U	16.628 U	15.138 U	17.16	108.934 U	205.833 U	96.900 U	88.217 U
COMP I Replicate 2	4	B	58	15.234 U	28.785 U	13.551 U	12.336 U	17.16	88.776 U	167.745 U	78.969 U	71.888 U
COMP I Replicate 3	4	B	81	13.252 U	16.019 J	11.789 U	10.732 U	17.16	77.226 U	93.348 J	68.700 U	62.541 U
COMP I	5	A	69	14.711 U	8.574 J	13.087 U	11.913 U	17.54	83.871 U	48.882 J	74.612 U	67.919 U
COMP II	1	D	72	8.019 J	6.739 J	13.376 U	12.177 U	15.12	53.038 J	44.571 J	88.466 U	80.536 U
COMP II	2	A	65	9.819 U	9.238 J	8.735 U	7.952 U	17.08	57.488 U	54.085 J	51.142 U	46.557 U
COMP II	3	C	14 ^(b)	13.955 U	8.034 J	12.414 U	11.301 U	17.30	80.665 U	46.439 J	71.757 U	65.324 U
COMP II	4	D	13 ^(b)	20.477 U	38.693 U	18.216 U	16.583 U	15.82	129.437 U	244.583 U	115.145 U	104.823 U
COMP II	5	C	0 ^(b)	16.043 U	30.315 U	14.272 U	1.510 J	16.64	96.412 U	182.181 U	85.769 U	9.075 J
COMP III	1	C	59 ^(b)	14.149 U	7.858 J	12.587 U	11.458 U	14.77	95.796 U	53.200 J	85.220 U	77.576 U
COMP III	2	D	31 ^(b)	18.274 U	34.529 U	16.256 U	14.798 U	16.64	109.820 U	207.506 U	97.692 U	88.930 U
COMP III	3	A	80 ^(b)	14.872 U	28.102 U	13.230 U	12.044 U	15.35	96.886 U	183.075 U	86.189 U	78.463 U
COMP III	4	D	0 ^(b)	10.925 U	20.643 U	9.718 U	8.847 U	16.35	66.820 U	126.257 U	59.437 U	54.110 U
COMP III	5	C	63	27.349 U	51.678 U	24.329 U	22.148 U	15.26	179.220 U	338.650 U	159.430 U	145.138 U
TC-5 Upper Comp	1	C	8 ^(b)	23.692 U	44.767 U	21.076 U	19.186 U	15.40	153.844 U	290.695 U	136.857 U	124.584 U
TC-5 Upper Comp	2	C	53	13.908 U	6.729 J	12.372 U	11.263 U	15.92	87.362 U	42.267 J	77.714 U	70.747 U
TC-5 Upper Comp	3	C	67	16.498 U	10.147 J	14.676 U	13.360 U	16.93	97.448 U	59.936 J	86.686 U	78.913 U
TC-5 Upper Comp	4	A	72	15.856 U	8.682 J	14.105 U	12.840 U	15.87	99.912 U	54.705 J	88.878 U	80.907 U
TC-5 Upper Comp Replicate 1	5	A	76	6.954 U	6.185 J	6.186 U	5.631 U	16.58	41.942 U	37.303 J	37.310 U	33.963 U
TC-5 Upper Comp Replicate 2	5	A	42	22.971 U	43.405 U	20.434 U	18.602 U	16.58	138.546 U	261.791 U	123.245 U	112.195 U
TC-5 Upper Comp Replicate 3	5	A	69	13.520 U	7.285 J	12.027 U	10.949 U	16.58	81.544 U	43.939 J	72.539 U	66.037 U
COMP IV	1	C	8 ^(b)	11.985 U	5.371 J	3.419 J	9.706 U	16.16	74.165 U	33.236 J	21.157 J	60.062 U
COMP IV	2	C	10 ^(b)	11.544 U	21.813 U	10.269 U	9.348 U	16.46	70.134 U	132.521 U	62.388 U	56.792 U
COMP IV	3	A	0 ^(b)	17.267 U	32.627 U	15.360 U	13.983 U	11.15	154.861 U	292.619 U	137.758 U	125.408 U
COMP IV	4	C	2 ^(b)	12.695 U	4.377	1.628	1.495 J	16.04	79.146 U	27.288	10.150	9.320 J
COMP IV	5	A	67	14.502 U	27.402 U	12.900 U	11.744 U	13.09	110.787 U	209.335 U	98.549 U	89.717 U

TABLE K.23. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tri-propyltin %Surrogate	Butyltin Species ($\mu\text{g/kg}$ wet weight)				Percent Dry Weight	Butyltin Species ($\mu\text{g/kg}$ dry weight)			
				Tetra butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin		Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
COMP V	1	A	71	12.855 U	8.869 J	4.968 J	10.410 U	15.27	84.185 U	58.079 J	32.534 J	68.173 U
COMP V	2	A	43	14.199 U	9.919 J	12.631 U	19.018	14.83	95.745 U	66.886 J	85.172 U	128.243
COMP V	3	A	67	11.257 U	21.271 U	10.014 U	9.116 U	17.13	65.715 U	124.174 U	58.459 U	53.217 U
COMP V	4	D	155 ^(b)	9.540	22.561	5.864 J	6.962 U	15.44	61.788	146.120	37.979 J	45.091 U
COMP V	5	B	30 ^(b)	11.288 U	15.813	5.838	9.141 U	17.14	65.858 U	92.256	34.061	53.331 U
COMP VI	1	C	17 ^(b)	9.963 U	9.062	8.863 U	8.068 U	15.08	66.068 U	60.094	58.773 U	53.501 U
COMP VI	2	A	71	14.298 U	10.649 J	12.719 U	11.579 U	15.83	90.322 U	67.268 J	80.347 U	73.146 U
COMP VI	3	B	19 ^(b)	11.014 U	7.443	4.442	8.919 U	16.25	67.778 U	45.805	27.334	54.886 U
COMP VI	4	A	66	14.399 U	27.208 U	12.809 U	11.661 U	15.89	90.617 U	171.227 U	80.610 U	73.386 U
COMP VI Replicate 1	5	D	283 ^(b)	45.349	37.745 U	17.770 U	16.176 U	16.24	279.243	232.420 U	109.421 U	99.606 U
COMP VI Replicate 2	5	D	94	24.703	16.259 J	6.308 J	18.655 U	16.24	152.113	100.118 J	38.844 J	114.871 U
COMP VI Replicate 3	5	D	0 ^(b)	12.070 U	20.213	6.492 J	2.947 J	16.24	74.323 U	124.464	39.975 J	18.147 J
R-AC	1	B	3 ^(b)	19.131 U	5.070 J	17.019 U	1.276 J	15.84	120.777 U	32.008 J	107.443 U	8.056 J
R-AC Replicate 1	2	C	0 ^(b)	1.270 J	3.564 J	1.296 J	1.632 J	16.14	7.869 J	22.082 J	8.030 J	10.112 J
R-AC Replicate 2	2	C	70	13.579 U	8.344 J	12.079 U	10.996 U	16.14	84.133 U	51.698 J	74.839 U	68.129 U
R-AC Replicate 3	2	C	80	12.274 U	10.444 J	10.919 U	9.940 U	16.14	76.047 U	64.709 J	67.652 U	61.586 U
R-AC	3	C	29 ^(b)	18.192 U	9.592 J	16.183 U	14.732 U	16.16	112.574 U	59.358 J	100.142 U	91.163 U
R-AC	4	A	66	9.611 U	11.776 J	8.550 U	7.783 U	13.29	72.318 U	88.611 J	64.334 U	58.563 U
R-AC	5	D	93	15.180	26.448	11.018 U	10.030 U	16.75	90.629	157.900	65.779 U	59.881 U
R-AM	1	B	71	9.679 U	22.797	8.610 U	7.838 U	17.29	55.980 U	131.853	49.798 U	45.333 U
R-AM	2	C	19 ^(b)	11.014 U	13.241	9.797 U	8.919 U	16.62	66.270 U	79.666	58.947 U	53.664 U
R-AM	3	B	50	7.689 U	18.817	2.252 J	6.226 U	16.26	47.288 U	115.723	13.847 J	38.290 U
R-AM	4	B	16 ^(b)	10.584 U	5.417	9.416 U	8.571 U	16.61	63.721 U	32.615	56.689 U	51.601 U
R-AM	5	B	51	13.405 U	26.587	5.344 J	10.855 U	11.30	118.628 U	235.282	47.295 J	96.062 U
R-BF	1	D	0 ^(b)	5.152 J	24.783	6.956 J	3.585 J	16.72	30.813 J	148.224	41.603 J	21.441 J
R-BF	2	B	27 ^(b)	12.274 U	23.193 U	4.835	9.940 U	13.79	89.007 U	168.187 U	35.065	72.081 U
R-BF	3	B	38 ^(b)	19.686 U	37.198 U	17.512 U	15.942 U	15.57	126.435 U	238.908 U	112.473 U	102.389 U
R-BF	4	A	68	21.791 U	9.834 J	6.372 J	17.647 U	15.24	142.986 U	64.529 J	41.813 J	115.794 U
R-BF	5	A	53	9.749 U	18.421 U	8.672 U	7.895 U	16.05	60.741 U	114.773 U	54.031 U	49.190 U
R-OS	1	B	43	12.092 U	22.849 U	10.757 U	9.792 U	15.79	76.580 U	144.706 U	68.125 U	62.014 U
R-OS	2	D	68	12.805	18.459 J	14.272 U	12.992 U	16.53	77.466	111.671 J	86.340 U	78.596 U
R-OS	3	B	56	16.633 U	19.223	14.796 U	13.469 U	15.02	110.739 U	127.980	98.509 U	89.674 U
R-OS	4	D	166 ^(b)	20.477	19.321 J	12.900 U	11.744 U	17.85	114.717	108.241 J	72.269 U	65.793 U
R-OS	5	C	71	12.896 U	6.174 J	11.472 U	10.443 U	17.02	75.770 U	36.276 J	67.403 U	61.357 U

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TABLE K.23. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tri-propyltin %Surrogate	Butyltin Species ($\mu\text{g}/\text{kg}$ wet weight)				Percent Dry Weight	Butyltin Species ($\mu\text{g}/\text{kg}$ dry weight)			
				Tetra butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin		Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
R-PF	1	C	134 ^(b)	8.579 U	6.209 J	1.931 J	6.947 U	13.90	61.719 U	44.669 J	13.892 J	49.978 U
R-PF	2	C	56	12.424 U	6.366 J	11.052 U	10.061 U	13.46	92.303 U	47.292 J	82.110 U	74.747 U
R-PF	3	D	133 ^(b)	10.994	16.983 J	9.490 U	8.639 U	16.88	65.130	100.610 J	56.220 U	51.179 U
R-PF	4	D	165 ^(b)	25.214	33.772 U	15.899 U	14.474 U	16.74	150.621	201.744 U	94.976 U	86.464 U
R-PF	5	A	61	6.724 U	8.175	1.709 J	5.446 U	16.47	40.826 U	49.637	10.374 J	33.066 U
C-SB	1	C	37 ^(b)	15.856 U	29.961 U	14.105 U	12.840 U	14.29	110.959 U	209.664 U	98.705 U	89.853 U
C-SB	2	D	101	6.520 J	11.025 J	6.664 U	6.066 U	16.03	40.671 J	68.778 J	41.572 U	37.842 U
C-SB	3	B	12 ^(b)	13.908 U	4.840 J	3.836 J	11.263 U	15.65	88.869 U	30.927 J	24.511 J	71.968 U
C-SB	4	A	68	7.450 U	10.669	6.627 U	6.033 U	16.06	46.389 U	66.433	41.264 U	37.565 U
C-SB	5	D	35 ^(b)	3.521 J	25.329 U	11.924 U	10.855 U	16.46	21.389 J	153.882 U	72.442 U	65.948 U
C-NE	1	B	63	5.211 U	9.847 U	4.636 U	4.220 U	15.94	32.691 U	61.775 U	29.084 U	26.474 U
C-NE	2	B	64	13.274 U	19.468	11.808 U	10.749 U	18.40	72.141 U	105.805	64.174 U	58.418 U
C-NE	3	B	65	11.812 U	22.319 U	10.507 U	9.565 U	16.01	73.779 U	139.407 U	65.628 U	59.744 U
C-NE	4	B	56	13.231 U	25.000 U	11.769 U	10.714 U	15.79	83.794 U	158.328 U	74.535 U	67.853 U
C-NE	5	B	29 ^(b)	7.631 U	14.419 U	6.788 U	6.180 U	15.28	49.941 U	94.365 U	44.424 U	40.445 U
MSL Background	1	E	84	2.710 U	5.120 U	4.283	2.194 U	19.82	13.673 U	25.832 U	21.609	11.070 U
MSL Background	2	E	81	2.700 U	5.102 U	3.068	2.187 U	19.82	13.623 U	25.742 U	15.479	11.034 U
MSL Background	3	E	60	3.345 U	6.321 U	1.325 J	5.856	19.82	16.877 U	31.892 U	6.685 J	29.546
MSL Background	4	E	77	3.990 U	7.539 U	3.549 U	3.231 U	19.82	20.131 U	38.037 U	17.906 U	16.302 U
MSL Background	5	E	31	2.694 U	5.091 U	5.413	2.083	19.82	13.592 U	25.686 U	27.311	10.510

(a) DL Detection limit.

(b) Recovery outside quality control range (40%-120%).

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

(d) U The analyte was not present above the level of the associated value.

(e) Percent dry weight was averaged from the other four replicates of COMP I.

TABLE K.24. Quality Control Data for Butyltins, Wet Weight, in Tissue of *N. caecoides*, Richmond Harbor Program

Sediment Treatment	Replicate	Analytical Batch	Tripropyltin % Surrogate	Butyltin Species ($\mu\text{g/kg}$ wet weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
<u>Method Blanks</u>							
Blank	1	A	27 ^(a)	40.75 U ^(b)	77 U	36.25 U	33 U
Blank	2	B	0 ^(a)	40.75 U	77 U	36.25 U	33 U
Blank	3	C	1 ^(a)	40.75 U	77 U	36.25 U	2.281 J ^(c)
Blank	4	D	0 ^(a)	58.473	77 U	36.25 U	33 U
<u>Matrix Spikes</u>							
Background JW05	1	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MS	1	A	37 ^(a)	3.651 U	13.808	15.373	2.957 U
Concentration Recovered			NA ^(d)	NA	13.808	15.370	NA
Amount Spiked			NS ^(e)	NS	29.498	24.247	NS
Percent Recovery			NA	NA	47%	63%	NA
Background JW05	1	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MSD	1	A	42	3.486 U	10.698	14.898	2.823 U
Concentration Recovered			NA	NA	10.698	14.898	NA
Amount Spiked			NS	NS	28.161	23.148	NA
Percent Recovery			NA	NA	38% ^(a)	64%	NA
MS/MSD RPD			NA	NA	21%	2%	NA
MS/MSD I-STAT			NA	NA	0.10	0.01	NA
Background JW05	2	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MS	2	B	74	3.933 U	35.558	22.592	3.185 U
Concentration Recovered			NA	NA	35.558	22.592	NA
Amount Spiked			NS	NS	31.776	26.120	NS
Percent Recovery			NA	NA	112%	86%	NA
Background JW05	2	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MSD	2	B	63	3.05 U	22.931	18.280	2.47 U
Concentration Recovered			NA	ND	22.931	18.280	NA
Amount Spiked			NS	NS	24.641	20.254	NS
Percent Recovery			NA	NA	93%	90%	NA
MS/MSD RPD			NA	NA	18%	4%	NA
MS/MSD I-STAT			NA	NA	0.09	0.02	NA
Background JW05	3	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MS	3	C	37 ^(a)	2.221 U	7.315	9.511	1.798 U
Concentration Recovered			NA	NA	7.315	9.511	NA
Amount Spiked			NS	NS	17.940	14.747	NS
Percent Recovery			NA	NA	41%	64%	NA
Background JW05	3	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MSD	3	C	0 ^(a)	5.855 U	12.937	22.156	1.64 J
Concentration Recovered			NA	NA	12.937	22.156	1.64
Amount Spiked			NS	NS	47.299	38.879	35.718
Percent Recovery			NA	NA	27% ^(a)	57%	5% ^(a)
MS/MSD RPD			NA	NA	39% ^(f)	12%	NA
MS/MSD I-STAT			NA	NA	0.20	0.06	NA

TABLE K.24. (contd)

Sediment Treatment	Replicate	Analytical Batch	Tripropyltin % Surrogate	Butyltin Species ($\mu\text{g}/\text{kg}$ wet weight)			
				Tetra-butyltin	Tri-butyltin	Di-butyltin	Mono-butyltin
Background JW05	4	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MS	4	D	0 ^(a)	6.747 U	15.419	43.172	2.679 J
Concentration Recovered			NA	NA	15.419	43.172	2.679
Amount Spiked			NS	NS	54.503	44.801	41.159 ^(a)
Percent Recovery			NA	NA	28% ^(a)	96%	7% ^(a)
Background JW05	4	E	72	4.065 U	7.682 U	3.616 U	3.399
Background MSD	4	D	0 ^(a)	6.637 U	11.91	38.611	2.249 J
Concentration Recovered			NA	NA	11.91	38.611	2.249
Amount Spiked			NS	NS	53.616	44.072	40.489 ^(a)
Percent Recovery			NA	NA	22% ^(a)	88%	6% ^(a)
MS/MSD RPD			NA	NA	24%	10%	16%
MS/MSD I-STAT			NA	NA	0.12	0.05	0.08
<u>Analytical Replicates</u>							
CDMP I Replicate 1	4	B	72	18.693 U	35.321 U	16.628 U	15.138 U
CDMP I Replicate 2	4	B	58	15.234 U	28.785 U	13.551 U	12.336 U
CDMP I Replicate 3	4	B	81	13.252 U	16.019 J	11.789 U	10.732 U
RSD				NA	NA	NA	NA
TC-5 Upper Comp Replicate 1	5	A	76	6.954 U	6.185 J	6.186 U	5.631 U
TC-5 Upper Comp Replicate 2	5	A	42	22.971 U	43.405 U	20.434 U	18.602 U
TC-5 Upper Comp Replicate 3	5	A	69	13.520 U	7.285 J	12.027 U	10.949 U
RSD				NA	NA	NA	NA
COMP VI Replicate 1	5	D	283 ^(a)	45.349 D	37.745 U	17.770 U	16.176 U
COMP VI Replicate 2	5	D	94	24.703	16.259 J	6.308 J	18.655 U
COMP VI Replicate 3	5	D	0 ^(a)	12.070 U	20.213	6.492 J	2.947 J
RSD				NA	NA	NA	NA
R-AC Replicate 1	2	C	0 ^(a)	1.270 J	3.564 J	1.296 J	1.632 J
R-AC Replicate 2	2	C	70	13.579 U	8.344 J	12.079 U	10.996 U
R-AC Replicate 3	2	C	80	12.274 U	10.444 J ^(f)	10.919 U	9.940 U
RSD				NA	47% ^(f)	NA	NA

(a) Recovery outside quality control range (40%-120%).

(b) U The analyte was not present above the level of the associated value.

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

(d) NA Not applicable.

(e) NS Not spiked.

(f) Value exceeds relative precision range of (30%).

APPENDIX L

MEAN CONCENTRATIONS AND STATISTICAL GROUPING' FOR *M. nasuta*

TABLE L.1. Mean Concentrations and Statistical Grouping for Naphthalene in *M.nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-OS	12.43	A
COMP III	11.41	A
COMP II	12.72	A
COMP I	13.14	A
R-PF	13.35	A
R-AM	15.55	A
COMP IV	13.96	A
R-AC	15.50	A
COMP V	15.27	A
R-BF	15.69	A
COMP VI	21.09	A
TC-5 Upper Comp	20.96	A

TABLE L.2. ANOVA Results for Naphthalene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.204	11	0.200	1.377	0.2144
Residual	6.985	48	0.146		

TABLE L.3. Mean Concentrations and Statistical Grouping for Fluorene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration</u> <u>($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	4.75	A
R-OS	5.04 U ^(a) J ^(b)	A
COMP I	5.12	A
R-BF	5.16	A
R-PF	5.30	A
COMP V	5.46	A
TC-5 Upper Comp	6.54	A
R-AM	7.26	A
R-AC	11.70	B

(a) U The analyte was not present above the level of the associated value.

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

TABLE L.4. ANOVA Results for Fluorene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.242	8	0.405	8.199	0.0001
Residual	1.779	36	0.049		

TABLE L.5. Mean Concentrations and Statistical Grouping for Phenanthrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	9.98	A
COMP III	10.14	A
R-OS	10.89	A
R-PF	11.17	A
COMP II	12.65	A
R-BF	14.02	A
COMP I	15.08	A
COMP VI	16.02	A
COMP V	16.48	A
TC-5 Upper Comp	27.88	B
R-AM	46.04	B
R-AC	111.96	C

TABLE L.6. ANOVA Results for Phenanthrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	28.454	11	2.587	49.762	0.0001
Residual	2.495	48	0.052		

TABLE L.7. Mean Concentrations and Statistical Grouping for Anthracene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-OS	2.61 U ^(a) J ^(b)	A
R-PF	3.55 UJ	AB
R-BF	3.39	AB
COMP V	4.83	AB
COMP VI	5.09	AB
TC-5 Upper Comp	6.11	B
R-AM	18.15	C
R-AC	45.51	C

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).

TABLE L.8. ANOVA Results for Anthracene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	36.500	7	5.214	20.677	0 .0001
Residual	8.070	32	0.252		

TABLE L.9. Mean Concentrations and Statistical Grouping for Fluoranthene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	8.00	A
R-PF	9.81	A
COMP III	11.38	A
R-OS	12.31	A
COMP II	25.42	B
COMP VI	34.97	BC
COMP I	36.02	BC
COMP V	41.63	BC
R-BF	45.69	C
TC-5 Upper Comp	154.17	D
R-AM	287.09	E
R-AC	1124.66	F

TABLE L.10. ANOVA Results for Fluoranthene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	122.479	11	11.134	154.140	0.0001
Residual	3.467	48	0.072		

TABLE L.11. Mean Concentrations and Statistical Grouping for Pyrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	5.55	A
R-PF	7.62	AB
R-OS	8.67	AB
COMP III	10.51	B
R-8F	48.62	C
COMP II	48.89	C
COMP I	61.42	C
COMP V	146.49	D
COMP VI	149.63	DE
TC-5 Upper Comp	267.23	EF
R-AM	316.09	F
R-AC	2614.47	G

TABLE L.12. ANOVA Results for Pyrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	187.444	11	17.040	230.457	0.0001
Residual	3.549	48	0.074		

TABLE L.13. Mean Concentrations and Statistical Grouping for Benzo(a)anthracene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-OS	3.86 U ^(a) J ^(b)	A
R-PF	6.95 UJ	AB
COMP II	6.99	ABC
COMP I	10.84	BC
R-BF	12.73	BC
COMP VI	17.54	CD
COMP V	18.76	CD
TC-5 Upper Comp	44.94	DE
R-AM	115.81	EF
R-AC	242.06	F

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).

TABLE L.14. ANOVA Results for Benzo(a)anthracene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	80.983	9	8.998	30.467	0.0001
Residual	11.813	40	0.295		

TABLE L.15. Mean Concentrations and Statistical Grouping for Chrysene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration</u> <u>(μg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-PF	3.83	A
COMP IV	4.36	A
COMP III	4.47	A
R-OS	5.19	A
COMP II	11.70	B
COMP I	15.97	B
R-BF	22.25	B
COMP VI	24.73	B
COMP V	26.50	B
TC-5 Upper Comp	69.35	C
R-AM	182.84	D
R-AC	299.76	D

TABLE L.16. ANOVA Results for Chrysene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	118.034	11	10.730	72.031	0.0001
Residual	7.150	48	0.149		

TABLE L.17. Mean Concentrations and Statistical Grouping for Benzo(b)fluoranthene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	4.41 U ^(a) J ^(b)	A
R-PF	6.97 UJ	A
COMP II	21.01	B
COMP I	24.51	B
R-BF	32.63	BC
COMP VI	55.03	CD
COMP V	57.06	CD
R-AM	75.95	D
TC-5 Upper Comp	80.93	D
R-AC	327.48	E

(a) U The analyte was not present above the level of the associated value.

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

TABLE L.18. ANOVA Results for Benzo(b)fluoranthene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	72.054	9	8.006	71.793	0.0001
Residual	4.461	40	0.112		

TABLE L.19. Mean Concentrations and Statistical Grouping for Benzo(k)fluoranthene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	17.58	A
R-PF	6.15 U ^(a) J ^(b)	A
COMP II	14.28	B
COMP I	16.15	8C
R-BF	17.58	BC
COMP V	37.37	CD
COMP VI	38.39	CD
TC-5 Upper Comp	61.72	D
R-AM	86.86	D
R-AC	244.02	E

- (a) U The analyte was not present above the level of the associated value.
(b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).

TABLE L.20. ANOVA Results for Benzo(k)fluoranthene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	76.695	9	8.522	48.585	0.0001
Residual	7.016	40	0.175		

TABLE L.21. Mean Concentrations and Statistical Grouping for Benzo(a)pyrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	3.72 U ^(a) J ^(b)	A
R-PF	5.91 UJ	B
COMP II	14.57	A
COMP I	15.68	B
R-BF	21.31	B
COMP VI	34.79	BC
COMP V	35.83	BCD
TC-5 Upper Comp	62.08	CD
R-AM	105.19	D
R-AC	358.85	E

(a) U The analyte was not present above the level of the associated value.

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

TABLE L.22. ANOVA Results for Benzo(a)pyrene *M. nasuta* in Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	89.609	9	9.957	43.856	0.0001
Residual	9.081	40	0.227		

TABLE L.23. Mean Concentrations and Statistical Grouping for Indeno(1,2,3-cd)pyrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	5.29 U ^(a) J ^(b)	A
COMP II	9.00	AB
COMP I	9.20	AB
R-PF	10.01 U	ABC
R-BF	10.74	BC
COMP VI	13.35	BC
COMP V	14.35	BC
TC-5 Upper Comp	22.49	BC
R-AM	29.82	C
R-AC	102.38	D

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).

TABLE L.24. ANOVA Results for Indeno(1,2,3-cd)pyrene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	32.731	9	3.637	16.413	0.0001
Residual	8.863	40	0.222		

TABLE L.25. Mean Concentrations and Statistical Grouping for Benzo(g,h,i)perylene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration</u> <u>(μg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-OS	7.26 U ^(a) J ^(b)	A
COMP I	10.98	AB
R-PF	13.58 U	BC
COMP VI	16.81	BC
R-BF	17.30	BC
COMP V	18.17	BC
TC-5 Upper Comp	27.07	C
R-AM	30.42	C
R-AC	105.28	D

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).

TABLE L.26. ANOVA Results for Benzo(g,h,i)perylene in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	25.375	8	3.172	16.821	0.0001
Residual	6.789	36	0.189		

TABLE L.27. Mean Concentrations and Statistical Grouping for Aroclor 1254 in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	22.827	A
R-PF	35.565	AB
COMP IV	37.798	C
COMP III	58.732	CD
COMP I	78.013	DE
R-AM	88.554	DEF
COMP II	92.039	DEF
R-BF	99.709	EF
R-AC	129.624	FG
COMP V	158.738	GH
TC-5 Upper Comp	173.525	GH
COMP VI	202.853	H

TABLE L.28. ANOVA Results for Aroclor 1254 in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	25.813	11	2.347	49.852	0.0001
Residual	2.259	48	0.042		

TABLE L.29. Mean Concentrations and Statistical Grouping for Alpha-BHC in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP II	0.564	A
COMP III	0.545	AB
R-PF	0.753	AB
TC-5 Upper Comp	0.792	AB
R-AC	0.995	AB
R-OS	1.107	AB
COMP IV	0.943	AB
COMP V	1.447	AB
COMP I	1.116	AB
R-BF	1.339	AB
COMP VI	1.792	AB
R-AM	2.041	B

TABLE L.30. ANOVA Results for Alpha-BHC in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	15.361	11	1.396	2.231	0.0279
Residual	30.046	48	0.626		

TABLE L.31. Mean Concentrations and Statistical Grouping for Delta-BHC in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-AC	0.532 U ^(a) J ^(b) E ^(c)	A
COMP V	0.655 UJE	A
R-OS	0.514 UJE	A
R-PF	0.667 UJE	A
R-BF	0.667 U	A
COMP VI	0.822 UJE	A
COMP I	0.704 UE	A
R-AM	0.939 U	A

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).
 (c) E Value an estimate, analyte not detected on confirmation column.

TABLE L.32. ANOVA Results for Delta-BHC in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.802	7	0.400	0.853	0.5531
Residual	15.99	32	0.469		

TABLE L.33. Mean Concentrations and Statistical Grouping for Gamma-BHC in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration</u> <u>($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP II	2.863 E ^(a)	A
COMP III	2.904 E	A
TC-5 Upper Comp	3.002 E	A
COMP IV	3.221 E	A
R-PF	3.286 E	A
R-AC	3.594 E	A
R-BF	3.629 E	A
R-AM	3.565 J ^(b) E	A
R-OS	4.094	A
COMP V	4.108 E	A
COMP I	4.179 E	A
COMP VI	4.561 E	A

(a) E Value an estimate, analyte not detected on confirmation column.

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

TABLE L.34. ANOVA Results for Gamma-BHC in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	1.555	11	0.141	1.630	0.1205
Residual	4.163	48	0.087		

TABLE L.35. Mean Concentrations and Statistical Grouping for 4,4'-DDD in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-AM	0.532 U ^(a) J ^(b)	A
R-PF	0.529	A
R-OS	0.505	A
COMP III	2.285	B
R-BF	2.542	B
COMP I	4.104	BC
R-AC	4.688	BC
COMP II	8.423	BC
TC-5 Upper Comp	11.178	C
COMP V	66.266	D
COMP VI	79.833	D

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).

TABLE L.36. ANOVA Results for 4,4'-DDD in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	168.211	10	16.821	42.868	0.0001
Residual	17.265	44	0.392		

TABLE L.37. Mean Concentrations and Statistical Grouping for 4,4'-DDE in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP III	1.593	A
R-AM	2.413	AB
R-BF	3.934	BC
R-AC	3.917	BC
R-OS	3.991	BC
R-PF	4.446	BC
COMP I	4.704	C
COMP II	5.060	CD
TC-5 Upper Comp	9.719	DE
COMP V	18.332	E
Comp VI	18.541	E

TABLE L.38. ANOVA Results for 4,4'-DDE in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	30.189	10	3.019	33.515	0.0001
Residual	3.963	44	0.090		

TABLE L.39. Mean Concentrations and Statistical Grouping for 4,4'-DDT in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
COMP V	1.047 U ^(a) J ^(b) E ^(c)	A
R-OS	1.330 U	A
R-BF	1.403 U	A
R-AC	1.400 U	A
R-AM	1.612	A
R-PF	1.651	A

(a) U The analyte was not present above the level of the associated value.

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

(c) E Value an estimate, analyte not detected on confirmation column.

TABLE L.40. ANOVA Results for 4,4'-DDT in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.489	5	0.698	1.497	0.2280
Residual	11.189	24	0.466		

TABLE L.41. Mean Concentrations and Statistical Grouping for Dieldrin in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-BF	0.764 J ^(a)	A
R-AM	2.931 U ^(b) J	AB
COMP II	1.209 JE ^(c)	ABC
TC-5 Upper Comp	2.081 JE	ABC
R-OS	4.128 UJ	ABC
R-AC	4.489 UJ	ABC
COMP V	6.245	BC
COMP VI	7.294	BC
R-PF	8.186 U	C

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).
 (b) U The analyte was not present above the level of the associated value.
 (c) E Value an estimate, analyte not detected on confirmation column.

TABLE L.42. ANOVA Results for Dieldrin in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	31.127	8	3.891	5.653	0.0001
Residual	24.778	36	0.688		

TABLE L.43. Mean Concentrations and Statistical Grouping for Endosulfan II in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-AM	1.701 U ^(a) J ^(b)	A
COMP II	1.269 UJE ^(c)	A
R-OS	1.575 UJ	A
COMP V	1.478 UJE	A
R-BF	1.650 UJ	A
COMP VI	1.750 UJE	A
R-AC	2.059 U	A
R-PF	2.429 U	A

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).
 (c) E Value an estimate, analyte not detected on confirmation column.

TABLE L.44. ANOVA Results for Endosulfan II in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	13.604	7	1.943	1.075	0.4018
Residual	57.851	32	1.808		

TABLE L.45. Mean Concentrations and Statistical Grouping for Silver in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-BF	0.243	A
TC-5 Upper Comp	0.234	A
COMP V	0.351	A
R-PF	0.363	A
R-AM	0.305	A
COMP II	0.476	A
R-OS	0.502	A
COMP I	0.457	A
R-AC	0.468	A
COMP IV	0.510	A
COMP III	0.535	A
COMP VI	0.622	A

TABLE L.46. ANOVA Results for Silver in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	7.536	11	0.685	1.456	0.1797
Residual	22.582	48	0.470		

TABLE L.47. Mean Concentrations and Statistical Grouping for Arsenic in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-OS	27.0	A
R-AC	28.4	A
R-AM	28.7	A
R-BF	28.3	A
COMP IV	29.2	A
R-PF	29.1	A
COMP VI	30.5	A
COMP II	29.8	A
COMP V	31.5	A
COMP I	31.6	A
TC-5 Upper Comp	33.2	A
COMP III	33.5	A

TABLE L.48. ANOVA Results for Arsenic in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.281	11	0.026	0.968	0.4872
Residual	1.268	48	0.026		

TABLE L.49. Mean Concentrations and Statistical Grouping for Cadmium in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	0.160	A
COMP I	0.168	AB
R-AC	0.194	AB
COMP II	0.182	AB
COMP VI	0.213	AB
R-OS	0.222	AB
COMP V	0.223	AB
COMP III	0.237	AB
R-AM	0.253	AB
R-BF	0.259	AB
TC-5 Upper Comp	0.265	AB
R-PF	0.338	B

TABLE L.50. ANOVA Results for Cadmium in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.126	11	0.284	1.975	0.0524
Residual	6.904	48	0.144		

TABLE L.51. Mean Concentrations and Statistical Grouping for Chromium in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP II	1.89	A
R-BF	1.95	A
COMP VI	2.14	A
R-AM	2.26	A
COMP I	2.44	A
COMP V	2.24	A
R-AC	2.38	A
TC-5 Upper Comp	2.51	A
COMP III	2.59	A
COMP IV	2.62	A
R-OS	2.71	A
R-PF	2.96	A

TABLE L.52. ANOVA Results for Chromium in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	1.173	11	0.107	0.938	0.5133
Residual	5.457	48	0.114		

TABLE L.53. Mean Concentrations and Statistical Grouping for Copper in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-OS	14.70	A
R-PF	16.45	A
R-AC	17.54	A
R-BF	17.54	A
TC-5 Upper Comp	17.90	A
R-AM	17.66	A
COMP IV	18.19	A
COMP II	18.79	A
COMP V	19.25	A
COMP III	19.62	A
COMP I	20.26	A
COMP VI	21.72	A

TABLE L.54. ANOVA Results for Copper in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.559	11	0.051	1.340	0.2327
Residual	1.821	56	0.038		

TABLE L.55. Mean Concentrations and Statistical Grouping for Mercury in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	0.054	A
COMP III	0.065	AB
R-AC	0.065	AB
R-OS	0.066	AB
COMP II	0.071	AB
R-PF	0.076	AB
COMP I	0.086	AB
R-AM	0.084	AB
COMP VI	0.094	AB
TC-5 Upper Comp	0.102	B
R-BF	0.101	B
COMP V	0.105	B

TABLE L.56. ANOVA Results for Mercury in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.785	11	0.253	2.721	0.0082
Residual	4.467	48	0.093		

TABLE L.57. Mean Concentrations and Statistical Grouping for Nickel in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP I	4.17	A
COMP II	4.56	A
R-AM	4.54	A
R-PF	4.83	A
R-AC	5.13	A
COMP IV	5.26	A
R-BF	5.17	A
COMP V	5.57	A
TC-5 Upper Comp	5.41	A
COMP III	5.45	A
COMP VI	5.60	A
R-OS	5.62	A

TABLE L.58. ANOVA Results for Nickel in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.539	11	0.049	0.781	0.6569
Residual	3.010	48	0.063		

TABLE L.59. Mean Concentrations and Statistical Grouping for Lead in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-PF	1.20	A
R-OS	1.22	A
COMP IV	1.42	AB
COMP III	1.55	ABC
R-AM	1.62	ABC
COMP I	1.67	ABC
COMP II	1.81	ABC
R-AC	1.84	ABC
R-BF	2.03	BC
COMP V	2.14	BC
TC-5 Upper Comp	2.13	BC
COMP VI	2.32	C

TABLE L.60. ANOVA Results for Lead in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.519	11	0.229	5.369	0.0001
Residual	2.047	48	0.043		

TABLE L.61. Mean Concentrations and Statistical Grouping for Selenium in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	1.26	A
COMP II	1.44	A
R-PF	1.43	A
COMP III	1.50	A
TC-5 Upper Comp	1.53	A
COMP VI	1.57	A
R-BF	1.60	A
R-OS	1.65	A
R-AM	1.67	A
COMP V	1.75	A
COMP I	1.75	A
R-AC	1.76	A

TABLE L.62. ANOVA Results for Selenium in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	.579	11	0.053	1.300	0.2536
Residual	1.943	48	0.040		

TABLE L.63. Mean Concentrations and Statistical Grouping for Zinc in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-OS	96.9	A
COMP I	99.8	A
COMP IV	104.7	A
COMP II	107.2	A
R-AC	115.9	A
R-PF	122.0	A
COMP VI	122.1	A
COMP III	123.1	A
R-BF	126.4	A
TC-5 Upper Comp	127.4	A
R-AM	133.0	A
COMP V	135.1	A

TABLE L.64. ANOVA Results for Zinc in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.714	11	0.065	2.082	0.0403
Residual	1.496	48	0.031		

TABLE L.65. Mean Concentrations and Statistical Grouping for Tributyltin in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
COMP I	38.6	A
R-PF	45.1	AB
COMP VI	45.9	ABC
R-OS	48.2	ABC
TC-5 Upper Comp	53.5	ABC
COMP III	53.8	ABC
COMP IV	56.9	ABC
COMP V	55.4	ABC
COMP II	58.8	ABC
R-BF	67.4	ABC
R-AM	73.7	BC
R-AC	77.5	C

TABLE L.66. ANOVA Results for Tributyltin in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.358	11	0.214	3.252	0.0022
Residual	3.164	48	0.066		

TABLE L.67. Mean Concentrations and Statistical Grouping for Dibutyltin in *M. nasuta* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-PF	2.7 U ^(a)	A
COMP VI	4.8	A
COMP III	4.8	A
R-BF	7.0	A
COMP V	6.4	A
COMP II	6.8	A
R-OS	9.4	A
COMP IV	9.6	A
TC-5 Upper Comp	10.1	A
R-AM	10.1	A
R-AC	11.9	A

(a) U The analyte was not present above the level of the associated value.

TABLE L.68. ANOVA Results for Dibutyltin in *M. nasuta* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	9.521	10	0.952	1.683	0.1154
Residual	24.896	44	0.566		

APPENDIX M

MEAN CONCENTRATIONS AND STATISTICAL GROUPING
FOR *N. caecoides*

TABLE M.1. Mean Concentrations and Statistical Grouping for Naphthalene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-PF	19.86	A
COMP V	16.93	A
COMP II	19.58	A
R-OS	23.43	A
R-AC	29.86	A
R-BF	31.55	A
R-AM	48.08	A
COMP I	48.87	A

TABLE M.2. ANOVA Results for Naphthalene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.279	7	0.468	0.961	0.4754
Residual	15.597	32	0.487		

TABLE M.3. Mean Concentrations and Statistical Grouping for Phenanthrene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
COMP III	15.41	A
R-OS	15.84	A
COMP II	19.18	AB
COMP IV	20.38	AB
COMP V	20.04	AB
COMP VI	20.85	AB
R-PF	23.07	AB
COMP I	22.32	AB
R-BF	25.06	B
TC-5 Upper Comp	56.60	C
R-AM	58.10	C
R-AC	319.66	D

TABLE M.5. ANOVA Results for Phenanthrene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	40.557	11	3.687	57.598	0.0001
Residual	3.073	48	0.064		

TABLE M.6. Mean Concentrations and Statistical Grouping for Fluoranthene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	11.15 J ^(a)	A
R-PF	18.54	B
COMP I	21.21	BC
COMP II	21.37	BC
COMP VI	28.51	C
R-BF	29.11	C
COMP V	28.44	C
R-AM	125.61	D
TC-5 Upper Comp	210.17	E
R-AC	1948.85	F

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

TABLE M.7. ANOVA Results for Fluoranthene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	109.526	9	12.170	190.872	0.0001
Residual	2.550	40	0.064		

TABLE M.8. Mean Concentrations and Statistical Grouping for Pyrene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-OS	13.73 J ^(a)	A
R-PF	19.74	A
COMP III	19.65	A
R-BF	55.70	B
COMP I	58.74	B
COMP II	67.48	B
COMP V	188.07	C
COMP VI	191.61	C
R-AM	273.46	C
TC-5 Upper Comp	491.66	D
R-AC	5907.89	E

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

TABLE M.9. ANOVA Results for Pyrene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	154.155	10	15.415	391.508	0.0001
Residual	1.732	44	0.039		

TABLE M.10. Mean Concentrations and Statistical Grouping for Chrysene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-OS	7.48 U ^(a) J ^(b)	A
R-PF	6.52 J	A
COMP I	13.290	B
COMP II	14.62	8C
R-BF	19.106	BC
COMP VI	25.47	C
COMP V	25.62	C
R-AM	51.78	D
TC-5 Upper Comp	87.64	D
R-AC	318.76	E

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL) but above instrument detection limit (IDL).

TABLE M.11. ANOVA Results for Chrysene in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	66.674	9	7.408	80.834	0.0001
Residual	3.666	40	0.092		

TABLE M.12. Mean Concentrations and Statistical Grouping for Aroclor 1254 in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration</u> <u>($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-PF	60.21 U ^(a)	A
R-OS	73.75 U	A
COMP III	75.53	AB
COMP I	93.82	ABC
R-AM	96.74	ABC
R-BF	151.91	BC
COMP II	172.22	CD
R-AC	186.47	CD
COMP V	317.81	DE
COMP VI	362.74	E
TC-5 Upper Comp	410.42	E

(a) U The analyte was not present above the level of the associated value.

TABLE M.13. ANOVA Results for Aroclor 1254 in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	24.187	10	2.419	25.880	0.0001
Residual	4.112	44	0.093		

TABLE M.14. Mean Concentrations and Statistical Grouping for 4,4'-DDD in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-PF	1.42 U ^(a)	A
R-OS	1.73 U	AB
R-AM	1.94 U	AB
COMP III	2.19	AB
R-BF	2.78	AB
R-AC	5.91	BC
COMP I	5.97	BC
COMP II	12.97	C
TC-5 Upper Comp	18.80	CD
COMP V	76.11	DE
COMP VI	105.48	E

(a) U The analyte was not present above the level of the associated value.

TABLE M.15. ANOVA Results for 4,4'-DDD in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	120.746	10	12.075	26.955	0.0001
Residual	19.710	44	0.448		

TABLE M.16. Mean Concentrations and Statistical Grouping for 4,4'-DDE in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g}/\text{kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-AM	5.08	A
COMP III	5.88	AB
R-OS	7.94	ABC
R-PF	8.86	BCD
R-BF	9.40	BCD
R-AC	10.02	BCD
COMP I	12.70	CD
CDMP II	14.58	DE
TC-5 Upper Comp	23.27	EF
COMP VI	37.33	F
COMP V	40.41	F

TABLE M.17. ANOVA Results for 4,4'-DDE in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	24.395	10	2.439	30.703	0.0001
Residual	3.496	44	0.079		

TABLE M.18. Mean Concentrations and Statistical Grouping for Silver in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	0.024	A
COMP V	0.030	AB
R-PF	0.029	AB
R-BF	0.031	AB
COMP III	0.030	AB
COMP I	0.033	AB
COMP VI	0.035	AB
R-AC	0.038	AB
R-OS	0.041	AB
TC-5 Upper Comp	0.047	AB
COMP II	0.048	AB
R-AM	0.056	B

TABLE M.19. ANOVA Results for Silver in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.633	11	0.330	1.831	0.0745
Residual	8.656	48	0.180		

TABLE M.20. Mean Concentrations and Statistical Grouping for Arsenic in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-AM	23.5	A
R-OS	24.1	A
R-PF	25.6	AB
COMP IV	28.2	ABC
COMP III	28.1	ABC
R-AC	28.5	ABC
R-BF	29.6	ABC
COMP II	31.1	ABC
COMP V	31.1	ABC
COMP VI	32.8	BC
COMP I	34.7	C
TC-5 Upper Comp	35.8	C

TABLE M.21. ANOVA Results for Arsenic in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.990	11	0.090	4.873	0.0001
Residual	0.886	48	0.018		

TABLE M.22. Mean Concentrations and Statistical Grouping for Cadmium in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-BF	0.95	A
TC-5 Upper Comp	0.97	A
COMP III	1.04	A
COMP V	1.08	A
COMP IV	1.12	A
COMP II	1.11	A
R-PF	1.11	A
R-OS	1.16	A
R-AC	1.17	A
COMP VI	1.17	A
COMP I	1.17	A
R-AM	1.18	A

TABLE M.23. ANOVA Results for Cadmium in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.313	11	0.028	0.954	0.4994
Residual	1.430	48	0.030		

TABLE M.24. Mean Concentrations and Statistical Grouping for Chromium in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP II	0.67	A
COMP IV	0.69	A
COMP V	0.73	A
COMP I	0.77	A
R-AC	0.77	A
R-AM	0.84	A
R-OS	0.86	A
COMP III	0.85	A
COMP VI	0.89	A
R-PF	0.89	A
R-BF	0.91	A
TC-5 Upper Comp	1.16	A

TABLE M.25. ANOVA Results for Chromium in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	1.326	11	0.121	1.241	0.2871
Residual	4.663	48	0.097		

TABLE M.26. Mean Concentrations and Statistical Grouping for Copper in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-BF	10.80	A
COMP III	11.16	A
COMP IV	11.49	A
TC-5 Upper Comp	11.55	A
COMP V	11.84	A
R-AM	12.07	A
R-PF	11.88	A
R-OS	11.86	A
R-AC	13.21	A
COMP VI	13.20	A
COMP II	13.82	A
COMP I	14.16	A

TABLE M.27. ANOVA Results for Copper in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	.409	11	0.037	2.025	0.0464
Residual	.881	48	0.018		

TABLE M.28. Mean Concentrations and Statistical Grouping for Mercury in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-AC	0.062	A
TC-5 Upper Comp	0.064	A
COMP V	0.065	A
COMP IV	0.069	A
COMP VI	0.069	A
COMP II	0.075	A
R-OS	0.074	A
R-AM	0.078	A
R-PF	0.078	A
COMP I	0.080	A
COMP III	0.079	A
R-BF	0.084	A

TABLE M.29. ANOVA Results for Mercury in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.566	11	0.051	2.091	0.0394
Residual	1.181	48	0.025		

TABLE M.30. Mean Concentrations and Statistical Grouping for Nickel in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP V	3.76	A
R-BF	4.41	A
COMP I	4.65	A
COMP VI	4.88	A
R-OS	5.33	A
R-PF	5.30	A
R-AC	5.44	A
COMP IV	5.48	A
TC-5 Upper Comp	5.48	A
R-AM	5.56	A
COMP II	5.78	A
COMP III	5.70	A

TABLE M.31. ANOVA Results for Nickel in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.882	11	0.080	1.792	0.0819
Residual	2.148	48	0.045		

TABLE M.32. Mean Concentrations and Statistical Grouping for Lead in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP IV	0.62	A
R-AM	0.62	AB
R-OS	0.62	AB
COMP III	0.74	AB
R-PF	1.44	AB
R-AC	0.96	AB
COMP II	0.96	AB
COMP I	1.05	AB
R-BF	1.07	AB
COMP V	1.12	AB
COMP VI	1.24	AB
TC-5 Upper Comp	1.26	B

TABLE M.33. ANOVA Results for Lead in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	3.912	11	0.356	3.217	0.0024
Residual	5.306	48	0.111		

TABLE M.34. Mean Concentrations and Statistical Grouping for Selenium in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
COMP III	1.36	A
R-BF	1.46	A
COMP II	1.45	A
R-PF	1.48	A
COMP IV	1.59	A
R-AM	1.57	A
COMP VI	1.68	A
COMP I	1.76	A
R-AC	1.72	A
R-OS	1.87	A
COMP V	1.88	A
TC-5 Upper Comp	2.04	A

TABLE M.35. ANOVA Results for Selenium in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.894	11	0.081	0.894	0.5522
Residual	4.360	48	0.091		

TABLE M.36. Mean Concentrations and Statistical Grouping for Zinc in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration (mg/kg dry weight)</u>	<u>Statistical Grouping</u>
R-OS	182.1	A
R-BF	186.0	A
R-PF	186.4	A
COMP IV	189.4	A
COMP V	190.9	A
TC-5 Upper Comp	193.1	A
COMP III	194.9	A
R-AM	196.7	A
COMP I	200.7	A
COMP VI	201.6	A
COMP II	203.1	A
R-AC	204.5	A

TABLE M.37. ANOVA Results for Zinc in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	0.075	11	0.007	.974	0.4824
Residual	0.336	48	0.007		

TABLE M.38. Mean Concentrations and Statistical Grouping for Dibutyltin in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration ($\mu\text{g/kg dry weight}$)</u>	<u>Statistical Grouping</u>
R-PF	51.51 U ^(a) J ^(b)	A
R-AM	45.31 UJ	A
COMP V	49.64	A
R-BF	57.60	A
COMP VI	61.96	A
R-AC	77.57 UJ	A
R-OS	78.53 U	A

(a) U The analyte was not present above the level of the associated value.

(b) J Analyte detected below method detection limit (MDL) but above instrument detection limit (IDL).

TABLE M.39. ANOVA Results for Dibutyltin in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.521	6	0.420	1.371	0.2605
Residual	8.582	28	0.306		

TABLE M.40. Mean Concentrations and Statistical Grouping for Tributyltin in *N. caecoides* Tissues, Richmond Harbor Program

<u>Sediment Treatment</u>	<u>Mean Concentration</u> <u>($\mu\text{g/kg}$ dry weight)</u>	<u>Statistical Grouping</u>
R-AC	76.81	A
R-PF	88.79	A
COMP VI	99.35	A
COMP V	97.50	A
R-OS	105.77	A
R-AM	119.03	A
R-BF	146.92 U ^(a) J ^(b)	A
COMP I	171.81	A

- (a) U The analyte was not present above the level of the associated value.
 (b) J Analyte detected below method detection limit (MDL) but above instrument detection limit (IDL).

TABLE M.41. ANOVA Results for Dibutyltin in *N. caecoides* Tissues, Richmond Harbor Program

<u>Source of Variation</u>	<u>Sum of Squares</u>	<u>d.f.</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>Significance Level</u>
Treatment	2.527	7	0.361	0.999	0.4499
Residual	11.563	32	0.361		

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