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Ecological Evaluation of Proposed Dredged Material from St. Andrew Bay, Florida

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SUMMARY

Panama City Harbor is located in St. Andrew Bay, Florida, about 105 miles east of Pensacola, Florida. St. Andrew Bay is about 10 miles long and parallels the gulf coast. Natural depths range to about 50 feet, with about 7 square miles of the Bay measuring at least 30 feet deep. St. Andrew Bay is nearly landlocked, separated from the Gulf of Mexico by a barrier sand beach formally known as Lands End Peninsula (known locally as "Shell Island"). The Bay has two outlets to the Gulf, one of which is a natural inlet at the eastern end of Lands End Peninsula and the other a dredged channel 32 feet deep through the barrier peninsula about 4 miles west of the natural opening. The dredged cut is stabilized by twin rubble-mound jetties and serves as the harbor entrance from the Gulf.

The U.S. Army Corps of Engineers (USACE), Mobile District, requested that the Battelle/Marine Sciences Laboratory (MSL) conduct field sampling and chemical and biological testing to determine the suitability of potential dredged material for open ocean disposal. Sediment from St. Andrew Bay was chemically characterized and evaluated for biological toxicity and bioaccumulation of contaminants following the guidelines in the *1991 Evaluation of Dredged Material Proposed for Ocean Disposal -- Testing Manual* (EPA/USACE 1991a), referred to as the *1991 Implementation Manual*, and in the *1991 Draft Regional Implementation Manual* (EPA/USACE 1991b). These two manuals, hereinafter referred to as the *1991 Implementation Manuals*, provide a tiered evaluation approach developed specifically for ocean disposal of dredged material at a selected site.

The Tier III guidance for ocean disposal testing requires tests of water column effects (following dredged material disposal), deposited sediment toxicity, and bioaccumulation of contaminants from deposited sediment (dredged material). To meet these requirements, the MSL conducted suspended-particulate-phase (SPP) toxicity tests, solid-phase toxicity tests, and bioaccumulation testing on sediment representing potential dredged material from Panama City Harbor. Physical and chemical characterization of sediment to support toxicity and bioaccumulation results was also conducted on both the test and reference sediments.

The MSL collected sediment samples from five sites in St. Andrew Bay and one reference site near Lands End Peninsula. The five test sediments and the reference sediment were analyzed for physical and chemical sediment characteristics, SPP chemical contaminants, solid-phase toxicity, SPP toxicity, and bioaccumulation of contaminants. The SPP toxicity tests were conducted with the mysid shrimp (<48 h old) *Mysidopsis bahia*, the planktonic larvae of the bivalve *Mytilus edulis*, and the silverside minnow *Menidia beryllina*. Acute toxicity solid-phase tests were conducted with the deposit-feeding polychaete *Nereis virens* and the filter/deposit-feeding infaunal amphipods *Ampelisca abdita* and *Rhepoxynius abronius*. Bioaccumulation of

contaminants was evaluated through a 28-day exposure of the bent-nose clam *Macoma nasuta* and *Nereis virens* to the solid phase of the proposed dredged material, followed by chemical analyses of the tissues for the EPA priority pollutants and butyltins.

The maximum concentrations of contaminants of concern in the SPP samples were several orders of magnitude below the EPA Water Quality Criteria (WQC). The results of the SPP toxicity tests showed that there was no acute toxicity to any of the three species tested (*M. bahia*, *M. beryllina*, and *M. edulis*). No LC₅₀ could be calculated because mortality did not exceed 50% of the population relative to the control.

The results of physical and chemical characterization of the sediment treatments show that, in general, the test treatments had higher concentrations of the majority of contaminants of concern relative to the reference sediment. Concentrations of TOC, total sulfides, PAHs, phthalate esters, chlorinated pesticides, metals, and butyltins were elevated in the test treatments relative to the reference sediment concentrations. The solid-phase tests of Panama City Harbor sediments showed solid-phase acute toxicity to *R. abronius* exposed to test treatment PC-2 when compared to the reference sediment using Dunnett's test (1964). There was no acute toxicity to either the *A. abdita* or *N. virens* solid-phase tests.

Tissue contaminant concentrations in *M. nasuta* and *N. virens* were orders of magnitude below the FDA action limits following exposure to Panama City Harbor sediments. Significant bioaccumulation of PAHs, pesticides, and PCBs were measured in *M. nasuta* tissues at levels between 2 and 21 times the concentrations observed in the tissues exposed to the reference sediment. Elevated metals concentrations in *M. nasuta* tissues exposed to the test treatments were generally at levels less than twice those found in the tissues exposed to the reference sediment, with the exception of Sb. Concentrations of Sb in *M. nasuta* tissues exposed to PC-4 were three times greater than in tissues exposed to the reference sediment. The tissues of *N. virens* exposed to the test treatments were statistically significantly different from the tissues exposed to the reference sediment, at levels less than 10 times the concentrations in the tissues exposed to the reference sediment for 6 of the 18 PAHs analyzed, and for 1 metal (Se).

There was no acute toxicity to water column organisms, and contaminant concentrations in SPP samples did not exceed WQC; therefore, the Panama City Harbor sediments meet water column criteria for ocean disposal. According to the 1991 *Implementation Manuals*, a proposed dredging area fails to meet the deposited sediment (solid-phase) criteria for ocean disposal if there is 1) statistically significant acute toxicity relative to reference and 2) a >10% difference (>20% for amphipods) between the test treatment and reference. Following these criteria, test treatment PC-2 fails to comply with the deposited sediment criteria due to the acute toxicity to *R. abronius*. Compliance criteria for bioaccumulation are not as well-defined as for water column effects or

deposited sediment toxicity. The scope of this project does not allow the MSL to make decisions regarding appropriate disposal of potential dredged material based on bioaccumulation results. Thus, bioaccumulation data are presented to assist the USACE and other resource agencies in providing a regional evaluation of disposal of proposed dredged material from St. Andrew Bay, Florida.

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LIST OF ACRONYMS AND ABBREVIATIONS

AA	atomic absorption
ANOVA	analysis of variance
BOS	Battelle Ocean Sciences, Duxbury, Massachusetts
CVAA	cold vapor atomic absorption
CVAF	cold vapor atomic fluorescence
DO	dissolved oxygen
EC ₅₀	concentration causing abnormal effects to 50% of organisms tested
EPA	U.S. Environmental Protection Agency
FDA	Food and Drug Administration
GC	gas chromatography
GC-ECD	gas chromatography with electron capture detection
GC/FPD	gas chromatography/flame photometric detection
GC/MS	gas chromatography/mass spectrophotometry
GFAA	graphite furnace atomic absorption
GPC	gel permeation chromatography
GPS	Gorman 100 Global Positioning System
HAA	hydride atomic absorption
HPAH	high-molecular-weight polynuclear aromatic hydrocarbons
HPLC	high performance liquid chromatography
HRGC/HRMS	high-resolution gas chromatography and high-resolution mass spectrometry
ICP/MS	inductively coupled plasma/mass spectroscopy
IDL	instrument detection limit
I-stat	industrial statistic
LC ₅₀	concentration causing mortality to 50% of organisms tested
LPAH	low-molecular-weight polynuclear aromatic hydrocarbons
LPC	limiting permissible concentration
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
MSL	Battelle/Marine Sciences Laboratory
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PNL	Pacific Northwest Laboratory, Richland, Washington
PSEP	Puget Sound Estuary Program
PVC	polyvinyl chloride

RIS	recovery internal standard
RPD	relative percent difference
RSD	relative standard deviation
QA/QC	quality assurance/quality control
SIM	selective ion mode
SIS	surrogate internal standard
SOP	standard operating procedure
SPP	suspended-particulate-phase
SRM	standard reference material
TEF	toxicity equivalent factors
TOC	total organic carbon
USACE	U.S. Army Corps of Engineers
WQC	Water Quality Criteria
XRF	x-ray fluorescence

1.0 INTRODUCTION

Panama City Harbor is located in St. Andrew Bay, Florida (Figure 1.1), about 105 miles east of Pensacola, Florida. The Bay is an arm of the Gulf of Mexico, about 10 miles long and parallel to the coast. Natural depths range to about 50 feet, with about 7 square miles of the Bay measuring at least 30 feet deep. St. Andrew Bay is nearly landlocked, separated from the Gulf of Mexico by a barrier sand beach formally known as Lands End Peninsula (known locally as "Shell Island"). The Bay has two outlets to the Gulf, one of which is a natural inlet at the eastern end of Lands End Peninsula and the other a dredged channel 32 feet deep through the barrier peninsula about 4 miles west of the natural opening. The dredged cut is stabilized by twin rubble-mound jetties and serves as the harbor entrance from the Gulf.

The U.S. Army Corps of Engineers (USACE), Mobile District, requested that the Battelle/Marine Sciences Laboratory (MSL)^(a) conduct field sampling and chemical and biological testing to determine the suitability of proposed dredged material for open ocean disposal. This testing is required by Section 103 of Public Law 92-532 [Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA)] which regulates open ocean disposal of dredged material. Sediment from St. Andrew Bay was chemically characterized and evaluated for biological toxicity and bioaccumulation of contaminants following the guidelines in the 1991 *Evaluation of Dredged Material Proposed for Ocean Disposal -- Testing Manual* (EPA/USACE 1991a), referred to as the *1991 Implementation Manual*, published jointly by the U.S. Environmental Protection Agency and the USACE, and in the 1991 Draft Regional Implementation Manual (EPA/USACE 1991b). These testing manuals, hereinafter referred to as the *1991 Implementation Manuals*, provide a tiered evaluation approach developed specifically for ocean disposal of dredged material at a selected site.

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The objectives of the Panama City Harbor Project were to collect and evaluate effects of the potentially contaminated sediment proposed for dredging and disposal. The results of analytical and toxicological measurements were compared to reference sediment results to

(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. Location of Panama City Harbor Study Area

determine if the test sediments contained more bioavailable contaminants than the reference sediment. The use of reference sediment allows for comparison of biological responses and contaminant levels between a proposed dredged sediment sample and a proposed disposal area sample 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..." Grab samples were collected from five sites in the harbor and one reference site near Lands End Peninsula. Reference site water was collected near Lands End Peninsula.

The five test sediments and the reference sediment were analyzed for physical and chemical sediment characteristics, SPP chemical contaminants, solid-phase toxicity, SPP toxicity, and bioaccumulation of contaminants. The chemical and biological tests were conducted following protocols in the *1991 Implementation Manuals*. The SPP toxicity tests were designed to test the effects of dissolved contaminants plus those associated with suspended particulates in the water. The solid-phase toxicity and bioaccumulation tests examined effects of the settled portion of proposed dredged sediment on sensitive benthic organisms relative to sediment from a possible disposal site reference. Control sediment samples were also collected and tested following the same procedures to validate test results based upon survival of test organisms following exposure to their native sediment. Sediment treatment PC-3 was sampled and analyzed for grain size, specific gravity, and total percent solids only.

Test organism selection also followed guidance in the *1991 Implementation Manuals*. Species proposed for acute toxicity solid-phase tests were the deposit-feeding polychaete *Nereis virens*, and the filter/deposit-feeding infaunal amphipods *Ampelisca abdita* and *Rhepoxynius abronius*. Species proposed for SPP toxicity tests were the mysid shrimp (<48 h old) *Mysidopsis bahia*, planktonic larvae of the bivalve *Mytilus edulis*, and the silverside minnow *Menidia beryllina*. Bioaccumulation of contaminants was evaluated through a 28-day exposure of the bent-nose clam *Macoma nasuta* and *Nereis virens* to the solid phase of the proposed dredged material followed by chemical analyses of the tissues for the EPA priority pollutants and butyltins. These species met the required selection criteria listed in the *1991 Implementation Manuals*, and have been successfully used in similar testing programs conducted by the MSL.

Chemical analyses included measurements of EPA priority pollutant metals, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), phenol and substituted phenols, phthalate esters, chlorinated pesticides, and dioxins as well as butyltins (tri- and dibutyltin) and conventional sediment parameters.

This report describes the evaluation of Panama City Harbor sediments relative to the Shell Island Reference Site. The report is divided into five sections. Following this introduction, Section 2.0 describes materials and methods used for sample collection and preparation for toxicological testing; sediment, water, and tissue chemistry; data analysis and interpretation; and

quality assurance/quality control requirements. Section 3.0 presents the results of sediment chemistry, SPP chemistry, toxicological testing, and tissue chemistry. Section 4.0 is a discussion of analyses of sediment characteristics and Tier II and III evaluations, and presents conclusions and recommendations regarding the acceptability of dredged material for ocean disposal. Section 5.0 lists the literature cited in support of this document. The following appendixes contain detailed data listings:

Appendix A	Field Sampling Data
Appendix B	Sediment Chemistry and Quality Control Data
Appendix C	Suspended-Particulate-Phase Chemistry and Quality Control Data
Appendixes D-K	Toxicity Test Data
Appendixes L-M	Tissue Chemistry and Quality Control Data
Appendix N	Organizational chart.

2.0 MATERIALS AND METHODS

2.1 SEDIMENT AND TEST ORGANISM COLLECTION

Sediment samples were collected from six test sites in St. Andrew Bay, Florida; one reference site located near Lands End Peninsula, also known as "Shell Island"; and four control sites in Sequim Bay, Washington (*M. nasuta*), Whidbey Island, Washington (*R. abronius*), San Pablo Bay, California (*A. abdita*), and Newcastle, Maine (*N. virens*). All samples were collected using either a ponar grab, specially designed anchor or sand dredges, or a shovel. Control sediment and test organisms collected at Whidbey Island and Sequim Bay were collected by MSL personnel using a small boat; San Pablo Bay and Newcastle sediment and organisms collected at these sites were supplied to the MSL by private contractors. Specific locations of sediment sampling stations are presented with the sampling results in Section 3.1.

2.1.1 Test Sediment, Reference Sediment and Water Collection

Sampling locations were selected by the USACE, based on proximity to industrial sites located in St. Andrew Bay and on depth and sediment type. Once the sampling location was identified, a marker buoy was deployed from the vessel. Test and reference sediments were collected from specific locations using a sand dredge that penetrated approximately the top 15 to 20 cm. The sand dredge and line were deployed until the dredge began to penetrate the surface of the sediment. Sediment entered the sand dredge through a box-like frame where it was contained in a reinforced canvas bag. The dredge was allowed to drag in the sampling area for ~3 min after which the sediment samples were transferred to clean, epoxy-coated 5-gal pails, sealed, and labeled with the study identifier, station name, date of collection, and number of buckets representing each station. Sampling records maintained in a logbook consisted of station position, date, time, replicate, water depth, sediment type, and comments. All samples were maintained at $-4 \pm 2^{\circ}\text{C}$ in a refrigerated van until ready for shipment. Once all samples were obtained in the field, they were shipped in the refrigerated van from Panama City, Florida, to Sequim, Washington. Upon arrival at the MSL, sediment samples were transferred to a climate-controlled cold room and maintained at -4°C until they were used for toxicity testing and chemical analysis.

Station positioning was accomplished through the use of a Gorman 100 Global Positioning System (GPS) provided and operated by USACE. Sampling depths were recorded using a calibrated fathometer (Raytheon).

The reference sediment sample located on the west end of "Shell Island" was collected with the sand dredge. Sediment samples were transferred to clean, epoxy-coated 5-gal pails, sealed, and labeled with the study identifier, station name, date of collection, and number of

buckets representing the station. Sampling records maintained in a logbook consisted of station position, date, time, replicate, water depth, sediment type, and comments.

Water samples collected at the reference site prior to sediment sampling were taken from just below the water surface by submerging, filling, and capping a carboy while it was submerged. Samples were contained in 20-L polypropylene carboys that were soap-and-water washed, rinsed with deionized water, soaked at least 4 h in 10% nitric acid, rinsed again with deionized water, allowed to air dry, and then rinsed with methylene chloride. Water samples were stored in the refrigerated van along with sediment samples at ~4°C. Water samples were collected at the reference site ~3 wk after the initial field sampling and were sent to the MSL to complete toxicity testing.

2.1.2 Control Sediment Collection

The control sediment sampling sites were Sequim Bay, Washington (*M. nasuta*), Whidbey Island, Washington (*R. abronius*), San Pablo Bay, California (*A. abdita*), and Newcastle, Maine (*N. virens*). Control sediment was collected using a variety of samplers. Control sediment and test organisms from Whidbey Island and Sequim Bay were collected by MSL personnel using a small boat at the same time and location at which test organisms were collected. Whidbey Island sediment was collected with a small, MSL-designed, anchor dredge sampler that also obtained sufficient quantities of the organisms for test purposes. The dredge was deployed from the MSL's 17-ft Boston Whaler in ~15 ft of water. The Whidbey Island sampling location was determined by reference to known shoreline features. Control sediment from Sequim Bay was collected with a ponar grab deployed from an MSL research vessel. San Pablo Bay and Newcastle sediments and organisms collected at these sites were supplied to the MSL by private contractors.

2.1.3 Test Organism Collection

Seven species of organisms were used to evaluate sediment samples from the Panama City Harbor Project study area:

- amphipod *Ampelisca abdita*
- amphipod *Rhepoxynius abronius*
- polychaete *Nereis virens*
- bent-nose clam *Macoma nasuta*
- silverside fish *Menidia beryllina*
- mysid shrimp *Mysidopsis bahia*
- larvae of mussel *Mytilus edulis*

All test organisms (except mysids, silversides, and mussels) were wild-captured individuals collected either by a commercial supplier or by MSL personnel. The organisms were shipped in native sediment or in another way designed to ensure their viability. After receipt at the MSL, test organisms were gradually acclimated to test conditions. Animals acting abnormally

were not used in toxicological tests. The amphipod *A. abdita* and the polychaete *N. virens* were supplied by Brezina and Associates, Dillon Beach, California. Samples of *A. abdita* and its native sediment were collected from San Pablo Bay, California, by dragging a large dipnet along the sediment surface. Test organisms were carefully removed from their tubes for enumeration, and then placed in clean native sediment for overnight transport to the MSL. Samples of *N. virens* were collected from an intertidal region in Newcastle, Maine, using a bucket and shovel and transported in moist mats of seaweed packed in coolers via overnight mail. The *R. abronius* samples were collected by MSL personnel from Whidbey Island using an MSL-designed anchor dredge. Amphipods were transported in clean coolers containing ~10 cm of sediment and 5 gal of clean seawater at a temperature approximating natural conditions. Samples of *M. nasuta* were collected from intertidal zones in Discovery Bay, Washington, by Johnson and Gunstone (a commercial supplier) using a shovel, bucket, and sieve. Clams were kept cool prior to shipment by placing them in large containers filled with sediment and seawater from the collection site. The *M. beryllina* samples were supplied by Aquatic Indicators, St. Augustine, Florida, shipped in large plastic bags containing seawater and maintained at ~15°C. Prior to shipment via overnight mail, seawater was supersaturated with oxygen to ensure test organism survival. Samples of *M. bahia* were obtained from Aquatic Biosystems, Fort Collins, Colorado, and shipped in plastic bags containing oxygen-supersaturated seawater maintained at ~15°C. The *M. edulis* samples were purchased from Taylor United, Inc. in Quilcene, Washington. These organisms were wrapped in moist paper towels and shipped in a styrofoam cooler containing blue ice to maintain an ambient temperature of ~15°C.

2.2 SEDIMENT SAMPLE PREPARATION

Sediment sample preparation involved all steps in the laboratory between delivery of the samples to the MSL and the preparation of samples for chemical and/or biological testing. Sediment for biological testing was prepared and used within the 6-week holding period specified in the *1991 Implementation Manuals*. During this holding time, the samples were received at the MSL, inventoried against chain-of-custody forms, processed for solid-phase and SPP testing, subsampled for sediment chemistry and water chemistry parameters, and used in the biological tests. The following sections describe equipment preparation, compositing strategy, preparation of sediments for chemistry and solid-phase biological testing, and preparation of SPP samples for chemistry and biological testing.

2.2.1 Preparation of Laboratory Glassware and Equipment

All glassware, stainless-steel or titanium utensils, Nalgene, Teflon, and other laboratory containers and equipment underwent stringent cleaning procedures to avoid contamination of samples. Glassware (test containers, aquaria, and sediment transfer dishes) 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. Polyvinyl chloride (PVC), Nalgene, and Teflon tools were also washed and soaked in acid baths in the same manner as for 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 the methylene chloride was allowed to evaporate under the hood.

Neoprene stoppers and polyethylene sheets or 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 0.45- μ m-filtered seawater for at least 2 days prior to use. Large pieces of laboratory equipment, such as the epoxy-coated sediment mixer, were washed with a dilute soap solution and thoroughly rinsed with tap water followed by deionized water.

Equipment used to determine water quality--such as pH, dissolved oxygen (DO), temperature, and salinity--were calibrated according to the manufacturer's specifications and Internal MSL Standard Operating Procedures (SOPs).

2.2.2 Designation and Preparation of Sediment Treatments

A total of 11 sediment treatments were evaluated for the Panama City Harbor Project: six test treatments (PC-1, PC-2, PC-1A, PC-3, PC-4, and PC-5), one reference treatment, and four control treatments (*M. nasuta* Control, *N. virens* Control, *A. abdita* Control, and *R. abronius* Control). Test sediment treatment PC-3 was originally included in the scope of work, but during the field sampling cruise there was concern that the material might be too coarse for the amphipod *A. abdita*; therefore, test sediment treatment PC-1A replaced PC-3. Sediment treatment PC-3 was sampled but was only tested for grain-size analysis and specific gravity. Station PC-1A, located midway between stations PC-1 and PC-2 (Figure 1.1), was chemically analyzed and used in the toxicological and bioaccumulation tests.

2.2.3 Preparation of Solid-Phase Treatments for Chemistry and Biological Testing

Solid phase refers to the sediment itself, in contrast to the suspended or dissolved phases. In biological tests, the solid phase of sediments represents 1) dredged material once it has settled at an aquatic disposal site (test sediment), 2) existing environmental conditions of a disposal site without dredged material (reference sediment), or 3) the environment of a benthic test organism ("native" control sediment). All solid-phase samples were thoroughly homogenized until constant color and texture were achieved before use in biological tests or chemical analysis.

Reference and control sediments were press-sieved through a 1.0-mm screen to remove predators. After sieving, the reference or control sediment was mixed in a large epoxy-coated

cement mixer. Between sieving of the reference and control sediments, all equipment was thoroughly rinsed with 0.45- μ m-filtered seawater to avoid potential cross-contamination between samples. Test sediment samples were processed by compositing the sediment from a station in the epoxy-coated mixer until a homogenous color and texture were evident. After compositing, aliquots of each sediment were sampled for chemical analyses and placed in cleaned and labeled containers appropriate for the parameters to be measured. A subsample of each sediment treatment was also taken for archival purposes. All sediment treatments (test, reference, and control) were then placed in 5-gal epoxy-coated pails that were sealed, labeled, and maintained at $4 \pm 2^\circ\text{C}$ until needed for biological testing.

2.2.4 Preparation of Suspended-Particulate-Phase Samples for Chemistry and Biological Testing

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

The SPP was prepared by creating a 4:1 (volume:volume) water to sediment slurry in 1-L glass jars with Teflon-lined lids. The jars were marked at 200 mL and 400 mL and filled to the 200-mL mark with 0.45- μ m-filtered seawater. Homogenized sediment was then added until the water was displaced to the 400-mL mark. Each jar was filled to 1 L with filtered seawater. Twelve jars of sediment and water were placed on a shaker table and agitated for 30 min at a shaking rate of 120 to 150 cycles/min. After shaking, the slurry was poured into 500-mL Teflon containers with tightly fitting lids. These containers were placed in a centrifuge and spun for 10 to 15 min at ~ 1750 rpm. The 10-min centrifugation was necessary to ensure that test organisms would be visible at the first observation following exposure to SPP test treatments. After centrifugation, the supernatant was poured into clean, labeled, 1-gal jars and used in the SPP tests as soon as possible (within 24 h). The SPP produced for the water chemistry analysis was poured into appropriate chemistry jars for specific analysis. If the SPP was not used immediately for biological tests, the jars were stored at $4 \pm 2^\circ\text{C}$. The Teflon jars were rinsed after each use and the above process continued until an adequate amount of SPP was produced. Between SPP preparations, all glass and Teflon containers were appropriately cleaned according to procedures described in Section 2.2.1.

2.3 TOXICOLOGICAL TESTING PROCEDURES

Biological tests to assess the ecological effects of aquatic disposal of dredged material from the Panama City Harbor Project area were conducted on the solid-phase and SPP of test sediments. Eight toxicological/bioaccumulation tests involving seven test species were conducted in support of the Panama City Harbor Project. Four species of marine organisms were exposed to test sediments from the Panama City Harbor Project area, reference area sediments, and control sediments. Three acute toxicity tests were conducted: 1) a 10-day solid-phase flow-through acute toxicity test using the amphipod *A. abdita*, 2) a 10-day solid-phase static acute toxicity test using the amphipod *R. abronius*, and 3) a 10-day solid-phase flow-through acute toxicity test using the polychaete *N. virens*. The bioaccumulation test was a 28-day solid-phase exposure of *N. virens* and *M. nasuta* (tested separately). The purpose of the 28-day test was to assess the potential for bioaccumulation of contaminants from the sediment in tissues of the organisms. The 28-day bioaccumulation tests and procedures were similar to the 10-day test with the exception of a longer exposure period, larger test population, and a depuration process for surviving *M. nasuta* and *N. virens*. All solid-phase tests consisted of five replicate containers for each treatment and species tested. All test containers were placed in random positions in the water tables.

Three SPP tests were conducted: a 96-h exposure using the silverside minnow *M. beryllina*, a 96-h exposure using the mysid shrimp *M. bahia*, and a 72-h exposure of larvae of the mussel *M. edulis*. The SPP treatments were prepared as described in Section 2.2.4. There were five replicates each of four SPP concentrations: 0% (seawater), 10%, 50%, and 100% (SPP). All test containers were placed in random positions in the water tables.

The five test treatments and one reference treatment were evaluated for all toxicological tests. Since the SPP tests evaluated the difference in test organism survival between 0% (seawater) and 100% SPP exposures, control tests were not required. 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 *A. abdita*

The *A. abdita* were held in a large holding tank containing their native sediment under flow-through conditions at ~20°C seawater. Organisms were not fed during the holding period, the ~48 h preceding test initiation. The *A. abdita* test was conducted in 1-qt flow-through Mason jars (Figure 2.1) placed at random positions on a water table maintained at 20°C. Prior to test initiation, sediment was added to the jars to a depth of 2 cm, then each jar was allowed to slowly fill via the flow-through system to a total volume of 750 mL. The flow-through Mason jar was designed to allow a subsurface exit of seawater, thereby reducing the chance of test organism

FIGURE 2.1. Flow-Through and Static Testing Containers for *A. abdita* and *R. abronius* Toxicity Tests

impingement on the screened discharge. Jars were placed on the water table overnight to stabilize the temperature to test conditions. After stabilization, initial water quality parameters were measured in each container and recorded on water quality forms. Gentle aeration was applied to each jar to provide adequate oxygenation of overlying water, and the test was conducted under a light regime of 16 h light/8 h dark.

The test was initiated by adding 20 *A. abdita* 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 and on the lids of test containers. The *A. abdita* were observed daily during the test, and the numbers of organisms either floating on the water surface, swimming in the jar, or on the sediment surface were recorded on observation forms. Amphipods floating on the water surface were gently pushed below-surface with a pipet tip, and observations were made as to whether they remained on the sediment surface, were buried below the sediment, or returned to the water 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. Flow rate was measured daily in all test containers. Acceptable ranges for water quality parameters during the experiment were:

DO	≥ 6.0 mg/L
pH	7.8 ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	20 ± 2.0 °C
Flow Rate	45 ± 10 mL/min.

At the end of the test (Day 10), the contents of each jar were sieved through a 0.5-mm Nytex screen to collect *A. abdita*. Organisms were placed in clean seawater in a glass dish labeled with the sediment treatment and replicate number, and the numbers of live, dead, and missing organisms were determined. If necessary, a dissecting microscope was used to examine moribund organisms for signs of life. The presence or absence of body parts recovered at the end of the test was also noted. The endpoint of this test was death, defined as the absence of pleopod movement in response to gentle probing. At least 10% of mortality counts were confirmed by a second observer. Test organism sensitivity was assessed through a 4-day reference toxicant test, which included a seawater control and four concentrations of cadmium (0.25, 0.5, 1.0, and 2.0 mg/L).

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

The *R. abronius* were held in a large holding tank containing their native sediment with flowing 15°C seawater. Organisms were not fed during the holding period, the < 2 wk

preceding test initiation. The *R. abronius* test was conducted in 1-qt static Mason jars (Figure 2.1) placed in random positions on a water table maintained at ~15°C. Prior to test initiation, sediment was added to the jars to a depth of 2 cm, then each jar was slowly filled with 0.45-µm-filtered seawater to a total volume of 750 mL. Jars were placed on the water table overnight to stabilize the temperature to test conditions. After settling, initial water-quality parameters were measured in each container and recorded on water quality forms. Gentle aeration was applied to each jar to provide adequate oxygenation of overlying water, and the test was conducted under a 24-h illumination.

This test was conducted in a manner similar to the *A. abdita* test, except that it was a static rather than flow-through test. Acceptable ranges for water quality parameters for the static *R. abronius* test were:

DO	≥6.0 mg/L
pH	7.8 ± 0.5 units
Salinity	30 ± 2.0‰
Temperature	15 ± 2.0°C.

Test organism sensitivity was assessed through a 4-day reference toxicant test, which included a seawater control and four concentrations of cadmium (0.5, 1.0, 2.0, and 4.0 mg/L).

2.3.3 10-Day Solid-Phase Flow-Through Test with *N. virens*

Prior to testing, *N. virens* were held in their native sediment in shallow trays covered with well-aerated 15°C seawater provided by the laboratory's flow-through system. Temperature, pH, DO, and salinity of water in each holding tank were monitored daily. Organisms were not fed during the holding period. Test containers were aerated, and the test was conducted under a light regime of 16 h light/8 h dark.

The 10-day flow-through test with *N. virens* was conducted in 10-gal flow-through aquaria (Figure 2.2) placed in random positions on water tables. Each aquarium was filled with ~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 evenly over the bottom of the aquarium.

The flow-through system was initiated and aquaria were allowed to fill to a total volume of ~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 adding the test organisms.

To initiate the test, 20 *N. virens* were collected from the holding tanks and placed in each aquarium. The label on each test aquarium included initiation time/date and initials of the examiner who placed the organisms into each aquarium. Water quality parameters (noted below) were

FIGURE 2.2. Flow-Through Aquaria for *M. nasuta* and *N. virens* Toxicity Tests

measured daily in at least one replicate of each sediment treatment and recorded on water quality data sheets. Acceptable ranges of water quality parameters established for the tests were:

DO	≥ 6.0 mg/L
pH	7.8 ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	15.0 ± 2.0 °C
Flow Rate	125 ± 10 mL/min.

Daily observations of test animal behavior were made and recorded on data forms for each test. The number of *N. virens* on the sediment surface was noted daily in each aquarium. In addition to daily observations of behavior, the number of dead organisms in each aquarium was recorded on daily observation forms. Dead organisms were removed from the aquaria and destroyed by incineration. If and when a dead *N. virens* 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 *N. virens*. Organisms were placed in glass baking dishes labeled with the sediment treatment number, and the numbers of dead versus live were determined. Death was determined by observing whether *N. virens* reacted to gentle probing; if there was no movement, the organism was considered dead. Mortality data were recorded on the termination forms and at least 10% of mortality counts were confirmed by a second observer. No reference toxicant test was run for this species.

2.3.4 28-Day Solid-Phase Flow-Through Test with *N. virens*

The procedure for conducting the 28-day solid-phase flow-through test with *N. virens* was identical to that of the 10-day test with three exceptions: 1) the exposure period was increased from 10 to 28 days; 2) surviving test organisms were depurated (voiding the digestive tract) in a flow-through seawater system for 48 h, and 3) tissues were saved for chemical analysis. The ranges for water quality parameters, as well as for test conditions such as temperature and flow rate, were the same in both the 28-day and 10-day tests. Water quality measurements and mortality monitoring of test organisms were performed at the same frequency in both tests.

When the 28-day test was terminated, *N. virens* 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 in a flow-through seawater system following the 28-day exposure. After 48 h of depuration, *N. virens* were gently washed in clean seawater to remove external sediment

grains and put in containers for future chemical analysis. No reference toxicant test was run for this species.

2.3.5 28-Day Solid-Phase Flow-Through Test with *M. nasuta*

The procedure for conducting the 28-day solid-phase flow-through test with *M. nasuta* was identical to that of the 28-day *N. virens* test, except that 25 *M. nasuta* were tested in each aquarium. As in the 28-day solid-phase flow-through *N. virens* test, *M. nasuta* were allowed to depurate for 48 h following the 28-day exposure to ensure that tissue chemistry results would not be biased by contaminants associated with sediment grains in the digestive tract. Surviving *M. nasuta* were placed in the depuration aquarium containing seawater-only. After 48 h of depuration, *M. nasuta* shells were cleaned with a scrub-brush and tissues were then removed using titanium knives, placed into pre-cleaned jars, and submitted for chemical analysis. No reference toxicant test was run for this species.

2.3.6 96-h Suspended-Particulate-Phase Static Test with *M. beryllina*

M. beryllina were held prior to testing in a 10-gal glass aquarium and fed <24-h-old brine shrimp nauplii *Artemia salina* twice daily. Temperature, pH, DO, and salinity of water in the aquaria were monitored daily. This 96-h static SPP test was conducted in 400-mL jars filled to a total volume of 300 mL. Test containers were aerated, and the test was conducted under a light regime of 16 h light/8 h dark. The *M. beryllina* were gently pipetted from the holding tank into clean seawater and counted into small transfer containers. The test was initiated by transferring 10 *M. beryllina* to each test container. The number of organisms was then confirmed by a second observer, and the date and time of initiation were recorded on data forms and on the lid of each test container. The *M. beryllina* were observed daily during the test, and numbers of live and dead organisms were noted on the data forms. Dead animals were removed daily. 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:

DO	≥4.0 mg/L
pH	7.8 ± 0.5 units
Salinity	30 ± 2.0‰
Temperature	20 ± 2.0°C.

At the end of the test (96 h), final observations were conducted. The endpoint of this test was death, defined as the absence of movement in response to gentle probing. At least 10% of mortality counts were confirmed by a second observer. Test organism sensitivity was assessed through a 96-h reference toxicant test, which included a seawater control and four concentrations of copper (16, 64, 160, and 400 µg/L).

2.3.7 96-h Suspended-Particulate-Phase Static Test with *M. bahia*

M. bahia were held prior to testing in a 10-gal glass aquarium and fed <24-h-old brine shrimp nauplii *Artemia salina* twice daily. Temperature, pH, DO, and salinity of water in the aquarium were monitored daily. This 96-h static SPP test was conducted in 400 mL glass jars filled to a total volume of 300 mL. Test containers were placed in random positions, aerated, and the test was conducted under a light regime of 16 h light/8 h dark. Mysids were gently pipetted from the holding tank into clean seawater using large-bore pipettes and counted into small transfer containers. The test was initiated by adding 10 *M. bahia* to each test container. The number of organisms was then confirmed by a second observer, and the date and time of initiation were recorded on data forms and the lid of each test container. The *M. bahia* were observed daily during the test, and numbers of live and dead organisms were noted on the data forms. Dead animals were removed daily. 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:

DO	≥4.0 mg/L
pH	7.8 ± 0.5 units
Salinity	30 ± 2.0‰
Temperature	20 ± 2.0°C.

At the end of the test (96 h), final observations were conducted. The endpoint of this test was death, defined as the absence of movement in response to gentle probing. At least 10% of mortality counts were confirmed by a second observer. Test organism sensitivity was assessed through a 96-h reference toxicant test, which included a seawater control and four concentrations of copper (32, 80, 200, and 500 µg/L).

2.3.8 72-h Suspended-Particulate-Phase Static Test with *M. edulis*

Adult *M. edulis* were obtained from a commercial supplier and used for testing within a few days of receipt. Test chambers for the larval test were 400-mL acid-washed, solvent-rinsed jars filled to a total volume of 300 mL. Dilutions of SPP for the larval test (0%, 10%, 50%, and 100%) were prepared in clean, labeled glass jars, then distributed to the appropriate test containers. The dilution water (collected from the reference area in St. Andrew Bay) was filtered at 20 µm. Test chambers containing SPP were placed in random positions on a water table and aerated. The light regime for this test was 16 h light/8 h dark. Once the containers had reached test temperature (16 ± 2°C), initial water quality parameters were measured in all replicates.

Adult *M. edulis* were induced to spawn by placing individuals in 15°C seawater that was then rapidly elevated to 20°C. Most adults spawned within 1 h and were removed from the 15°C holding container and placed in individual baking dishes containing site water for the collection of

gametes. Egg solutions were filtered through a 75- μ m screen prior to the introduction of sperm. Sperm from up to three males was pooled and introduced to containers of egg suspension, where fertilization occurred. The egg suspensions were mixed frequently using a perforated plunger over a period of 90 to 140 min, at which time fertilization (indicated by the presence of multi-cell embryos) of the embryos was assessed. Egg suspensions with a high percentage of fertilized embryos were pooled into a common stock for use in the test. This egg suspension was then rinsed on a 20- μ m screen to clear away excess sperm, and embryos were rinsed from the 20- μ m screen into a clean container filled with seawater.

To estimate fertilization success and embryo density, a 0.1-mL sample was removed from the embryo stock and the number of developing embryos and non-fertilized eggs was scored using a Sedgewick-Rafter counting chamber on a compound microscope at low (4x) magnification. The mean number of embryos from the replicate counts was multiplied by 10 to estimate the density of embryos/mL in the egg stock, resulting in a stock density of 23,000 embryos/mL.

To initiate the test, 1.2 mL of mussel larvae embryo stock solution was pipetted into each test container to yield a density of 23 embryos/mL. The test initiation date and time were recorded on data record forms. A 10-mL subsample was removed from all test containers 1 h after test initiation. Each test container was mixed with the perforated plunger and 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:

DO	≥ 4.0 mg/L
pH	7.8 ± 0.5 units
Salinity	30 ± 2.0 ‰
Temperature	16.0 ± 2.0 °C

The mussel test was terminated after 72 h, when development of D-shaped larvae was >90% 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 pipettor 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 counts were confirmed by a second observer. Test organism sensitivity was assessed through a 72-h reference toxicant test which included a seawater control and five concentrations of copper (2.9, 9.0, 30, and 100 μ g/L).

2.4 SEDIMENT, WATER, AND TISSUE CHEMISTRY

Sediment samples collected in support of the Panama City Harbor Project were analyzed for conventional and other chemical parameters. Conventional parameters included grain size, specific gravity, total solids, total organic carbon (TOC), ammonia, cyanide, and total sulfides. Sediments were also analyzed for PAHs, PCB/pesticides, dioxins, phenol and substituted phenols, phthalate esters, metals, and butyltins. Water samples (100% SPP) were analyzed for PAHs, PCB/pesticides, phenols and substituted phenols, phthalate esters, metals, cyanide and ammonia. Chemical analysis of *M. nasuta* and *N. virens* tissues was also conducted to determine bioaccumulation potential. Selected tissues were analyzed for total lipids, PAHs, PCBs, chlorinated pesticides, phenol and substituted phenols, phthalate esters, metals, dioxins, and organotins. Table 2.1 presents the analytical parameters measured in sediment, water, and tissue samples, the method used to perform each analysis, and the target analytical detection limits.

The following sections briefly describe the methods used for analysis of sediments, waters, and tissues within the required physical and chemical parameters. Analyses followed established EPA procedures where applicable. Quality control samples included method blanks, matrix spike (MS), standard reference materials (SRM), and analytical replicates. The MS and SRMs were used as a measurement of analytical accuracy. Analytical replicates were used to evaluate analytical precision.

2.4.1 Conventional Measurements

Conventional parameters included grain size, specific gravity, total solids, TOC, ammonia, cyanide, and total sulfides. Grain size, specific gravity, and total solids analyses were conducted by Soil Technology, Bainbridge Island, Washington. Grain size and total solids analyses followed the procedures described in Plumb (1981); specific gravity analysis was consistent with ASTM Method D-854 (1991). Sixteen grain size fractions (in μm) were quantified: 3350, 2000, 1000, 250, 125, 62.5, 48, 31.2, 23, 15.6, 7.8, 3.9, 1.9, 0.9, 0.4, and <0.4 . Because organic material is included in the analysis, these data are reported as "apparent" grain size. Grain size data are corrected for dissolved solids (salt) concentrations. Specific gravity determinations were made on the minus U.S. No. 40 sieve portion of the grain size samples. Total solids, reported as percent, were determined after oven drying at 90°C.

Total organic carbon is the amount of non-volatile, partially volatile, volatile, and particulate organic carbon compounds in a sample. Analysis of TOC was performed by Global Geochem, Canoga Park, California, following modified Method SW846 EPA 9060 (EPA 1986a). 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 and reported as

TABLE 2.1. List of Analytes, Methods and Target Detection Limits^(a)

Analyte	Reference Method	Detection Limit		
		Sediment	Tissue	Water
Grain Size	Plumb 1981	1.0%	NA ^(b)	NA
Specific Gravity	D-854 (ASTM 1991)	NA	NA	NA
Total Solids	Plumb 1981	1.0%	1.0%	NA
TOC	9060 (EPA 1986a)	0.1%	NA	NA
Ammonia	Whitledge et al. 1981	1.0 μ mole/L	NA	1.0 μ mole/L
Cyanide	335.2 (EPA 1979)	1.0 mg/kg	NA	4.0 μ g/L
Total Sulfides	Plumb 1981	0.2 mg/kg	NA	NA
Total Lipids	8290 (EPA 1990a)	NA	0.1%	NA
PAHs				
Acenaphthene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Acenaphthylene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Anthracene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Benzo(a)anthracene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Benzo(a)pyrene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Benzo(b)fluoranthene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Benzo(g,h,i)perylene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Benzo(k)fluoranthene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Chrysene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 μ g/L
Dibenzo(a,h)anthracene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Fluoranthene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Fluorene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Indeno(1,2,3-cd)pyrene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Naphthalene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Methylnaphthalene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Phenanthrene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Pyrene	8270 (EPA 1986a)	30 μ g/kg	30 μ g/kg	20 ng/L
Phenol and Substituted Phenols				
Phenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
2,4-dimethylphenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
2,4,6-trichlorophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
Para-chloro-meta-cresol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
2-chlorophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
2,4-dichlorophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
2-nitrophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
4-nitrophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
2,4-dinitrophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
4,6-dinitro-o-cresol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
Pentachlorophenol	8270 (EPA 1986a)	330 μ g/kg	330 μ g/kg	1000 ng/L
Phthalate Esters				
Bis (2-ethylhexyl) phthalate	8270 (EPA 1986a)	100 μ g/kg	100 μ g/kg	200 ng/L
Butyl benzyl phthalate	8270 (EPA 1986a)	100 μ g/kg	100 μ g/kg	200 ng/L
Di-n-butyl phthalate	8270 (EPA 1986a)	100 μ g/kg	100 μ g/kg	200 ng/L
Di-n-octyl phthalate	8270 (EPA 1986a)	100 μ g/kg	100 μ g/kg	200 ng/L
Diethyl phthalate	8270 (EPA 1986a)	100 μ g/kg	100 μ g/kg	200 ng/L
Dimethyl phthalate	8270 (EPA 1986a)	100 μ g/kg	100 μ g/kg	200 ng/L

TABLE 2.1. Continued

Analyte	Reference Method	Detection Limit		
		Sediment	Tissue	Water
Pesticides				
Aldrin	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
α-BHC	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
β-BHC	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
γ-BHC (Lindane)	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
δ-BHC	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
Chlordane	8080 (EPA 1986a)	30 µg/kg	30 µg/kg	5 ng/L
4,4'-DDD	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
4,4'-DDE	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
4,4'-DDT	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
Dieldrin	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
Endosulfan & derivatives	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	5 ng/L
Endrin & derivatives	8080 (EPA 1986a)	10 µg/kg	10 µg/kg	5 ng/L
Heptachlor & derivatives	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	5 ng/L
Methoxychlor	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	5 ng/L
Toxaphene	8080 (EPA 1986a)	30 µg/kg	30 µg/kg	50 ng/L
PCBs				
Aroclor, 1016	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Aroclor, 1221	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Aroclor, 1232	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Aroclor, 1242	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Aroclor, 1248	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Aroclor, 1254	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Aroclor, 1260	8080 (EPA 1986a)	20 µg/kg	20 µg/kg	50 ng/L
Metals				
Aluminum	ICP/MS (EPA 1990b)	5.0 mg/kg	NA	NA
Antimony	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Arsenic	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Beryllium	ICP/MS (EPA 1990b)	0.2 mg/kg	NA	NA
Cadmium	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	N/A
Chromium	ICP/MS (EPA 1990b)	0.6 mg/kg	NA	NA
Copper	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Lead	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Mercury	CVAA (Bloom and Crescelius 1984)	0.01 mg/kg	NA	NA
Nickel	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Selenium	ICP/MS (EPA 1990b)	0.2 mg/kg	NA	NA
Silver	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Thallium	ICP/MS (EPA 1990b)	0.1 mg/kg	NA	NA
Zinc	ICP/MS (EPA 1990b)	0.3 mg/kg	NA	NA

TABLE 2.1. Continued

Analyte	Reference Method	Detection Limit		
		Sediment	Tissue	Water
Metals cont'd				
Antimony	ICP/MS (EPA 1990b)	NA	0.1 mg/kg	NA
Arsenic	XRF (PNL SOP)	NA	0.1 mg/kg	NA
Beryllium	ICP/MS (EPA 1990b)	NA	0.2 mg/kg	NA
Cadmium	ICP/MS (EPA 1990b)	NA	0.1 mg/kg	NA
Chromium	ICP/MS (EPA 1990b)	NA	0.6 mg/kg	NA
Copper	ICP/MS (EPA 1990b)	NA	0.1 mg/kg	NA
Lead- <i>M. nasuta</i>	GFAA (EPA 1986)	NA	0.1 mg/kg	NA
Lead- <i>N. virens</i>	ICP/MS (EPA 1990b)	NA	0.1 mg/kg	NA
Mercury	CVAA (Bloom and Grocclius 1984)	NA	0.01 mg/kg	NA
Nickel	ICP/MS (EPA 1990b)	NA	1.0 mg/kg	NA
Selenium	XRF (PNL SOP)	NA	0.3 mg/kg	NA
Silver	ICP/MS (EPA 1990b)	NA	0.1 mg/kg	NA
Thallium	ICP/MS (EPA 1990b)	NA	0.1 mg/kg	NA
Zinc	XRF (PNL SOP)	NA	0.3 mg/kg	NA
Arsenic	HAA (EPA 1986a)	NA	NA	1.0 µg/L
Cadmium	GFAA (EPA 1986a)	NA	NA	0.1 µg/L
Chromium	GFAA (EPA 1986a)	NA	NA	1.0 µg/L
Copper	GFAA (EPA 1986a)	NA	NA	0.1 µg/L
Lead	GFAA (EPA 1986a)	NA	NA	0.1 µg/L
Mercury	CVAF (Bloom and Grocclius 1983)	NA	NA	0.001 µg/L
Nickel	GFAA (EPA 1986a)	NA	NA	0.1 µg/L
Selenium	GFAA (EPA 1986a)	NA	NA	2.0 µg/L
Silver	GFAA (EPA 1986a)	NA	NA	0.01 µg/L
Zinc	GFAA (EPA 1986a)	NA	NA	2.0 µg/L
Butyltins				
Tributyltin	Unger et al. (1986)	10 µg/kg	10 µg/kg	NA
Dioxins				
All congeners	8290 (EPA 1990a)	1.0 ng/kg	1.0 ng/kg	NA

(a) Detection limits are in dry weight for all sediment parameters and for metals in tissues. Detection limits are in wet weight for all organic tissue parameters.

(b) NA Not applicable.

percent of dry weight. Ammonia was analyzed by the University of Washington, Seattle, following the method described by Whittedge et al. (1981). Ammonium is determined by hypochloride-citrate analysis in which hypochlorous acid and phenol react with ammonium in aqueous alkaline solution to form indophenol blue. Sediment from the five test treatments and the reference sediment were placed into acid-cleaned teflon containers and centrifuged to release pore water from the sediment. This pore water was forced through a Gelman AE 0.03µ filter, frozen, and then analyzed for ammonium concentrations. The data are reported as NH₃-N (ammonia) and NH₄ (ammonium) in mg/L. Cyanide was measured by Analytical Resources, Inc. (ARI), Seattle,

using a colorimetric method described in EPA Method 335.2 (EPA 1979). This standard acid-reflux distillation measures free cyanide, simple cyanide, and most complexed cyanides. Released cyanides (HCN or CN⁻) are trapped in a basic absorbing medium (1M NaOH), which is then analyzed for cyanide by the colorimetric method. Total sulfides analyses were also measured by ARI following the methodology described in Plumb (1981). This method requires acidification and distillation to release sulfide from the sediment. Released sulfide is then trapped in zinc acetate, and this solution is then analyzed by the spectrophotometric methylene-blue procedure.

2.4.2 Polynuclear Aromatic Hydrocarbons (PAHs)

Analyses for 18 PAHs in the Panama City Harbor sediment, water, and tissue samples were performed by Battelle Ocean Sciences (BOS) in Duxbury, Massachusetts. Analysis of these compounds followed a modification to EPA SW- 846 Method 8270 (EPA 1986a). Sediment, water, and tissue samples were extracted two to three times consecutively using a roller technique. The extracts were dried over sodium sulfate, passed through a cleanup column, and concentrated in preparation for further cleanup by liquid chromatography. Tissue extracts were run through gel-permeation-chromatography (GPC) prior to analysis to remove any additional interferences. The PAHs in sample extracts were analyzed via high-resolution capillary gas chromatography/mass spectrophotometry (GC/MS). A data system provided for identification and measurement of the selected PAHs listed in Table 2.1 using a selective ion mode (SIM). In the SIM mode, each PAH compound was monitored simultaneously for the presence of a parent ion and a confirming second ion.

2.4.3 Phenols, Substituted Phenols, and Phthalate Esters

Phenols, substituted phenols, and phthalate esters in sediment, water, and tissue samples were analyzed by BOS in Duxbury, Massachusetts, following modified EPA Method 8270 (EPA 1986a). This method is appropriate for the extraction of semivolatile priority pollutants from sediment, water, and tissue samples for analysis by gas chromatography (GC). In this procedure, ~100 g of sediment was extracted using 2:1 (v:v) dichloromethane/ methanol in a Soxhlet extractor. The extract was partitioned with water, then dried through a column of anhydrous sodium sulfate. Elemental sulfur was removed using metallic mercury. Biological macromolecules were removed by cleanup with GPC. A portion of the extract underwent alumina column chromatography to separate polar compounds from pesticides and PCBs prior to capillary gas chromatography with electron capture detection (GC-ECD) analysis. The remaining extract underwent reverse-phase column chromatography (bonded C₁₈ solid phase) to reduce interferences from unresolved paraffinic hydrocarbons prior to capillary GC/MS analysis for acid, base, and neutral compounds.

2.4.4 PCB/Pesticides

The PCB and pesticide analyses for the Panama City Harbor sediment, water, and tissue samples were performed by BOS in Duxbury, Massachusetts. Chlorinated pesticides and PCBs were quantified by GC-ECD following modified EPA SW-846 Method 8080 (EPA 1986a).

Chlorinated pesticides and PCBs were extracted simultaneously with the PAH compounds using the roller technique as described for PAHs. 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. Most samples required an additional cleanup treatment using high-performance liquid chromatography (HPLC) to remove other interferences. Analytical quantification was performed using GC/ECD analysis.

2.4.5 Metals

Metals in sediment, water, and tissue samples were analyzed at the MSL and at Pacific Northwest Laboratory (PNL) in Richland, Washington. Six techniques were used for the analysis of metals: inductively coupled plasma/mass spectroscopy (ICP/MS), energy-dispersive x-ray fluorescence (XRF), graphite furnace atomic absorption (GFAA), cold vapor atomic absorption (CVAA), cold vapor atomic fluorescence (CVAf), and hydride atomic absorption (HAA). The ICP/MS procedure follows EPA 200.8 (EPA 1990b). The GFAA, CVAA, CVAf, and HAA methodologies are summarized in EPA SW846, 7000 Series (1990 a) which were modified into the MSL SOPs. Sediment samples were analyzed for a total of 14 metals: aluminum (Al), antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), and zinc (Zn). Water and tissue samples were analyzed for the same metals except aluminum. The analytical techniques used for these analyses are summarized in Table 2.2.

To prepare sediment and tissues for analysis, samples were freeze-dried and blended in a Spex mixer-mill. Approximately 5 g of mixed sample were 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 ICP/MS, GFAA, and CVAA analyses, 0.2- to 0.5-g aliquots of dried homogenous sample underwent an acid digestion process to separate and isolate the metals from the matrix.

Water samples analyzed for metals were extracted according to several MSL SOPs, based on the particular metal. For Cd, Cu, Pb, Ni, and Ag, samples were extracted in accordance with the ammonium pyrrolidinedithiocarbamate (APDC) extraction method. Briefly, samples are chelated, precipitated out of solution, then filtered. The filter is digested in concentrated acid and the digestate analyzed by GFAA spectrometry. For Cr, Se, and Zn, samples were analyzed

TABLE 2.2. Analytical Methods for Analyzing Metals in Sediment, Water, and Tissue Matrices

<u>Sediment</u>		<u>Water</u>			<u>Tissue</u>			
<u>ICP/MS</u>	<u>CVAA</u>	<u>HAA</u>	<u>GFAA</u>	<u>CVAE</u>	<u>ICP/MS</u>	<u>XRF</u>	<u>CVAA</u>	<u>GFAA</u>
Al Sb As Be Cd Cr Cu Pb Ni Se Ag Ti Zn	Hg	As	Cd Cr Cu Pb Ni Se Ag Zn	Hg	Sb Be Cd Cr Cu Pb Ni Ag Ti	As Se Zn	Hg	Pb

directly by GFAA spectrometry. For Hg, samples were analyzed directly by CVAE. Briefly, this method is a CVAE technique based on emission of 254-nm radiation by excited Hg⁰ atoms in an inert gas stream. Mercuric ions in the oxidized sample are reduced to Hg⁰ with SnCl₂, and then purged onto gold-coated sand traps as a means of preconcentration and interference removal. Mercury vapor is thermally desorbed to a second "analytical" gold trap, and from that into the fluorescence cell. Fluorescence (peak areas) is proportional to the quantity of mercury collected, which is quantified using a standard curve as a function of the quantity of sample purged. For As, the samples were analyzed by HAA. Briefly, arsenate, arsenite, methylarsonic acid, and dimethylarsinic acid are volatilized from solution at a specific pH after reduction to the corresponding arsines with sodium borohydride. The volatilized arsines are then swept onto a liquid-nitrogen-cooled chromatographic trap which, upon warming, allows for a separation of species based on boiling points. The released arsines are swept by helium carrier gas into a quartz cuvette burner cell, where they are decomposed to atomic arsenic. Arsenic concentrations are then determined by atomic absorption spectroscopy. For all metals analyzed by atomic absorption, results were blank corrected by subtracting the blank absorbance readings prior to performing quantitation calculations.

2.4.6 Organotins

Organotins in sediment and tissue samples were analyzed at the MSL in Sequim, Washington. Butyltin compounds in sediments and tissues were analyzed using gas chromatography/flame photometric detection (GC/FPD) following the methods of Unger et al. (1986) and MSL-SOPs. Briefly, ~20 g of sample were dried with Na₂SO₄ and extracted with methylene chloride. The sample was derivatized, cleaned with Florisil, then concentrated, and the concentrate analyzed by GC/FPD. Samples were quantified using the recovery internal

standard (RIS), with triphenyltin chloride added just prior to extraction. The internal standard--triphenylbutyltin, which was added to each sample just prior to instrument analysis--was used to measure recoveries of the RIS.

2.4.7 Dioxins

Dioxin analysis in sediment samples was performed by Battelle Columbus Operations, Columbus, Ohio, following the procedures summarized in EPA SW846, Method 8290 (EPA 1990a). This analytical method uses high-resolution gas chromatography and high-resolution mass spectrometry (HRGC/HRMS) on purified sample extracts. Samples were spiked with a solution containing nine isotopically labeled PCDD/PCDF compounds, and extracted according to a matrix-specific procedure. Sediment and soil samples underwent a toluene or benzene Soxhlet extraction; tissue samples underwent a hexane/methylene chloride Soxhlet extraction. The extracts were subjected to an acid/base washing and dried. Following a solvent-exchange step, residues were cleaned by column chromatography and spiked with $^{13}\text{C}_{12}$ -1,2,3,4-TCDD to determine percent recoveries of tetra- and pentachlorinated PCDD/PCDF congeners, and with $^{13}\text{C}_{12}$ -1,2,3,7,8,9-HxCDD to determine percent recoveries of hexa-, hepta-, and octachlorinated PCDD/PCDF congeners. The extracts were injected into an HRGC/HRMS system capable of performing in the SIM mode. Significant revisions to Method 8290 were as follows:

- Use of additional $^{13}\text{C}_{12}$ -labeled internal standards so that each 2,3,7,8-substituted PCDD/PCDF isomer could be related to an internal standard for identification and quantification purposes. Use of a complete range of internal standards provided better accuracy than afforded by current EPA Method 8290 procedures.
- Use of $^{37}\text{C}_{14}$ -labeled 2,3,7,8-tetra-CDD as a cleanup recovery standard added to sample extracts prior to cleanup to evaluate analyte recovery through cleanup procedures and provide an additional measure of quality control. Procedures similar to EPA Method 1613 were followed for this cleanup recovery standard.
- Routine calibration at only the beginning of the analytical period rather than at the beginning and end of the analytical period. This did not appear to affect data quality.

2.5 DATA ANALYSIS AND INTERPRETATION

Statistical analyses were conducted to determine the magnitude and significance of toxicity and bioaccumulation in test treatments relative to reference treatments. Each statistical test was based on a completely random design that allowed unbiased comparison between treatments. The *1991 Implementation Manuals* recommend Dunnett's test (Dunnett 1964) for comparing test treatments to a single reference treatment. This test was used to evaluate all solid-phase tests, including toxicological and bioaccumulation exposures. Test design and specific statistical analysis procedures are discussed in the following sections.

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 Excel 3.0 spreadsheet software. For the SPP tests, *M. beryllina*, *M. bahia*, and larval *M. edulis* tests were randomly allocated to SPP replicates for all concentrations.

2.5.2 Statistical Analysis of Solid-Phase Tests

Solid-phase toxicity of all sediment treatments was compared by analysis of variance (ANOVA) 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 assumptions of the ANOVA. All treatments were compared using Dunnett's test for comparison of all test treatments to the reference using an experiment-wise error rate of $\alpha = 0.05$.

2.5.3 Statistical Analysis of Suspended-Particulate-Phase Tests

Two statistical tests are presented in the *1991 Implementation Manuals* 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 to be performed only when survival in the 100% SPP is less than control (0% SPP) survival and when control survival is >90% for non-larval tests and >70% for larval tests (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 Manuals* is an LC₅₀ or EC₅₀ calculation, the concentration of SPP that is lethal to or affects 50% of organisms tested. The LC₅₀ or EC₅₀ values for these tests are calculated using the trimmed Spearman-Kärber method (Finney 1971). The Spearman-Kärber estimator is appropriate only if there is increasing mortality (or effect) with increasing concentration and if $\geq 50\%$ or greater mortality (or effect) is observed in test solutions when normalized to control survival. If 50% mortality (or effect) does not occur in the 100% SPP dilutions for any treatments, then LC₅₀ or EC₅₀ values are reported as >100% SPP.

2.5.4 Statistical Analysis of Bioaccumulation

Before statistical analysis of *M. nasuta* and *N. virens* tissue concentrations, a visual inspection of the tissue chemistry data was performed. If visual inspection showed that a compound was undetected in most replicate samples of test treatments, or that mean tissue concentration in the reference treatment was greater than that in the test treatments, no further analysis was performed. If the detected concentration of a compound exceeded that of the

reference treatment, statistical analysis was performed. In all cases, detection limits were used in numerical calculations when a compound was undetected.

Treatments in which contaminants of concern were detected were compared to the reference treatment using ANOVA and Dunnett's test. Analytical detection limit values were used for replicates in which the compound was not detected (U flag). If a compound was detected at levels below the method detection limit (J flag), then the associated value was used in the statistical analysis. If all replicates of a test treatment were flagged with U, J, or UJ qualifications (explained in Section 3.5) by the analytical laboratory, the data comprising that treatment were not analyzed. Significant bioaccumulation of a contaminant was determined by the statistical results of Dunnett's test at $\alpha = 0.05$.

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

The QA/QC procedures for these studies were consistent with the *1991 Implementation Manuals* and EPA protocols (PSEP 1986), and were documented by the PNL 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. Laboratory notebooks (Data Accumulation Notebooks) were assigned to each portion of the study and served as records of day-to-day activities during the research. All entries in the laboratory notebooks were signed, dated, and reviewed by the project manager. The following discussion summarizes QA/QC procedures followed for sediment sampling, biological testing, and chemical testing.

2.6.1 Sample Tracking and Storage

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

All sediment collected for these studies was stored in glass, cellulose acetate butyrate containers, or steel drums lined with 9-C-4-A-phenolic epoxy, a noncontaminating coating. Sediment samples were stored at 4°C prior to biological testing. Subsamples of sediment for chemical analyses and archiving were obtained prior to biological testing. These subsamples were stored frozen (-20°C) until chemical analyses were performed. Samples for organic analyses were stored frozen up to 2 mo (PSEP 1986). Samples for metals were freeze-dried upon receipt at the laboratory and held up to 6 mo (PSEP 1986; EPA/USACE 1991a).

Water samples were held at 4°C prior to chemical analysis. The water samples analyzed for organics were extracted within the 7-day holding period and analyzed within 40 days after extraction. Sediment and tissue samples were extracted within the 14-day holding period and analyzed within 40 days following extraction. Tissue samples were frozen immediately upon completion of the bioaccumulation tests. Samples for organic analyses were stored in precleaned glass jars with Teflon-lined lids. Samples for metals analyses were stored in precleaned plastic jars.

2.6.2 Sediment and Tissue Chemistry Quality Control Procedures

Chemical testing procedures require that specific QA/QC protocols be followed. The QA/QC guidelines specific to this project are provided in the PNL QA Plan. These guidelines include the following, where applicable:

- analysis of a method blank with each batch of 20 samples

- analysis of surrogate internal standards with each sample

- analysis of matrix spikes on 10% of samples (where applicable) with appropriate compounds to assess accuracy

- triplicate analyses on at least 10% of samples to assess analytical precision

- analysis of SRMs at a frequency of 5%, if available for the analytes of interest and sample matrix

- archiving of all instrument printouts (e.g., raw data and chromatograms from AA and GC analyses) for future review.

In actual practice, some specific guidelines listed in the QA Plan for analytical precision and accuracy were modified for application to the most current laboratory methods. Guidelines for detection limits, range of recovery, and relative precision are listed in the Panama City Harbor QA Plan provided to USACE by the MSL.

Measurements of accuracy can be determined by analyzing the MSs of known concentrations and SRMs that have been certified for the presence of specific parameters. The MSs were analyzed for metals and organic parameters and generally consist of a subset of the analytes of interest. Percent recoveries were calculated based on differences between the amount spiked and the amount recovered in the sample. Metal spikes were analyzed at a frequency of 10%, and organic compound spikes were generally analyzed at 10%. Analytical accuracy is measured through the analysis of SRMs. In sediment, SRMs were analyzed for metals, PAHs, butyltins, and PCB congeners/pesticides (non-certified compounds); in tissues, SRMs were analyzed for PAHs, metals, and PCB congeners/pesticides (non-certified compounds); in waters, SRMs were analyzed for metals only. Surrogate compounds were added in known amounts to samples analyzed for PCBs, pesticides, PAHs, dioxins, and

butyltins. Surrogate compounds were added to samples prior to extraction, and their recoveries were 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 include 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 the MSL for future reference. Procedures and related data were written into the appropriate Data Accumulation Notebooks. 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 the 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 Manuals* 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 the MSL before use in testing. 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 representing at least 60% saturation in solid-phase tests (at least 40% in SPP tests), and controlled levels of light each day. Salinity was permitted to vary $\pm 2.0\%$, 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 Manuals*. Water quality instruments were calibrated according to the manufacturer's specification or PNL protocols.

3.0 RESULTS

3.1 FIELD COLLECTION

Sediment samples were collected from six test sites and one reference site in St. Andrew Bay, Florida. Table 3.1 and Appendix A summarize the test, reference, and control sediment collection information for the Panama City Harbor Project. Sediment samples were collected September 28-29, 1992. A sand dredge was used to collect the test and reference sediment samples in Panama City Harbor, Florida. This sampler was used to obtain the top 15 to 20 cm of sediment from each site. The site location was identified through the use of a GPS that was provided and operated by the USACE. A marker buoy was deployed from the vessel to mark the site. The sand dredge was deployed near the buoy and dragged for ~100 ft before being retrieved. Once the sand dredge was onboard the vessel, the sediment was poured and/or scooped into labeled, epoxy-coated buckets. All samples were stored at ~4°C and shipped to MSL via refrigerated van. Figure 3.1 shows the sampling locations for test and reference sediment collection. Water samples were collected at the reference site prior to sediment sampling by submerging, filling, and capping a clean, polypropylene carboy while it was submerged below the water surface. A second batch of water samples was collected ~3 wk following initial field sampling and shipped to the MSL to complete toxicity testing. Water quality instruments were calibrated and used to determine the hydrographic measurements (conductivity, pH, turbidity, dissolved oxygen, salinity, and water temperature) of water samples collected at the reference site. The following data were collected at the reference site:

conductivity	4200 μ mhos
pH	8.25
water transparency	3.3 m (measured with a Secchi disk)
dissolved oxygen	8.7 mg/L
salinity	28‰
water temperature	26.1°C

Four control sediments were collected by MSL personnel or obtained from a commercial supplier for use in the biological toxicity tests. The *R. abronius* and *M. nasuta* control sediments (Figures 3.2 and 3.3) were collected by MSL personnel using a Battelle-designed anchor dredge and ponar grab, respectively. The *A. abdita* and *N. virens* control sediments were collected by a commercial supplier from San Pablo Bay, California, and Newcastle, Maine, respectively, during test organism collection.

3.2 SEDIMENT SAMPLE PREPARATION

The processing of sediment samples began once they were received at MSL. Each container of sediment was checked on the chain-of-custody form accompanying the samples. All sediment collected for each of the seven test treatments was homogenized thoroughly in a large,

TABLE 3.1. Field Collection Summary for Test and Reference Sediment Treatments

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Water Depth (ft)</u>
PC-1	30° 08' 03.4" N	085° 37' 37.4" W	-30
PC-1A	30° 07' 54.6" N	085° 37' 44.4" W	-32
PC-2	30° 07' 46.2" N	085° 38' 01.9" W	-33
PC-3	30° 08' 38.1" N	085° 39' 58.7" W	-32
PC-4	30° 09' 31.6" N	085° 42' 28.3" W	-34
PC-5	30° 10' 30.3" N	085° 43' 44.1" W	-27
Reference	30° 05' 50.3" N	085° 40' 06.6" W	-14

epoxy-coated cement-type mixer for sediment chemistry sampling and biological testing. Table 3.2 presents the sediment treatment strategy for the Panama City Harbor Project. This table summarizes sample designations and the appropriate chemistry and/or toxicity testing for each sediment treatment.

Suspended-particulate-phase samples were prepared for chemical analysis and biological testing. The homogenized sediment was mixed with the reference area site water in a 4:1 (v:v) water to sediment mixture and prepared according to the procedure in Section 2.2.4 to create a 100% SPP mixture for each sediment treatment. This SPP was sampled for chemistry measurements and prepared and diluted for three SPP toxicity tests.

3.3 SEDIMENT CHEMISTRY RESULTS

Five test sediment treatments and one reference sediment were analyzed for a variety of contaminants. The sediment chemistry analyses consisted of measurements of conventional parameters (grain size, specific gravity, total solids, TOC, ammonia, cyanide, and total sulfides), PAHs, chlorinated pesticides, PCBs, phenol and substituted phenols, phthalate esters, dioxins, metals, and butyltins. The purposes of these measurements were to provide an accurate characterization of contaminants associated with each sediment treatment and to compare test treatment characteristics with those of the reference area. This section addresses data quality, sediment chemistry results, and relationships between sediment treatments and the analytes. The complete sediment chemistry results and quality control data are presented in Appendix B.

3.3.1 Conventional Measurements

Conventional parameters measured in sediment are summarized in Table 3.3. The data and associated quality control data for all the conventional parameters are presented in Appendix B, Tables B.1 through B.9. Quality control data for TOC, ammonia, cyanide, and total sulfide analyses met all requirements. Measurements of the four major grain size fractions (gravel, sand, silt, and clay) indicate that replicate precision was excellent. There were 4 of 16 grain size

FIGURE 3.1. Location of Panama City Harbor Study Area

FIGURE 3.2. Location of *R. abronius* Control, West Beach, Whidbey Island, Washington

FIGURE 3.3. Location of *M. nasuta* Control, Sequim, Washington

TABLE 3.2. Summary of Sediment Treatment Strategy for Chemical and Biological Testing

<u>Sediment Treatment</u>	<u>Sediment Chemistry</u>	<u>Water Chemistry</u>	<u>Solid-Phase Acute Toxicity</u>	<u>SPP Toxicity</u>	<u>Bioaccumulation</u>
PC-1	YES	YES	YES	YES	YES
PC-2	YES	YES	YES	YES	YES
PC-1A	YES	YES	YES	YES	YES
PC-3(a)	YES	NO	NO	NO	NO
PC-4	YES	YES	YES	YES	YES
PC-5	YES	YES	YES	YES	YES
Reference(b)	YES	YES	YES	YES	YES
<i>M. nasuta</i> Control(b)	NO	NO	NO	NO	YES
<i>N. virens</i> Control(b)	NO	NO	YES	NO	YES
<i>A. abdita</i> Control(b)	NO	NO	YES	NO	NO
<i>R. abronius</i> Control(b)	NO	NO	YES	NO	NO

(a) Sediment sample for grain size and specific gravity analysis only.

(b) Sediment was dry-sieved to remove organisms before it was homogenized for testing.

fractions exceeding the relative standard deviation (RSD) that did not affect data interpretation, since the increased variation was due to fractions with low contributions to sediment coarseness.

Table 3.3 summarizes the specific gravity, grain size, TOC, total ammonia, cyanide, total sulfides, and total solids in sediment samples. Specific gravity was relatively consistent, ranging from 2.59 to 2.76. Grain size results show that all sediment treatments were composed primarily of sand, with values ranging from 63% dry weight in PC-2 to 96% dry weight in the reference. The percent solids in these sediment treatments ranged from 38% to 78%, with the highest value recorded in the reference sediment. The TOC levels ranged from 0.11% dry weight in the reference to 2.14% dry weight in PC-2, increasing as the percentage of sand and percent solids decreased. Concentrations of ammonia in the pore water ranged from 1.86 mg/L in PC-1 to 5.26 mg/L in the reference. Cyanide was undetected in all treatments. Total sulfides ranged from undetected at 2.0 mg/kg dry weight in the reference, to 295 mg/kg dry weight in PC-2. Fine-grained sediments and sediments with elevated TOC concentrations did not correspond to elevated concentrations of ammonia and total sulfides in the pore water samples.

3.3.2 Polynuclear Aromatic Hydrocarbons

Eighteen PAHs were analyzed in Panama City Harbor sediment treatments. The results are summarized in Table 3.4. The PAHs are reported as low-molecular-weight PAH compounds (LPAH) and high-molecular-weight PAH compounds (HPAH). The quality control data for PAH analysis (Appendix B, Tables B.10 through B.14) show that the method blank analyzed for PAHs was free of contamination, with the exception of naphthalene which was present at

TABLE 3.3. Summary of Conventional Parameters in Panama City Harbor Sediment Treatments

Sediment Treatment	Specific Gravity	Gravel	Sand (% dry weight)	Silt	Clay	TOC (%)	Ammonia (mg/L)	Cyanide (mg/kg)	Total Sulfides (mg/kg)	Percent Solids
PC-1	2.66	4	78	5	13	1.06	1.86	0.177 U ^(a)	33.9 ^(b)	58
PC-1A	2.66	4	83	3	10	0.75	2.08	0.142 U	67.4	68
PC-2	2.70 ^(b)	1 ^(b)	63 ^(b)	14 ^(b)	22 ^(b)	2.14	4.93	0.272 U	295	38 ^(b)
PC-3(c)	2.76	19	79	0	2	NA ^(d)	NA	NA	NA	76
PC-4	2.71	1	86	4	9	0.72	2.77 ^(b)	0.150 U ^(b)	92.0	68
PC-5	2.59	1	85	5	9	0.33	4.40	0.172 U	122	57
Reference	2.66	0	96	1	3	0.11 ^(b)	5.26	0.120 U	2.0 U	78

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

(b) Mean of replicate measurements.

(c) Sediment collected from station PC-3 was analyzed for grain size and specific gravity only.

(d) NA Not applicable.

TABLE 3.4. Summary of PAHs, Phenols, Substituted Phenols, and Phthalate Ester Concentrations in Panama City Harbor Sediment Samples

Compound	Concentrations in $\mu\text{g/kg}$ dry weight					Reference
	PC-1(a)	PC-1A	PC-2	PC-4	PC-5	
PAHs						
Naphthalene	26.13 B(b)	14.59 B	67.29 B	5.79 B	5.10 B	2.07 B
2-methylnaphthalene	14.17	6.16	12.72	1.91	2.39	0.86 J(c)
1-methylnaphthalene	7.24	3.00	6.60	1.04 J	1.25 J	0.51 J
Acenaphthylene	6.00	6.15	14.21	1.74 J	22.54	0.21 J
Acenaphthene	4.74	1.69 J	3.78	0.48 J	2.41	1.69 U(d)
Fluorene	6.11	2.35	5.04	0.84 J	3.47	1.34 U
Phenanthrene	36.03	12.34	33.11	4.37	18.60	0.72 J
Anthracene	13.51	9.70	21.98	3.28	31.27	0.34 J
Fluoranthene	56.00	24.22	60.76	10.03	51.38	0.98 J
Pyrene	126.32	22.0 ^a	58.25	8.61	62.48	0.92 J
Benzo(a)anthracene	28.85	16.6 ^a	31.55	5.64	59.23	0.36 J
Chrysene	26.77	14.21	28.83	6.69	113.89	0.47 J
Benzo(b)fluoranthene	54.73	28.09	57.64	12.61	213.43	0.76 J
Benzo(k)fluoranthene	36.09	17.65	30.00	7.72	139.08	0.46 J
Benzo(a)pyrene	52.80	25.23	35.32	6.61	145.72	0.39 J
Indeno(1,2,3-cd)pyrene	23.06	13.85	29.83	5.95	80.37	0.56 J
Dibenzo(a,h)anthracene	9.49	4.44	6.79	1.60 J	17.99	0.30 J
Benzo(g,h,i)perylene	36.53	15.05	26.42	5.38	49.23	0.63 J
Total LPAH(e)	113.93	55.98	164.73	19.45	87.03	4.71
Total HPAH(e)	450.64	181.51	365.39	70.84	932.80	5.83
Total PAH(e)	564.57	237.49	530.12	90.29	1019.83	10.54
Phenols						
Phenol	1112.30	130.26 J	159.37 J	368.95 J	94.35 J	1002.93
2-chlorophenol	144.06 UJ(f)	362.16 U	602.06 U	377.32 U	380.17 U	21.58 J
2-nitrophenol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
2,4-dimethylphenol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
2,4-dichlorophenol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
Para-chloro-meta-cresol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
2,4,6-trichlorophenol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
2,4-dinitrophenol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
4-nitrophenol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
4,6-dinitro-o-cresol	423.30 U	362.16 U	602.06 U	377.32 U	380.17 U	312.72 U
Pentachlorophenol	149.87 UJ	1.70 J	4.37 J	6.55 J	380.17 U	312.72 U
Phthalate Esters						
Dimethyl phthalate	84.66 U	72.43 U	120.41 U	75.46 U	0.99 J	1.08 J
Diethyl phthalate	42.13 J	32.54 J	56.66 J	17.67 J	18.79 J	14.28 J
Di-n-butyl phthalate	3.77 J	2.10 J	120.41 U	2.18 J	2.75 J	2.51 J
Butyl benzyl phthalate	30.57 UJ	4.60 J	14.20 J	3.98 J	5.45 J	2.60 J
Bis(2-ethylhexyl)phthalate	21.57 J	17.55 J	62.20 J	22.42 J	45.30 J	43.45 J
Di-n-octyl phthalate	1.91 J	2.29 J	120.41 U	3.04 J	4.46 J	12.69 J

(a) Mean of replicate measurements.

(b) B Analyte was found in the method blank; results presented are not corrected for the amount in the blank.

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

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

(e) Values are the sum of detected values.

(f) UJ Value is mean of replicates; analyte was either undetected or detected below the method detection limit in all replicates.

<2 times the achieved detection limit. The data associated with this sample were flagged with a "B." The achieved detection limits were all below target detection limits set in the QA/QC plan. All of the percent recoveries calculated for the MS samples were within the 40% to 120% range set in the QA/QC plan. The percent difference of certified PAHs in the sediment SRM was acceptable, with the exception of two PAHs [benzo(a)pyrene (34%) and benzo(g,h,i)perylene (41%)]. Analytical precision and intrasample variation were assessed through the analysis of triplicate subsamples. Three of the eight LPAHs and all but one of the HPAHs had RSD values exceeding 30%. Three PAH surrogate compounds, naphthalene-d₈, acenaphthene-d₁₀, and benzo(a)pyrene-d₁₂, were analyzed with the samples (Appendix B, Table B.19). Recovery of these surrogate internal standard (SIS) compounds was acceptable. Adequate SRM precision and SIS compound recovery indicate that the larger variation observed with triplicate subsample measurements is due to intrasample variation of the relatively low concentrations of PAHs, and not to the precision of extraction and analyses.

The PAHs, phenol and substituted phenols, and phthalate ester concentrations in sediment samples are summarized in Table 3.4. This table shows that the highest total detected PAH concentrations occurred in PC-5 (1019.83 µg/kg dry weight) and the lowest levels were found in the reference sediment (10.54 µg/kg dry weight). Where PAHs were detected, the majority of measured PAHs were HPAH (>68% except for the reference sediment). The HPAH compounds are less volatile and tend to be more persistent in the environment.

3.3.3 Phenols, Substituted Phenols, and Phthalate Esters

Eleven phenol and substituted phenols and six phthalate esters were analyzed in Panama City Harbor sediment treatments (Table 3.4). The quality control data for phenol and substituted phenols (Appendix B, Tables B.16 and B.19) show that the method blank was uncontaminated. The surrogate percent recovery for 2-fluorophenol was poor. Achieved detection limits were slightly elevated above target detection limits set in the QA/QC plan. These elevated detection limits do not present a problem because all but two samples were undetected or detected below the target detection limit. Of the 11 phenol and substituted phenol compounds, 4 had MS recoveries beyond the 40% to 120% range set in the QA/QC plan. Quality control data for phthalate esters are shown in Appendix B, Table B.18. The MS recoveries in phthalate ester compounds were all within the 40% to 120% range. No SRM sample was analyzed with these samples. Analytical precision and intrasample variability were assessed through the analysis of triplicate subsamples. Two of six phthalate ester compounds had RSDs beyond the 30% range. The only calculable RSD for the phenol and substituted phenol analysis, the surrogate 2-fluorophenol, was 75%, well outside the 30% range.

Substituted phenols were either undetected, indicated by a "U" flag, or detected below the method detection limit, indicated by a "J" flag (Table 3.4). Phenol was detected in two

sediment treatments, with values of 1112.30 µg/kg dry weight in PC-1 and 1002.93 µg/kg dry weight in the reference sediment. Phthalate concentrations were either undetected or detected below the method detection limit.

3.3.4 Chlorinated Pesticides and Polychlorinated Biphenyls

Chlorinated pesticide and PCB concentrations are summarized in Table 3.5. All data associated with these summaries and related quality assurance measurements may be found in Appendix B, Tables B.20 through B.26. The method blank analyzed for chlorinated pesticides and PCBs was uncontaminated, and achieved detection limits were below the target detection limits set in the QA/QC plan. Of the 17 percent recoveries calculated for the MS samples, 5 exceeded the 40% to 120% range targeted in the QA/QC plan. Analytical precision was assessed through the analysis of triplicate samples. All calculable RSDs were within the 30% range.

The majority of chlorinated pesticides and PCBs were either undetected, indicated by a "U" flag, or detected below the method detection limit, indicated by a "J" flag. Table 3.5 shows the compounds with detected concentrations. The reference sediment had pesticide and PCB concentrations that were either undetected or detected below the method detection limit. Concentrations of pesticides 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT in sediment treatments PC-1 and PC-2 ranged from 4 to 16 times higher than concentrations found in the reference sediment. All the PCBs except Aroclor 1254 were undetected in all sediment treatments. Aroclor 1254 was detected below the method detection limit, indicated by a "J" flag, or undetected above the method detection limit, indicated by a "U" flag, in all sediment treatments.

3.3.5 Metals

Fourteen metals were analyzed in sediment samples from Panama City Harbor. Metals concentrations are summarized in Table 3.6. All data associated with these summaries and related quality assurance measurements may be found in Appendix B, Tables B.27 through Tables B.30. The method blank analyzed for metals had low levels of Al, Cr, Hg, Ni, Pb, and Zn. The detection limit goals for all metals were met. Of the 12 MS recoveries, 3 (Ag, Se, and Sb) were outside the 75% to 125% range targeted in the QA/QC plan. Analytical accuracy was assessed through analysis of an SRM and was within QA/QC limits. Of the 14 RSD calculations, 5 exceeded 20%.

Table 3.6 shows that all metals in the test treatments were elevated above metals concentrations in the reference sediment. Test treatment PC-2 exhibited the highest metals concentrations for all 14 metals analyzed. Concentrations of metals in PC-2 were 70 times higher than the reference sediment for Be, 26 times higher for Hg, 16 times higher for Cr, and 15 times higher for Ag. Test treatment PC-5 produced the lowest metals concentrations of the five test treatments for 8 of the 14 metals analyzed.

TABLE 3.5. Summary of Detected Pesticide and PCB Concentrations in Panama City Harbor Sediment Samples

Compound	Concentrations in $\mu\text{g/kg}$ dry weight					Reference
	PC-1 ^(a)	PC-1A	PC-2	PC-4	PC-5	
4,4'-DDD	8.447	2.220	8.775	0.762 J ^(b)	1.082 J	0.545 J
4,4'-DDE	2.418	0.998	3.259	0.555	0.640	0.411 U ^(c)
4,4'-DDT	2.205	2.652	6.260	2.115	1.933	0.556 J
Aroclor-1254	36.224 J	11.308 J	24.158 J	38.916 U	39.210 U	32.253 U

(a) Mean of replicate measurements.

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

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

The Florida Department of Environmental Regulation devised a technique by which sediment samples collected from coastal Florida waters can be compared with other Florida sediments based on concentrations of metals in the sediment. The concentration of Al in the sediment treatments was compared with concentrations of As, Cd, Cu, Cr, Pb, Ni, and Zn by plotting the concentrations (mg/kg dry weight) on a log-log scale. These graphs were developed as an interpretive tool based on the relatively constant natural relationships existing between metals and aluminum (Florida Department of Environmental Regulation 1988). Sediments were collected from "clean" coastal areas throughout Florida and analyzed for their metals content. Metal/aluminum regressions and prediction limits were calculated, and Panama City Harbor metals data were plotted on the graphs. Sediment was judged to be "natural" or "metal-enriched" depending on position of data points relative to the regression lines and 95% prediction limits. If a point fell within the 95% prediction limits, then the sediment metal concentration was considered within the expected natural range; if a point fell above the upper 95% prediction limit, then the sediment was considered to be metal-enriched. Some data points from "clean" sediments will fall below the lower prediction limit. By normalizing metal concentrations to aluminum, an assessment of relative metal enrichment levels can be made, allowing estuaries to be ranked according to specific metal enrichment problems.

Metals data for the six sediment treatments were plotted on log-log scale graphs (Figures 3.4 and 3.5). These graphs show that, with the exception of a few points, the data fell within the 95% prediction limits for the calculated regression line. The Cd data for PC-4 and the Ni data for the reference area produced data points that fell slightly below the lower 95% prediction limit. To evaluate the Hg data, the maximum Hg values in the "clean" sediment data set (0.21 mg/kg) were assumed to represent the maximum Hg concentration found in natural sediments of Florida (Florida Department of Environmental Regulation 1988). Concentrations in the Panama City Harbor

TABLE 3.6. Summary of Metals Concentrations in Panama City Harbor Sediment Samples

Compound	Concentrations in mg/kg dry weight					Reference (a)
	PC-1	PC-1A	PC-2	PC-4	PC-5	
Ag	0.05	0.07	0.15	0.06	0.04	0.01
Al	2,720	7,030	14,000	3,210	4,070	1,743
As	4.86	3.46	7.90	3.09	1.95	0.69
Be	0.32	0.21	0.7	0.19	0.14	0.01
Cd	0.03	0.02	0.14	0.01	0.02	0.01 U(b)
Cr	20.60	13.40	33.70	10.30	9.82	2.13
Cu	5.80	4.75	9.93	2.97	2.91	0.74
Hg	0.0594	0.0320	0.0840	0.0235	0.0286	0.0032
Ni	5.15	3.24	9.55	2.99	2.39	0.71
Pb	8.32	6.18	24.10	6.86	9.00	2.68
Se	0.05 U	0.11	0.7	0.05 U	0.05 U	0.05 U
Sb	0.140	0.065	0.160	0.057	0.053	0.021
Ti	0.15	0.095	0.27	0.13	0.035	0.03
Zn	20.4	14.3	40.6	13.8	19.5	3.51

(a) Mean of replicate measurements.

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

sediments were in the range 0.0032 to 0.0840 mg/kg, well below the 0.21 mg/kg level, and were therefore considered typical of clean sediments.

3.3.6 Organotins

Organotin concentrations are summarized in Table 3.7. All data associated with these summaries and related quality assurance measurements may be found in Appendix B, Tables B.31 and B.32. The method blank analyzed with the samples was uncontaminated, and achieved detection limits were below the target detection limits. The MS recoveries were within the 40% to 120% range set in the QA/QC plan. Analytical precision was assessed through the analysis of an SRM sample, and the results were within QA/QC limits. Triplicate precision was acceptable.

Table 3.7 shows that dibutyltin was either undetected or detected below the method detection limit for all sediment treatments. Monobutyltin was undetected in five of the six sediment treatments. Tributyltin was detected above the method detection limit in three of the six sediment treatments at levels in the range 3.7 to 11.1 µg/kg dry weight.

3.3.7 Dioxins

Dibenzodioxin and dibenzofuran concentrations are summarized in Table 3.8. All data associated with these summaries and related quality assurance measurements may be found in Appendix B, Tables B.33 through B.39. The method blank analyzed for dioxins was uncontaminated for all dioxins and furans, with the exception of OCDD. The OCDD

FIGURE 3.4. Regression Lines With 95% Prediction Limits for Arsenic/Aluminum, Cadmium/Aluminum, Chromium/Aluminum, and Copper/Aluminum in Panama City Harbor Sediments

FIGURE 3.5. Regression Lines With 95% Prediction Limits for Nickel/Aluminum, Lead/Aluminum, and Zinc/Aluminum in Panama City Harbor Sediments

TABLE 3.7. Summary of Butyltins Concentrations in Panama City Harbor Sediment Samples

Compound	Mean Concentration (ug/kg dry weight)					Reference
	PC-1	PC-1A ^(a)	PC-2	PC-4	PC-5	
Tributyltin	3.7	1.9 UJ ^(b)	11.1	1.1 J ^(c)	5.1	1.8 U ^(d)
Dibutyltin	1.2 J	1.6 UJ	2.6 U	1.3 U	2.3 U	2.2 U
Monobutyltin	2.6 U	3.5	2.5 U	2.3 U	2.4 U	2.6 U

(a) Mean of replicate measurements.

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

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

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

concentration of 2.45 ng/kg dry weight was footnoted because the mass ratio was outside the limits for that sample. Because this value is lower than the detection limit, the accuracy of quantification at levels lower than the detection limits cannot be guaranteed. Achieved detection limits for all dioxin congeners analyzed were lower than the target detection limits set in the QA plan, except for OCDF. The concentration of OCDF found in the blank was slightly higher than the target detection limit, but sample concentrations were elevated 58 to 89 times higher than the detection limit. Matrix spike/matrix spike duplicate (MS/MSD) recoveries for all the dioxin congener analyses were within the 40% to 120% range set in the QA/QC plan. Analytical precision was determined by RPD calculations performed on the MS/MSD percent recoveries. These values are within the 30% limit set in the QA/QC plan. The sediment samples were spiked with 15 labeled surrogate compounds and a clean-up standard. Of the 80 surrogate percent recoveries, 17 were outside the targeted recovery range of 40 to 120%. All but one of the surrogate percent recoveries for station PC-1 (range from 19% to 39%) were below 40% to 120%.

Table 3.8 shows the dioxin congeners analyzed in sediment treatments PC-1 and PC-2. The dioxin congener 2378-TCDD, considered the most toxic by EPA based on its Toxicity Equivalent Factors (TEF) ranking (EPA 1988), was detected at 0.86 and 1.45 ng/kg dry weight in PC-1 and PC-2, respectively. Two other dioxin congeners detected in sediment treatments, 12378-PeCDD and 23478-PeCDF, are considered one-half as toxic based on TEF rankings. The dioxin congener 12378-PeCDD was found in PC-1 and PC-2 at concentrations of 0.72 and 0.74 ng/kg dry weight, respectively. The dioxin congener 23478-PeCDF was undetected above the method detection limit in both PC-1 and PC-2. Other dioxin congeners were detected at elevated concentrations, but are considered much less toxic based upon TEFs.

TABLE 3.8. Summary of Dioxin Concentrations in Panama City Harbor Sediment Samples

<u>Compound</u>	<u>Concentration in ng/kg dry weight</u>	
	<u>PC-1</u>	<u>PC-2</u>
2378-TCDD(a)	0.86	1.45
12378-PeCDD	0.72	0.74
123478-HxCDD(a)	0.74	0.87
123678-HxCDD(a)	4.97	3.74
123789-HxCDD(a)	3.05	3.21
1234678-HpCDD	123.52	94.74
OCDD	1717.19	1026.32
2378-TCDF(a)	5.88	9.21
12378-PeCDF	0.69 U(b)	0.45
23478-PeCDF	1.90 U	1.58 U
123478-HxCDF	0.81	0.71
123678-HxCDF	0.78	1.32 U
123789-HxCDF	0.76	2.11 U
234678-HxCDF	0.69 U	0.53 U
1234678-HpCDF(a)	18.33	11.63
1234789-HpCDF	1.05	0.92
OCDF(a)	88.83	57.89
Total TCDD	4.76	6.53
Total PeCDD	4.33	4.08
Total HxCDD	72.05	65.79
Total HpCDD	453.38	292.11
Total TCDF	13.62	26.32
Total PeCDF	7.52	8.37
Total HxCDF	19.64	0.71
Total HpCDF	72.00	47.37

(a) Daily calibration response factors out of limits.

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

3.4 SUSPENDED-PARTICULATE-PHASE (SPP) CHEMISTRY RESULTS

Suspended-Particulate-Phase samples from the five test sediments and one reference sediment were analyzed for ammonia, cyanide, PAHs, chlorinated pesticides, PCBs, phenol and substituted phenols, phthalate esters, and metals. A procedural blank was processed in the same manner as the SPP samples to ensure that the SPP process was not contributing to the concentration of analytes. As stated in the *1991 Implementation Manuals*, "the dredged-material impact in the water column must be within the applicable marine WQC for all contaminants of concern outside the boundary of the site at all times and within the site following the 4-h initial-mixing period. When there are no WQC for all contaminants of concern, or when synergistic effects are suspected between the contaminants, water-column impact must also be investigated by toxicity testing..." This section of the report addresses data quality, SPP chemistry results, and relationships between sediment treatments and the analytes. The complete SPP chemistry results and quality control data are presented in Appendix C.

3.4.1 Polynuclear Aromatic Hydrocarbons (PAHs)

Eighteen PAHs were analyzed in the SPP samples. The results are summarized in Table 3.9, with PAHs reported as LPAH and HPAH. The data for PAH analysis (Appendix C, Tables C.3 through C.7) indicate contamination of naphthalene, 2-methylnaphthalene, and phenanthrene in the procedural blank. Data associated with this blank were flagged with a "B". No HPAHs were found in the procedural blank at levels above the detection limit. Of the 16 PAH, 5 MS recoveries were slightly outside the 40% to 120% range set in the QA/QC plan. Analytical precision was within QA limits. Recovery of the SIS compounds, naphthalene-d₈ and acenaphthene-d₁₀, was acceptable in all SPP samples. Recovery of the SIS compound benzo(a)pyrene-d₁₂ was poor in all but one of the samples; however, the blank spike sample processed with the SPP samples showed acceptable recoveries of all SIS compounds. There is reason to believe that matrix interference in the SPP samples resulted in poor recovery of benzo(a)pyrene-d₁₂. No SRMs were analyzed for PAHs, phenol, substituted phenols, phthalate esters, chlorinated pesticides, or PCBs in the SPP samples.

Table 3.9 summarizes the PAHs, phenol and substituted phenols, and phthalate ester concentrations in SPP samples. This table shows that the lowest total PAH concentrations occurred in treatment PC-1 (71.74 ng/L) and the highest total PAH concentrations occurred in treatment PC-1A (141.17 ng/L). Concentrations of PAHs in the reference sediment were within the same range found in the test treatments.

3.4.2 Phenol, Substituted Phenols, and Phthalate Esters

Eleven phenols and substituted phenols and six phthalate esters were analyzed in the SPP samples. The results are summarized in Table 3.9, and data for phenol and substituted phenol analysis and phthalate ester analysis are presented in Appendix C, Tables C.8 through C.12. No phenol or substituted phenols were found in the procedural blank at levels above the detection limit. There was contamination of diethyl phthalate and bis(2-ethylhexyl) phthalate in the procedural blank, and data associated with this blank were "B" flagged. Of the 11 phenol and substituted phenols, 6 had MS recoveries outside the 40% to 120% range. The MS recoveries for substituted phenols ranged from 1% to 15%. Phenol had an MS recovery of 184%. All phthalate ester MS recoveries were within the QA limits. There were no calculable RSDs because of the lack of detected values. Replicate precision between triplicates for the phthalate esters analysis showed two of the six RSDs to be out of range. The surrogate recovery of 2-fluorophenol was outside the quality control range of 40% to 120%. The poor recovery of 2-fluorophenol was believed to be due to matrix interferences in the SPP samples.

Table 3.9 shows that all the phenol and substituted phenols analyzed were either undetected or detected below the method detection limit. The phthalate esters that were

TABLE 3.9. Summary of PAHs, Phenol, Substituted Phenols, and Phthalate Ester Concentrations in Panama City Harbor SPP Samples

Compound	Concentrations in ng/L						Procedural
PAHs	PC-1 ^(a)	PC-1A	PC-2	PC-4	PC-5	Reference	Blank
Naphthalene	22.46 B ^(b)	43.87 B	23.12 B	31.31 B	18.85 B	33.13 B	33.47 B
2-methylnaphthalene	9.98 B	24.73 B	11.62 B	15.49 B	11.43 B	15.47 B	9.96 B
1-methylnaphthalene	8.53	15.91	7.74	9.66	8.13	15.54	5.53 J
Acenaphthylene	8.89 U ^(c)	0.87 J ^(d)	9.54 U	9.30 U	2.98 J	9.43 U	4.06 J
Acenaphthene	4.11 UJ ^(e)	1.37 J	1.35 J	5.95 U	6.01 U	6.04 U	5.84 U
Fluorene	4.38 UJ	8.47	4.32 J	4.71 J	5.69 J	3.60 J	3.43 J
Phenanthrene	5.79 JB ^(f)	11.86 B	7.03 JB	6.67 JB	8.34 B	7.78 JB	11.86 B
Anthracene	4.93 UJ	2.03 J	1.21 J	1.02 J	3.35 J	1.48 J	1.18 J
Fluoranthene	4.15 J	6.39	3.91 J	3.45 J	9.70	3.07 J	1.89 J
Pyrene	4.86 J	4.45 J	3.19 J	2.39 J	11.73	2.18 J	1.70 J
Benzo(a)anthracene	10.77 UJ	1.79 J	0.99 J	30.45 U	1.10 J	0.53 J	29.86 U
Chrysene	1.83 J	3.19 J	1.76 J	1.56 J	6.24 J	1.80 J	19.09 U
Benzo(b)fluoranthene	3.28 J	4.67 J	3.24 J	2.25 J	22.74	1.97 J	14.59 U
Benzo(k)fluoranthene	2.20 J	2.81 J	1.61 J	1.31 J	11.97 J	1.22 J	13.27 U
Benzo(a)pyrene	4.71 UJ	6.69 U	6.65 U	6.48 U	6.53 U	6.57 U	6.35 U
Indeno(1,2,3-cd)pyrene	8.30 UJ	3.15 J	2.01 J	20.96 U	6.36 J	21.26 U	20.56 U
Dibenzo(a,h)anthracene	7.83 UJ	2.38 J	22.42 U	21.85 U	2.39 J	22.17 U	21.43 U
Benzo(g,h,i)perylene	8.24 UJ	3.23 J	1.97 J	20.24 U	4.05 J	1.51 J	19.85 U
Total LPAH ^(g)	48.63	109.11	56.39	68.86	58.77	77.00	69.49
Total HPAH ^(g)	23.11	32.06	18.68	10.96	76.28	12.28	3.59
Total PAH ^(g)	71.74	141.17	75.07	79.82	135.05	89.28	73.08
Phenols							
Phenol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	388.5 J
2-chlorophenol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	1381.2 U
2-nitrophenol	442.55 UJ	9.53 J	1445.09 U	8.34 J	7.74 J	1428.57 U	1381.2 U
2,4-dimethylphenol	443.06 UJ	23.64 J	11.51 J	14.83 J	16.34 J	1428.57 U	4.9 J
2,4-dichlorophenol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	3.9 J
Para-chloro-meta-cresol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	10.2 J
2,4,6-trichlorophenol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	1381.2 U
2,4-dinitrophenol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	1381.2 U
4-nitrophenol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	21.8 J
4,6-dinitro-o-cresol	1347.05 U	1453.49 U	1445.09 U	1408.45 U	1420.45 U	1428.57 U	1381.2 U
Pentachlorophenol	442.48 UJ	6.16 J	5.02 J	1408.45 U	26.79 J	1428.57 U	25.5 J
Phthalate Esters							
Dimethyl phthalate	118.79 J	87.75 J	95.22 J	90.60 J	102.11 J	104.70 J	137.96 J
Diethyl phthalate	135.00 JB	146.71 JB	185.42 JB	155.80 JB	181.01 JB	174.98 JB	291.88 B
Di-n-butyl phthalate	93.75 J	135.47 J	124.65 J	120.32 J	93.47 J	71.21 J	253.21 J
Butyl benzyl phthalate	45.66 J	65.09 J	74.66 J	57.13 J	81.32 J	27.25 J	172.65 J
Bis(2-ethylhexyl)phthalate	218.43 JB	288.72 JB	222.60 JB	336.23 B	377.17 B	166.66 JB	2448.25 B
Di-n-octyl phthalate	12.38 J	16.68 J	23.79 J	14.52 J	39.66 J	22.86 J	37.85 J

(a) Mean of replicate measurements.

(b) B Analyte was found in the method blank; results presented are not corrected for the amount in the blank.

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

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

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

(f) JB Analyte was detected below the method detection limit (MDL) but above the instrument detection limit (IDL) and was found in the method blank; results presented are not corrected for the amount in the blank.

(g) Values are the sum of detected values.

analyzed were all detected below the detection limit of 290.70 ng/L, except for bis(2-ethylhexyl)-phthalate detected above the method detection limit in one replicate of test treatments PC-4 and PC-5.

3.4.3 Chlorinated Pesticides and Polychlorinated Biphenyls

Nineteen chlorinated pesticides and seven PCBs were analyzed in the SPP samples. The data for pesticides and PCB analysis (Appendix C, Tables C.13 through C.19) indicate no contamination of the procedural blank sample. All but 3 of the 17 pesticide MS recoveries were within the 40% to 120% range set in the QA/QC plan. These three MS recoveries ranged from 121% to 148%. The PCB Aroclor 1254 had an MS recovery of 108%, within QA limits. One of the RSDs (39%), for pesticides and PCB analysis, was outside the QA/QC goal of $\leq 30\%$. The SIS compounds were all within the QA limits of 40% to 120%. Pesticide and PCB concentrations were either undetected or detected below the method detection limit for all samples, except 4,4'-DDD detected at 5.981 ng/L in the reference treatment.

3.4.4 Cyanide

Cyanide was analyzed in the SPP samples. The results are summarized in Table 3.10, and data for cyanide analysis are presented in Appendix C, Tables C.1 and C.2. The quality control data indicate no blank contamination, the MS recovery was within the QA/QC range, and replicate precision was excellent. The cyanide analysis showed that no SPP samples had detectable concentrations of cyanide.

3.4.5 Ammonia

Ammonia ($\text{NH}_3\text{-N}$) was analyzed in the SPP samples. The results are summarized in Table 3.10, and data for ammonia analysis are presented in Appendix C, Tables C.1 and C.2. The quality control data for ammonia analysis indicate the blank was not contaminated and analytical precision was excellent.

TABLE 3.10. Summary of Cyanide and Ammonia in Panama City Harbor SPP Samples

<u>Water Treatment</u>	<u>Cyanide ($\mu\text{g/L}$)</u>	<u>Ammonium (NH_4) (mg/L)</u>	<u>Ammonia ($\text{NH}_3\text{-N}$) (mg/L)</u>
PC-1	4.0 U(a)	0.23	0.18
PC-1A	4.0 U(b)	0.20	0.16
PC-2	4.0 U	0.63	0.49
PC-4	4.0 U	0.24(b)	0.18(b)
PC-5	4.0 U	0.43	0.33
Reference	4.0 U	0.82	0.64

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

(b) Mean of replicate measurements.

Ammonia concentrations in the SPP samples ranged from 0.16 mg/L in PC-1A to 0.64 mg/L in the reference treatment. Ammonia concentrations in the SPP samples were approximately 10 times less than concentrations in the sediment pore water samples. The concentrations of ammonium (NH₄) were calculated and are presented in Table 3.10.

3.4.6 Metals

Metals were analyzed in the SPP samples. The results are summarized in Table 3.11, and data for metals analysis are presented in Appendix C, Tables C.20 and C.21. Some metals were detected slightly above the detection limit in the procedural and method blanks. The data associated with these blanks are corrected for the amount found in the method blank. Matrix spike recoveries were all within the QA limits of 75% to 125%. The precision between analytical replicates was excellent and within the ≤20% QA/QC goal. Analytical accuracy was assessed through the analysis of an SRM and was within QA/QC limits.

Table 3.11 presents concentrations of metals in the SPP samples. SPP sample PC-1A had the lowest metals concentrations in five of the ten metals analyzed relative to the other test and reference treatments. PC-1 and PC-4 had the highest concentrations of Zn and Hg, respectively, relative to the other test and reference treatments. PC-2 was highest in two metals concentrations (As and Cr); the reference was highest in two metals concentrations (Ag and Ni); PC-5 was highest in three metals (Cd, Cu, and Pb) concentrations.

3.5 TOXICOLOGICAL TESTING RESULTS

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

Solid-phase toxicity tests were conducted to evaluate the six Panama City Harbor sediment treatments. The appropriate "native" control sediment for each species was also tested for toxicity. To assess acute toxicity of the sediment, three species of sensitive marine organisms were exposed for 10 days to the solid-phase treatments: the amphipod *R. abronius*, the amphipod *A. abdita*, and the polychaete *N. virens*. A 28-day exposure of *M. nasuta* and *N. virens* to the six sediment treatments was conducted to assess bioaccumulation of contaminants in test organism tissues. The results of each solid-phase test were examined to ensure test validation by 90% survival in the native control sediment. Data from the 10-day solid-phase acute toxicity tests were then evaluated by ANOVA and Dunnett's test to determine any significant differences between test and reference treatments.

TABLE 3.11. Summary of Metals Concentrations in Panama City Harbor SPP Samples

Compound	Concentrations in $\mu\text{g/L}$						Procedural Blank
	PC-1	PC-1A	PC-2(a)	PC-4	PC-5	Reference	
Ag	0.001 U(b)	0.006	0.003	0.005	0.004	0.009	0.007
As	8.24	7.98	17.8	7.23	7.04	1.49	1.14
Cd	0.015 U	0.015 U	0.031 U	0.015 U	0.018	0.015 U	0.022
Cr	0.719	0.745	0.874	0.694	0.848	0.848	0.257
Cu	0.24	0.30	0.36	0.33	0.39	0.38	0.57
Hg	0.00076	0.00238	0.00190	0.00304	0.00158	0.0026	0.00311
Ni	0.93	1.07	1.31	1.1	1.21	2.11	0.86
Pb	0.323	0.593	0.826	0.69	1.09	0.604	0.108
Se	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
Zn	2.14	1.69	1.77	1.58	2.03	0.39 U	3.61

(a) Mean of replicate measurements.

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

Suspended particulate-phase toxicity tests were conducted on five test sediment treatments and one reference treatment. Three concentrations of SPP (10%, 50%, and 100%), were prepared and tested along with a control (0% SPP, reference site water). Three species of organisms were exposed to the six SPP treatments: the mysid shrimp *M. bahia*, the silverside minnow *M. beryllina*, and planktonic larvae of the bivalve *M. edulis*. Control survival and water quality data were evaluated to determine test validity. The data for the 0% (control) and 100% SPP treatments were statistically compared using a two-sample t-test. If the result was significant ($\alpha=0.05$), and there was at least 50% reduction in survival relative to control, an LC_{50} or EC_{50} estimate was made using the trimmed Spearman-Kärber method.

3.5.1 10-Day Solid-Phase Flow-Through Test with *A. abdita*

Results of the 10-day solid-phase flow-through test with *A. abdita* are presented in Tables 3.12 and 3.13, and water quality data and test results are presented in Appendix D. Water quality data for the 10-day test were all within range. The 96-h static reference toxicant test had some pH values slightly out of range on one of the four days, although this did not appear to affect the outcome due to adequate survival. The reference toxicant exposure resulted in an LC_{50} to cadmium of 1.423 mg/L, which is similar to previous tests conducted at MSL (range from 0.5 to 1.4 mg/L). Test organism survival in the control treatment (San Pablo Bay) was 85%. Statistical analyses were performed on the data, and the Dunnett's test and ANOVA test results are summarized in Tables 3.12 and 3.13. Survival of *A. abdita* ranged from 84% to 90%, and there were no significant differences between test organism survival in test treatments relative to the reference treatment.

TABLE 3.12. Results of the 10-Day Solid-Phase Flow-Through Test with *A. abdita*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	<u>Statistical Significance</u>
PC-1	84.0	NS ^(a)
PC-1A	84.0	NS
PC-2	90.0	NS
PC-4	88.0	NS
PC-5	87.0	NS
Reference	88.0	NA ^(b)
<i>A. abdita</i> Control	85.0	NA

(a) NS No significant difference from the reference at $\alpha = 0.05$.

(b) NA Not applicable.

3.5.2 10-Day Solid-Phase Static Test with *R. abronius*

Results of the 10-day solid-phase static test with *R. abronius* are presented in Tables 3.14 and 3.15, and water quality data and test results are presented in Appendix E. Water quality data for the 10-day test were all within range, except for salinity in treatment PC-5, which exceeded the maximum range on one of the 10 days. However, this did not appear to affect validity of the test due to adequate survival. Water quality data for the 96-h static reference toxicant test were all within range. The reference toxicant exposure resulted in an LC₅₀ to cadmium of 1.630 mg/L, which is higher than the value cited in the recent ASTM (ASTM 1990) although similar to previous MSL studies (mean LC₅₀ of 1.46 mg/L, sd = 0.50 mg/L). The *R. abronius* test was valid, as indicated by 100% survival in the control treatment. Statistical analysis was performed on the data to compare test treatments to the reference treatment (Table 3.14). Organisms exposed to sediment treatment PC-2 had a mean survival of 61%, which was statistically significantly different from, and >20% lower than, the reference treatment (92%).

3.5.3 10-Day Solid-Phase Flow-Through Test with *N. virens*

The 10-day solid-phase flow-through test with *N. virens* results are presented in Tables 3.16 and 3.17, and water quality data and test results are presented in Appendix F. The water quality data indicate that all parameters were within range. The test is valid, as indicated by 96% survival in the control treatment. Survival in the test treatments ranged from 96% to 99%. Statistical analyses were performed on the data, and the results are summarized in Table 3.16.

TABLE 3.13. ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with *A. abdita*

<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	0.030	5	0.006	0.224	0.9485
Residual	0.633	24	0.026		

TABLE 3.14. Results of the 10-Day Solid-Phase Static Test with *R. abronius*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	<u>Statistical Significance</u>
PC-1	93.0	NS ^(a)
PC-1A	95.0	NS
PC-2	61.0	S ^(b)
PC-4	98.0	NS
PC-5	91.0	NS
Reference	92.0	NA ^(c)
<i>R. abronius</i> Control	100.0	NA

(a) NS No significant difference from the reference at $\alpha = 0.05$.

(b) S Significant difference from the reference.

(c) NA Not applicable.

This table shows no significant differences between test organism survival in test treatments relative to the reference treatment. No reference toxicant test (LC₅₀) was performed.

3.5.4 28-Day Solid-Phase Flow-Through Test with *N. virens*

Results of the 28-day solid-phase flow-through test with *N. virens* are presented in Table 3.18, and water quality data and test results are presented in Appendix G. The water quality data indicate that all parameters were within range. The test is valid, as indicated by 92% survival in the control treatment. Survival in the test treatments ranged from 88% to 98%. Statistical analysis was not conducted on this data, because the purpose of the 28-day solid-phase test was to provide results regarding bioaccumulation potential of specific test treatments.

3.5.5 28-Day Solid-Phase Flow-Through Test with *M. nasuta*

Results of the 28-day solid-phase flow-through test with *M. nasuta* are presented in Table 3.18, and water quality data and test results are presented in Appendix H. The water quality data indicate that all parameters were within range. The test is valid, as indicated by 96% survival in the control treatment. Survival in the test treatments ranged from 95.2% to 100%. Statistical analysis was not conducted on this data, because the purpose of the 28-day solid-phase test was to provide results as to the bioaccumulation potential of specific test treatments.

3.5.6 96-h Suspended-Particulate-Phase Static Test with *M. bahia*

Results of the 96-h SPP static test with *M. bahia* are presented in Table 3.19, and water quality data and test results are presented in Appendix I. The water quality data indicate that a

TABLE 3.15. ANOVA Results for the 10-Day Solid-Phase Static Test with *R. abronius*

<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	1.052	5	0.210	6.257	0.0008
Residual	0.807	24	0.034		

TABLE 3.16. Results of the 10-Day Solid-Phase Flow-Through Test with *N. virens*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	<u>Statistical Significance</u>
PC-1	96.0	NS ^(a)
PC-1A	99.0	NS
PC-2	97.0	NS
PC-4	98.0	NS
PC-5	99.0	NS
Reference	96.0	NA ^(b)
<i>N. virens</i> Control	96.0	NA

(a) NS No significant difference from the reference at $\alpha = 0.05$.

(b) NA Not applicable.

few pH and salinity values exceeded the targeted range, although not affecting the validity of the test. The reference toxicant water quality was within range, except for salinity measurements that exceeded the maximum range. However, these did not appear to affect validity of the test due to adequate survival. The reference toxicant exposure resulted in an LC₅₀ to copper of 340.0 µg/L. This response is within control ranges for this species and indicates appropriate test organism sensitivity. The test is validated by >90% survival observed in the control (0% SPP) treatment. Table 3.19 indicates that survival was >90% in all test treatments. Since a 50% decrease in survival in the SPP treatments relative to the seawater control was not found, an LC₅₀ was not calculable. Therefore, there is no evidence of acute toxicity of the SPP prepared from these test treatments to this test species.

3.5.7 96-h Suspended-Particulate-Phase Static Test with *M. beryllina*

Results of the 96-h SPP test with *M. beryllina* are presented in Table 3.20, and water quality data and test results are presented in Appendix J. The water quality data indicate that all parameters were within range, except for a slightly elevated salinity (33.0‰) in one test jar on one of the four days. However, this did not seem to affect validity of the test. Water quality data for the reference toxicant test were within range, except for two salinity measurements (32.5‰) that slightly exceeded the maximum range. However, this did not appear to affect validity of the test due to adequate survival. The reference toxicant exposure resulted in an LC₅₀ to copper of 108.6 µg/L. This response is within control ranges for this species and indicates appropriate test organism sensitivity. The test is validated by >90% survival observed in the control (0% SPP)

TABLE 3.17. ANOVA Results for the 10-Day Solid-Phase Flow-Through Test with *N. virens*

<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	0.048	5	0.010	0.509	0.7663
Residual	0.454	24	0.019		

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TABLE 3.18. Results of the 28-Day Solid-Phase Flow-Through Test with *N. virens* and *M. nasuta*

<u>Sediment Treatment</u>	<u>Percent Survival</u>	
	<u><i>N. virens</i></u>	<u><i>M. nasuta</i></u>
PC-1	96.0	100.0
PC-1A	96.0	100.0
PC-2	88.0	100.0
PC-4	98.0	99.2
PC-5	97.0	96.8
Reference	98.0	95.2
<i>N. virens</i> Control	92.0	NA ^(a)
<i>M. nasuta</i> Control	NA	96.0

(a) NA Not applicable.

treatment. Table 3.20 indicates that survival was >90% in all test treatments. Since a 50% decrease in survival in the SPP treatments relative to the seawater control was not found, an LC₅₀ is not calculable. Therefore, there is no evidence of acute toxicity of the SPP prepared from these test treatments to this test species.

3.5.8 72-h Suspended-Particulate-Phase Static Test with *M. edulis*

Results of the 72-h SPP static test with *M. edulis* are summarized in Table 3.21, and water quality data and test results are presented in Appendix K. The water quality data indicate that all parameters were within range for the 72-h test and the reference toxicant test. The reference toxicant exposure resulted in an LC₅₀ to copper of 17.00 µg/L and an EC₅₀ of 16.34 µg/L. This response is within control ranges for this species and indicates appropriate test organism sensitivity. Table 3.21 indicates that test organism survival and percent of normal larvae were >74% and 69%, respectively, for all the test treatments. The test was validated by the >78% survival in the control (0% SPP) treatments. Mean percent survival was calculated by adding the numbers of normal D-shaped larvae, the abnormal larvae, and the other larvae, and dividing the sum by the average stocking-density larval count (249 for the SPP test, and 245 for the reference toxicant test). The mean percent survival for the test treatments ranged from 75% in the 50% SPP from PC-2, to 91% in the 100% SPP from PC-1. The mean percent normal was calculated by dividing the normal D-shaped larvae by the average stocking-density larval count. All SPP sediment treatments had >69% normality. The LC₅₀ or EC₅₀ values for SPP were not calculable. Therefore, there is no evidence of acute toxicity of the SPP prepared from these test treatments to this test species.

TABLE 3.19. Results of the 96-h Suspended-Particulate-Phase Static Test with *M. bahia*

<u>Sediment Treatment</u>	<u>Percent SPP</u>	<u>Percent Survival</u>
PC-1	0	100.0
PC-1	10	96.0
PC-1	50	100.0
PC-1	100	94.0
PC-1A	0	98.0
PC-1A	10	98.0
PC-1A	50	98.0
PC-1A	100	96.0
PC-2	0	98.0
PC-2	10	96.0
PC-2	50	98.0
PC-2	100	100.0
PC-4	0	98.0
PC-4	10	100.0
PC-4	50	100.0
PC-4	100	100.0
PC-5	0	100.0
PC-5	10	98.0
PC-5	50	100.0
PC-5	100	100.0
Reference	0	100.0
Reference	10	98.0
Reference	50	100.0
Reference	100	98.0

3.6 TISSUE CHEMISTRY

M. nasuta and *N. virens* were tested in a 28-day solid-phase test by exposing these organisms to the test, reference, and control sediment treatments to evaluate bioaccumulation potential of these sediment treatments. The tissues of *M. nasuta* and *N. virens* were analyzed for PAHs, phenol and substituted phenols, phthalate esters, chlorinated pesticides, PCBs, metals, and organotins. The tissues of *M. nasuta* were also exposed to sediment treatments PC-1 and PC-2 and to the reference sediment for dioxin analysis. Complete tissue chemistry results in wet and dry weight, quality control data, and quality control summaries for these analyses are presented in Appendixes L and M. Tissue chemistry results from these analyses, summarized in the following section, were statistically analyzed using Dunnett's test ($\alpha = 0.05$) for comparison of all test treatment means relative to the reference treatment. If a contaminant was detected (no U or J qualifier) in tissues exposed to any replicate test treatment, and if the mean tissue concentration of the test replicates was greater than the mean tissue value of the reference treatment, a statistical comparison was made between test treatment and reference treatment

TABLE 3.20. Results of the 96-h Suspended-Particulate-Phase Static Test with *M. beryllina*

<u>Sediment Treatment</u>	<u>Percent SPP</u>	<u>Percent Survival</u>
PC-1	0	98.0
PC-1	10	100.0
PC-1	50	98.0
PC-1	100	100.0
PC-1A	0	98.0
PC-1A	10	98.0
PC-1A	50	100.0
PC-1A	100	100.0
PC-2	0	100.0
PC-2	10	98.0
PC-2	50	98.0
PC-2	100	100.0
PC-4	0	100.0
PC-4	10	98.0
PC-4	50	98.0
PC-4	100	98.0
PC-5	0	98.0
PC-5	10	100.0
PC-5	50	98.0
PC-5	100	96.0
Reference	0	98.0
Reference	10	98.0
Reference	50	96.0
Reference	100	98.0

concentrations. Reference treatments were used whether or not the values were detected or undetected. If a value was undetected (U flag), the detection limit value was used in the statistical analysis. If a compound was detected below the method detection limit (J flag), then the associated value was used for statistical analysis. Background (pre-exposure) and control tissue concentrations were not included in the statistical analysis. The background tissues were taken from *M. nasuta* specimens that had been contained in clean sediment and then allowed to depurate prior to subsampling for chemical analysis. These tissues were then chemically analyzed to determine if *M. nasuta* were exposed to contaminants prior to biological testing. Mean contaminant concentrations and the results of statistical comparisons are presented in the following sections.

The individual replicate tissue samples analyzed for PAHs, PCBs, and chlorinated pesticides in *M. nasuta* tissues, and for PAHs in *N. virens* tissues, were contaminated in the analytical chemistry laboratory during analysis. As a result, archived and uncontaminated tissue samples from individual replicates were combined into a single composite for each sediment

TABLE 3.21. Results of the 72-h Suspended-Particulate-Phase Static Test with *M. edulis*

<u>Sediment Treatment</u>	<u>Percent SPP</u>	<u>Mean Percent Survival</u>	<u>Mean Percent Normal</u>
PC-1	0	91.00	81.93
PC-1	10	83.53	78.80
PC-1	50	75.02	69.00
PC-1	100	91.41	86.10
PC-1A	0	89.80	81.69
PC-1A	10	87.23	78.63
PC-1A	50	87.07	82.09
PC-1A	100	86.75	78.63
PC-2	0	88.27	79.92
PC-2	10	88.92	83.13
PC-2	50	74.70	70.52
PC-2	100	88.19	83.29
PC-4	0	79.12	73.41
PC-4	10	79.68	71.57
PC-4	50	77.99	70.52
PC-4	100	82.73	78.71
PC-5	0	78.15	70.44
PC-5	10	82.83	75.91
PC-5	50	89.48	81.45
PC-5	100	81.93	75.50
Reference	0	89.32	84.02
Reference	10	91.16	86.83
Reference	50	81.23	73.90
Reference	100	88.84	84.82
Brine Control	NA(a)	79.84	72.93

(a) NA Not applicable.

treatment, and reanalyzed for the parameters listed above. After receipt of the composite data, the original and composite data sets were evaluated based on the following criteria. If the mean of the individual replicate concentrations was ≥ 2 times the composite concentration, and if the individual replicate concentrations were detected (no U qualifiers) and also ≥ 3 times the composite concentration, then the data were footnoted in the Appendixes and the reanalyzed composite concentration was substituted for the anomalous value(s) prior to statistical analysis. The individual replicate concentrations and the composite concentrations are both reported in Appendixes L and M.

3.6.1 Bioaccumulation of Polynuclear Aromatic Hydrocarbons in *M. nasuta*

Tables 3.22 and 3.23 present the mean concentrations of LPAH and HPAH compounds in *M. nasuta* for test and reference treatments as well as background and control tissue concentrations. The results of Dunnett's test for the LPAH compounds indicate that *M. nasuta* tissues exposed to test treatment PC-5 were statistically significantly different from the tissues exposed to the reference, and at a level >2 times but ≤5 times the reference for anthracene. Dunnett's test for the HPAH compounds indicates that nine of the ten HPAH compounds analyzed had statistically significant elevations in *M. nasuta* tissues in at least one of the test treatments. Fluoranthene, chrysene, indeno(1,2,3-c,d)pyrene, and benzo(g,h,i)perylene were statistically significantly elevated in *M. nasuta* tissues exposed to test treatment PC-5 at a magnitude of >2 times but ≤10 times the reference. Pyrene was statistically significantly elevated in *M. nasuta* tissues exposed to test treatments PC-1 and PC-5, with concentrations in PC-5 >5 times but ≤10 times the reference. Benzo(a)anthracene and benzo(b)fluoranthene were elevated in *M. nasuta* tissues exposed to all five test treatments. Benzo(k)fluoranthene and benzo(a)pyrene were statistically significantly elevated in *M. nasuta* tissues exposed to four test treatments and three test treatments, respectively. The four above mentioned compounds were measured in *M. nasuta* tissues exposed to PC-5 at concentrations >10 times the reference site. ANOVA data for those comparisons are presented in Table 3.24.

TABLE 3.22. Mean Low PAH Concentrations in the Tissues of *M. nasuta* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than the reference site when compared by Dunnett's test; box indicates value is >2 times but ≤5 times the reference site)

Sediment Treatment	Mean Concentration (µg/kg dry weight)				
	Naphthalene	2-methylnaphthalene	1-methylnaphthalene	Phenanthrene	Anthracene
Reference	45.86	4.92	2.49 J(a)	26.52	4.51 UJ(b)
PC-1	183.92	5.78	3.44	29.73	2.33 J
PC-1A	29.28	6.55	2.39 J	28.22	2.68 J
PC-2	29.76	5.78 U(c)	3.46 UJ	12.87	3.57 J
PC-4	6.47	4.78	2.10 J	6.83	1.43 J
PC-5	5.59	4.73 UJ	2.64 J	9.63	15.51
<i>M. nasuta</i> Control(d)	26.29	4.52	3.30 J	13.30	2.25 J

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

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

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

(d) Treatment not included in Dunnett's test data set.

TABLE 3.23. Mean High PAH Concentrations in the Tissues of *M. nasuta* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than the reference site when compared by Dunnett's test; box indicates value is >2 times but ≤5 times the reference site; shaded box indicates value is >5 times but ≤10 times the reference site; underline indicates value is >10 times the reference site)

Sediment Treatment	Mean Concentration (μg/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	Benzo(g,h,i)-perylene	
Reference	23.54	13.98	4.02 J(a)	10.42	8.20	3.05 J	3.52 UJ(b)	8.66 UJ	4.84 UJ	
PC-1	19.11	22.39	8.67	10.49	15.47	6.89	6.23	3.77 J	4.98	
PC-1A	17.93	13.56	9.77	12.91	20.07	7.46	8.41	3.96 J	4.52 J	
PC-2	15.20	13.27	7.20	9.77	15.14	4.13	4.84	3.16 J	3.52	
PC-4	16.42	15.87	6.12 J	10.22	14.73	5.23	4.44	4.67 J	3.47 J	
PC-5	72.60	118.71	54.56	54.60	174.68	77.53	73.65	18.53	15.80	
<i>M. nasuta</i> Control(c)	37.04	25.19	6.08 J	13.21	14.69	5.59	3.80	4.98 J	6.29	

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

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

(c) Treatment not included in Dunnett's test data set.

TABLE 3.24. ANOVA Results for Chemical Parameters in Tissues of *M. nasuta* Exposed to Test Treatments Compared to Tissues Exposed to the Reference Sediment

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
<u>Polynuclear Aromatic Hydrocarbons</u>						
Naphthalene	24.858	20.833	5	24	5.727	0.0013
2-methylnaphthalene	0.609	3.354	4	20	0.908	0.4781
1-methylnaphthalene	0.778	3.562	5	24	1.048	0.4130
Phenanthrene	5.717	10.589	5	24	2.591	0.0520
Anthracene	16.358	4.879	5	24	16.094	0.0001
Fluoranthene	8.667	1.509	5	24	27.564	0.0001
Pyrene	18.621	2.178	5	24	41.043	0.0001
Benzo(a)anthracene	20.144	0.554	5	24	174.678	0.0001
Chrysene	11.183	0.884	5	24	60.704	0.0001
Benzo(b)fluoranthene	28.412	0.601	5	24	227.037	0.0001
Benzo(k)fluoranthene	31.454	2.625	5	24	57.519	0.0001
Benzo(a)pyrene	32.103	1.907	5	24	80.799	0.0001
Indeno(1,2,3-c,d)pyrene	10.086	4.577	5	24	10.578	0.0001
Benzo(g,h,i)perylene	7.673	5.130	5	24	7.179	0.0003
<u>Phenol and Substituted Phenols</u>						
Phenol	11.138	43.191	5	24	1.238	0.3225
<u>Phthalate Esters</u>						
Bis (2-ethylhexyl) phthalate	5.271	31.666	5	24	0.799	0.5613
<u>Chlorinated Pesticides</u>						
Alpha-BHC	0.551	6.461	3	16	0.455	0.7173
Lindane	0.307	2.615	5	24	0.563	0.7270
Dieldrin	0.182	3.346	2	12	0.326	0.7280
4,4'-DDD	16.888	23.850	5	24	3.399	0.0184
4,4'-DDE	6.461	4.199	5	24	7.385	0.0003
4,4'-DDT	0.584	1.088	2	12	3.221	0.0759
<u>Polychlorinated Biphenyls</u>						
Aroclor-1254	4.890	6.827	5	24	3.438	0.0175
<u>Metals</u>						
Silver	0.806	3.279	5	24	1.179	0.3484
Arsenic	0.022	0.291	5	24	0.366	0.8670
Beryllium	0.348	6.090	1	8	0.457	0.5179
Cadmium	0.359	0.912	5	24	1.892	0.1332
Chromium	0.301	0.630	5	24	2.293	0.0774
Copper	0.100	0.540	5	24	0.888	0.5045
Mercury	0.099	1.082	5	24	0.439	0.8170
Nickel	0.523	0.657	5	24	3.819	0.0110
Lead	0.506	0.580	5	24	4.183	0.0071
Antimony	5.401	4.652	5	24	5.573	0.0015
Selenium	0.192	0.989	5	24	0.934	0.4767
Zinc	0.310	0.260	5	24	5.731	0.0013
<u>Butyltins</u>						
Tributyltin	0.151	1.016	4	20	0.745	0.5725

3.6.2 Bioaccumulation of Phenol, Substituted Phenols, and Phthalate Esters in *M. nasuta*

Concentrations of phenol, substituted phenols, and phthalate esters in *M. nasuta* tissues were either undetected or detected below the method detection limit for all compounds except phenol and bis (2-ethylhexyl) phthalate. However, there were no statistically significant differences between test treatments and the reference treatment for these two compounds. Bis (2-ethylhexyl) phthalate is a common laboratory contaminant that can be introduced into the sample or analytical procedure from materials such as plastics. ANOVA data for those comparisons are presented in Table 3.24. Complete *M. nasuta* tissue chemistry data in both wet and dry weight, quality control data, and quality control summaries are contained in Appendix L.

3.6.3 Bioaccumulation of Chlorinated Pesticides and Polychlorinated Biphenyls in *M. nasuta*

Concentrations of pesticides and PCBs in *M. nasuta* tissues were either undetected or detected below the method detection limit for all compounds, except alpha-BHC, lindane, dieldrin, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and Aroclor-1254. The data for these compounds were analyzed statistically, and the results of Dunnett's test are presented in Table 3.25. Concentrations of three compounds, 4,4'-DDD, 4,4'-DDE, and Aroclor-1254, were statistically significantly different between the test treatments and the reference treatment. *M. nasuta* tissues exposed to sediment treatment PC-1 were statistically significantly different for 4,4'-DDD when compared to tissues exposed to the reference treatment and at a magnitude of >2 times but ≤5 times the reference. Tissues exposed to PC-1A and PC-2 were statistically significantly different for Aroclor-1254 when compared to tissues exposed to the reference treatment and at a magnitude of >2 times but ≤5 times the reference. Concentrations of 4,4'-DDE in *M. nasuta* tissues were statistically significantly elevated in all the test treatments when compared to the tissues exposed to the reference treatment and at a magnitude of >2 times but ≤5 times the reference. ANOVA data for these comparisons are in Table 3.24.

3.6.4 Bioaccumulation of Metals in *M. nasuta*

Results of Dunnett's test and concentrations of metals in the tissues of *M. nasuta*, expressed in mg/kg dry weight, are presented in Table 3.26. The concentrations of Ti were undetected in all test, reference, and control treatments. Concentrations of Cr in *M. nasuta* tissues were statistically significantly different in the test treatments PC-2, PC-4, and PC-5 when compared to the reference treatment. Concentrations of Pb in *M. nasuta* tissues were statistically significantly different in the test treatment PC-5 when compared to the reference. Concentrations of Sb in *M. nasuta* tissues were statistically significantly different in test treatment PC-4 when compared to the reference treatment and at a magnitude of >2 times but ≤5 times the reference. ANOVA data for these comparisons are presented in Table 3.24.

TABLE 3.25. Mean Concentrations of Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs) in the Tissues of *M. nasuta* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than: the reference site when compared by Dunnett's test; box indicates value is >2 times but ≤5 times the reference site)

Sediment Treatment	Mean Concentration (ug/kg dry weight)						
	Alpha-BHC	Lindane	Dieldrin	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aroclor-1254
Reference	0.98	1.34 U(a)	0.72	6.81	1.49	3.28	29.50 U
PC-1	0.84	1.36	0.85	18.57	4.60	1.66 UJ(b)	62.11
PC-1A	0.75 J(c)	1.21	0.45 UJ	3.22	3.57	1.66 UJ	73.79
PC-2	0.65	1.06	0.25 J	1.75	3.92	1.97 UJ	91.37
PC-4	0.85	1.08	0.51 UJ	1.50	3.29	2.13	39.45
PC-5	0.91	1.27	0.68	11.49	4.97	3.34	40.27
<i>M. nasuta</i> Control(d)	0.79	1.01 U	0.88	14.52	2.06	1.15 UJ	19.84 U

- (a) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.
 (b) UJ Undetected or detected below the method detection limit in all replicates; value is the mean of detected values and dry weight detection limits.
 (c) J Detected below the method detection limit in all replicates.
 (d) Treatment not included in Dunnett's test data set.

TABLE 3.26. Mean Metal Concentrations in the Tissues of *M. nasuta* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than the reference site when compared by Dunnett's test; box indicates value is >2 times but ≤5 times the reference site)

Sediment Treatment	Mean Concentration (mg/kg dry weight)												
	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Reference	0.222	26.7	0.017	0.306	0.838	8.60	0.110	2.51	1.05	0.020	1.74	0.005 U(a)	87.3
PC-1	0.148	27.8	0.014 U	0.283	1.026	7.76	0.111	2.18	1.13	0.016	1.50	0.006 U	74.1
PC-1A	0.186	26.3	0.014 U	0.285	0.985	8.63	0.112	2.38	1.29	0.021	1.59	0.006 U	73.0
PC-2	0.149	26.2	0.014 U	0.219	1.120	8.50	0.099	2.00	1.13	0.018	1.69	0.006 U	74.2
PC-4	0.226	26.5	0.039	0.292	1.089	9.15	0.115	2.99	1.28	0.073	1.97	0.012 U	96.8
PC-5	0.179	25.2	0.016 U	0.249	1.112	9.26	0.104	2.71	1.53	0.025	1.66	0.005 U	81.5
Background(b)	0.266	30.6	0.010 U	0.354	1.720	11.60	0.108	4.43	1.28	0.071	1.72	0.006 U	91.4
M. nasuta Control(b)	0.140	30.3	0.014 U	0.272	1.826	9.60	0.095	3.88	1.23	0.022	1.68	0.006 U	74.7

(a) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.

(b) Treatment not included in Dunnett's test data set.

3.6.5 Bioaccumulation of Butyltins 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 3.27. Tributyltin was the only butyltin at detectable concentrations in the sediment treatments. No statistically significant difference occurred between test treatments and the reference treatment when data were analyzed using Dunnett's test. The ANOVA data for this statistical comparison are presented in Table 3.24.

3.6.6 Bioaccumulation of Dioxins in *M. nasuta*

Mean dibenzodioxins and dibenzofurans concentrations (ng/kg dry weight) in *M. nasuta* tissues exposed to test treatments PC-1 and PC-2 and the reference treatment are summarized in Table 3.28. *M. nasuta* tissue samples for dioxin analysis were composite tissue samples from the five replicate aquaria per sediment treatment. The dioxin and furan congeners were undetected above the method detection limit in tissue samples for test treatments PC-1 and PC-2 with the exception of five compounds (1231378-HpCDD, OCDD, 2378-TCDF, 123789-HxCDF, and OCDF). Concentrations of the compounds 1231378-HpCDD, OCDD, 123789-HxCDF, and OCDF were found in tissues exposed to both the test and reference treatments. These compounds were detected in relatively small concentrations and are believed to be partially the result of solvents used during laboratory glassware cleaning. Hepta- and octa- dioxin and furan compounds are determined to be ubiquitous in the analytical laboratory (EPA 1990c); therefore, their presence in *M. nasuta* tissues should not be a concern. The presence of 2378-TCDF in *M. nasuta* tissues exposed to sediment treatments PC-1 and PC-2 were detected at respective concentrations of 0.39 ng/kg and 0.55 ng/kg wet weight, slightly above the method detection limit.

TABLE 3.27. Mean Butyltin Concentrations in the Tissues of *M. nasuta* Exposed to Panama City Harbor Sediments (no test treatments were statistically significantly different from the reference when compared by Dunnett's test)

Sediment Treatment	Mean Concentration ($\mu\text{g/kg}$ dry weight)		
	Tributyltin	Dibutyltin	Monobutyltin
Reference	47.1	35.2 U(a)	56.4 U
PC-1	41.0	36.1 U	57.7 U
PC-1A	35.0 U	35.0 U	56.0 U
PC-2	39.7	35.6 U	56.9 U
PC-4	36.1	35.1 U	56.2 U
PC-5	36.4	34.4 U	55.0 U
Background(b)	27.5 U	27.5 U	43.9 U
<i>M. nasuta</i> Control(b)	38.5	34.0 U	54.4 U

(a) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.

(b) Treatment not included in Dunnett's test data set.

TABLE 3.28. Summary of Dioxin Concentrations in *M. nasuta* Tissues Exposed to Panama City Harbor Sediments

Compound	Concentrations in ng/kg dry weight		
	PC-1	PC-2	Reference
2378-TCDD	2.9 U(a)	2.1 U	1.4 U
12378-PeCDD	1.5 U	1.4 U	1.4 U
123478-HxCDD	0.7 U	1.4 U	0.7 U
123678-HxCDD	2.9 U	2.1 U	0.7 U
123789-HxCDD	2.2 U	2.1 U	1.4 U
1231378-HpCDD	10.68(b)(c)	20.6 U	3.58
OCDD	90.42	67.82	32.33
2378-TCDF	2.83	3.91	2.1 U
12378-PeCDF	1.5 U	1.4 U	0.7 U
23478-PeCDF	0.7 U	0.7 U	0.7 U
123478-HxCDF	0.7 U	0.7 U	0.7 U
123678-HxCDF	0.7 U	0.7 U	0.7 U
123789-HxCDF	1.38	2.8 U	1.07
231378-HxCDF	0.7 U	0.7 U	0.7 U
1231378-HpCDF	8.0 U	5.0 U	11.4 U
1234789-HpCDF	0.7 U	0.7 U	0.7 U
OCDF	3.99	1.78	1.72
Total TCDD	2.18	1.49	ND(d)
Total PeCDD	ND	ND	ND
Total HxCDD	11.55	7.33	5.15
Total HpCDD	40.31	25.62	10.73
Total TCDF	8.35	10.46	ND
Total PeCDF	ND	ND	ND
Total HxCDF	4.72	2.42	1.65
Total HpCDF	3.12	1.92	1.07

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

(b) Calibration response factor at beginning of day out of limits.

(c) Mass ratio out of limits.

(d) ND Not detected.

3.6.7 Bioaccumulation of Polynuclear Aromatic Hydrocarbons in *N. virens*

Tables 3.29 and 3.30 present the mean concentrations of LPAH and HPAH compounds in *N. virens* for test and reference treatments, as well as background and control tissue concentrations. The results of Dunnett's test for the LPAH compounds indicate that *N. virens* tissues were statistically significantly elevated in test treatment PC-4 for acenaphthylene and anthracene when compared to the reference, at a magnitude of >2 but ≤5 times the reference treatment. Table 3.30 presents the HPAH compounds that were statistically analyzed using Dunnett's test. Pyrene and benzo(k)fluoranthene were statistically significantly elevated in *N. virens* tissues exposed to PC-5 when compared to the reference. Benzo(a)anthracene was statistically significantly elevated in *N. virens* tissues exposed to all five test treatments at magnitudes of >2 times but ≤10 times the reference. Chrysene was statistically significantly

TABLE 3.29. Mean Low PAH Concentrations in the Tissues of *N. virens* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than the reference site when compared by Dunnett's test; box indicates value is >2 times but ≤5 times the reference site)

Sediment Treatment	Mean Concentrations (µg/kg dry weight)				
	Naphthalene	2-methylnaphthalene	1-methylnaphthalene	Acenaphthylene	Anthracene
Reference	48.83	4.62	3.74	3.10 UJ ^(a)	1.83 J ^(b)
PC-1	49.70	3.80 UJ	4.42	2.05 UJ	0.51 J
PC-1A	37.77	4.66	4.81	0.98 J	0.59 J
PC-2	30.34	4.49 UJ	5.64	3.11 UJ	3.10
PC-4	100.14	7.86	6.02	7.65	4.59
PC-5	42.04	5.47	6.11	0.71 J	3.77
<i>N. virens</i> Control ^(d)	38.43	3.94	3.74	7.70 UJ	5.65

- (a) UJ Analyte was either undetected or detected below the method detection limit in all replicates; value is mean of detected values and dry weight detection limits.
 (b) J Analyte was either detected below the method detection limit (MDL) but above the instrument detection limit (IDL).
 (c) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.
 (d) Treatment not included in Dunnett's test data set.

elevated at a magnitude of >2 times but ≤5 times the reference in *N. virens* tissues exposed to PC-4 and PC-5. ANOVA data for these comparisons are presented in Table 3.31.

3.6.8 Bioaccumulation of Phenol, Substituted Phenols, and Phthalate Esters in *N. virens*

Concentrations of phenol, substituted phenols, and phthalate esters in *N. virens* tissues were either undetected or detected below the method detection limit for all compounds, except di-n-butyl phthalate and butyl benzyl phthalate. However, no statistically significant differences were found between the test and reference sediment treatments for these two compounds. ANOVA data for those comparisons are presented in Table 3.31. Complete *N. virens* tissue chemistry data in both wet and dry weight, quality control data, and quality control summaries are contained in Appendix M.

3.6.9 Bioaccumulation of Chlorinated Pesticide and Polychlorinated Biphenyls in *N. virens*

Concentrations of pesticides and PCBs in *N. virens* tissues were either undetected or detected below the method detection limit for all compounds, except alpha-BHC, dieldrin, 4,4'-DDD, and Aroclor-1260. The dry weight data for these compounds were analyzed statistically using Dunnett's test, and there were no statistically significant differences between test treatments and the reference (Table 3.32). ANOVA data for those comparisons are

TABLE 3.30. Mean High PAH Concentrations in the Tissues of *N. virens* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than the reference site when compared by Dunnett's test; box indicates value is >2 times the reference site; shaded box indicates value is >5 times but ≤10 times the reference site)

Sediment Treatment	Mean Concentration (µg/kg dry weight)									
	Fluoranthene	Pyrene	Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno(1,2,3-c,d)-pyrene	Dibenzo(a,h,j)-anthracene	Benzo(g,h,i)-perylene	
Reference	7.98	4.39	0.50 J(a)	3.77 J	4.45 UJ(b)	1.97 UJ	3.71 UJ	3.71 UJ	4.23 UJ	
PC-1	8.16	6.28	2.82 UJ	4.96 UJ	3.04 UJ	1.72 UJ	3.69 UJ	3.18 UJ	3.10 UJ	
PC-1A	6.84	4.57	1.59 J	3.44 J	3.70 UJ	1.73 UJ	3.16 UJ	2.19 UJ	3.44 UJ	
PC-2	7.49	4.95	1.61 J	4.17 J	3.06 UJ	2.59 UJ	5.23 UJ	3.82 UJ	4.24 UJ	
PC-4	13.50	4.56 UJ	4.01 UJ	8.32	4.97 UJ	2.73 UJ	4.94 UJ	2.79 UJ	4.97 UJ	
PC-5	10.23	10.61	2.49 J	8.58	5.30	3.82	3.32 UJ	2.65 UJ	3.34 UJ	
<i>N. virens</i> Control(c)	8.79	5.95	4.32 UJ	7.25 UJ	5.49 UJ	3.47 UJ	6.96 UJ	6.49 UJ	5.72 UJ	

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

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

(c) Treatment not included in Dunnett's test data set.

TABLE 3.31. ANOVA Results for Chemical Parameters in Tissues of *N. virens* Exposed to Test Treatments Compared to Tissues Exposed to the Reference Sediment

Parameter	Sum of Squares		Degrees of Freedom		F-ratio	p-value
	Treatment	Residual	Treatment	Residual		
<u>Polynuclear Aromatic Hydrocarbons</u>						
Naphthalene	3.697	7.905	5	24	2.245	0.0826
2-methylnaphthalene	1.455	3.865	5	24	1.806	0.1497
1-methylnaphthalene	0.714	2.614	5	24	1.312	0.2924
Acenaphthylene	14.854	18.067	5	24	3.947	0.0094
Anthracene	18.740	5.374	5	24	16.737	0.0001
Fluoranthene	0.826	3.052	5	24	1.299	0.2974
Pyrene	2.841	2.484	5	24	5.488	0.0017
Benzo(a)anthracene	11.475	4.233	5	24	13.010	0.0001
Chrysene	3.668	2.917	5	24	6.035	0.0009
Benzo(b)fluoranthene	2.453	8.828	5	24	1.334	0.2839
Benzo(k)fluoranthene	3.680	7.559	5	24	2.337	0.0730
Indeno(1,2,3-c,d)pyrene	1.791	7.789	5	24	1.104	0.3843
Dibenzo(a,h)anthracene	1.707	26.615	5	24	0.308	0.9034
Benzo(g,h,i)perylene	0.996	4.862	5	24	0.984	0.4480
<u>Phthalate Esters</u>						
Di-n-butyl phthalate	7.672	33.273	5	24	1.107	0.3829
Butyl benzyl phthalate	0.717	13.291	5	24	0.259	0.9311
<u>Chlorinated Pesticides</u>						
Alpha-BHC	0.833	8.621	5	24	0.464	0.7991
Dieldrin	0.576	3.628	5	24	0.762	0.5858
4,4'-DDD	1.228	10.362	5	24	0.569	0.7229
<u>Polychlorinated Biphenyls</u>						
Aroclor-1260	0.385	5.862	5	24	0.315	0.8989
<u>Metals</u>						
Silver	0.318	0.122	5	24	12.470	0.0001
Arsenic	0.142	0.223	5	24	3.051	0.0285
Beryllium	0.000	0.000	5	24	NA(a)	NA
Cadmium	0.006	0.021	5	24	1.278	0.3056
Chromium	0.153	1.265	5	24	0.580	0.7152
Copper	0.023	0.153	5	24	0.729	0.6087
Mercury	0.110	0.250	5	24	2.101	0.1003
Nickel	1.659	9.064	5	24	0.878	0.5104
Lead	0.161	0.496	5	24	1.555	0.2107
Antimony	0.068	0.309	5	24	1.055	0.4092
Selenium	0.656	2.078	5	24	1.515	0.2224
Thallium	0.000	-1.110 E-16	5	24	NA	NA
Zinc	1.250	5.249	5	24	1.143	0.3654
<u>Butyltins</u>						
Dibutyltin	7.732 E-5	0.183	2	12	0.003	0.9975

(a) NA Not applicable.

TABLE 3.32. Mean Concentrations of Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs) in the Tissues of *N. virens* Exposed to Panama City Harbor Sediments (no test treatments were statistically significantly different than the reference when compared by Dunnett's test)

Sediment Treatment	Mean Concentration ($\mu\text{g/kg dry weight}$)			
	Alpha-BHC	Dieldrin	4,4'-DDD	Aroclor-1260
Reference	1.35	1.10	1.59	135.66
PC-1	2.62	0.93	3.04	126.43
PC-1A	1.27	0.89	2.34	119.57
PC-2	2.06	1.10	3.09	153.66
PC-4	1.49	1.29	1.96	152.58
PC-5	1.49	0.99	1.95	126.04
Background ^(a)	3.03	1.09	1.23 U ^(b)	145.82
<i>N. virens</i> Control ^(a)	2.63	1.25	2.15	194.34

(a) Treatment not included in Dunnett's test data set.

(b) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.

presented in Table 3.31. Complete *N. virens* tissue chemistry data in both wet and dry weight, quality control data, and quality control summaries are contained in Appendix M.

3.6.10 Bioaccumulation of Metals in *N. virens*

Results of Dunnett's test and concentrations of metals in the tissues of *N. virens*, expressed in mg/kg dry weight, are presented in Table 3.33. The concentrations of Be and Ti were undetected in all test, reference, and control treatments. Selenium was the only metal that was statistically significantly elevated, at a magnitude <2 times the reference in *N. virens* tissues exposed to sediment treatment PC-4 when compared to tissues exposed to the reference sediment. The ANOVA data for this statistical comparison are presented in Table 3.31.

3.6.11 Bioaccumulation of Butyltins in *N. virens*

Mean butyltin concentrations ($\mu\text{g/kg}$ dry weight) in *N. virens* tissues exposed to test, reference, and control treatments are summarized in Table 3.34. Dibutyltin was the only butyltin found at detectable levels in the tissues of *N. virens* following exposure to the sediment treatments. Tissues exposed to sediment treatments PC-1A and PC-5 had detected values that were compared statistically to the reference. No statistically significant differences were found between the test and reference sediment treatments. The ANOVA data for this statistical comparison are presented in Table 3.31.

TABLE 3.33. Mean Metal Concentrations in the Tissues of *N. virens* Exposed to Panama City Harbor Sediments (bold type indicates value is significantly greater than the reference site when compared by Dunnett's test; box indicates value is >2 times but ≤5 times the reference site)

Sediment Treatment	Mean Concentration (mg/kg dry weight)										
	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se
Reference	0.230	15.9	0.080 U(a)	0.295	0.993	6.59	0.150	0.535	0.558	0.049	0.95
PC-1	0.178	15.0	0.080 U	0.272	0.897	6.29	0.132	0.376	0.558	0.050	1.06
PC-1A	0.195	16.7	0.080 U	0.296	1.044	6.30	0.141	0.650	0.676	0.053	1.25
PC-2	0.170	13.5	0.080 U	0.282	0.879	6.70	0.128	0.382	0.575	0.049	1.15
PC-4	0.187	15.3	0.080 U	0.287	1.075	6.60	0.129	0.844	0.632	0.056	1.40
PC-5	0.171	14.1	0.080 U	0.257	0.999	6.25	0.125	0.537	0.646	0.049	1.04
Background(b)	0.155	15.5	0.080 U	0.302	0.789	7.22	0.137	0.759	0.481	0.048	1.53
<i>N. virens</i> Control(b)	0.194	15.8	0.080 U	0.287	0.897	7.25	0.152	0.489	0.808	0.048	1.28

(a) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.

(b) Treatment not included in Dunnett's test data set.

TABLE 3.34. Mean Butyltin Concentrations in the Tissues of *N. virens* Exposed to Panama City Harbor Sediments (no test treatments were statistically significantly different than the reference when compared by Dunnett's test)

<u>Sediment Treatment</u>	<u>Mean Concentration (µg/kg dry weight</u>		
	<u>Tributyltin</u>	<u>Dibutyltin</u>	<u>Monobutyltin</u>
Reference	34.3 U(a)	37.1	54.8 U
PC-1	34.9 U	34.9 U	55.9 U
PC-1A	34.8 U	37.2	55.7 U
PC-2	36.9 U	36.9 U	59.0 U
PC-4	35.4 U	35.4 U	56.6 U
PC-5	36.6 U	37.2	58.5 U
Background(b)	36.0 U	43.7	57.6 U
<i>N. virens</i> Control(b)	36.9 U	36.9 U	59.1 U

(a) U Analyte was not present above the level of the associated value in all replicates; value is mean of dry weight detection limits.

(b) Treatment not included in Dunnett's test data set.

4.0 DISCUSSION

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

4.1 SEDIMENT CHARACTERISTICS

The sediment chemistry results are intended to provide information about chemical contaminants of concern that could potentially cause toxicity or bioaccumulation. In general, the test treatments contained higher concentrations of most contaminants of concern relative to the reference sediment. Concentrations of TOC, total sulfides, PAHs, phthalate esters, chlorinated pesticides, metals, and butyltins were elevated in the test treatments relative to reference treatment concentrations.

4.2 TIER II EVALUATIONS

As stated in the *1991 Implementation Manual*, "the dredged-material impact in the water column must be within the applicable marine water quality criteria for all contaminants of concern outside the boundary of the site at all times and within the site following the 4-h initial-mixing period. When there are no WQC for all contaminants of concern, or when synergistic effects are suspected between the contaminants, water-column impact must also be investigated by toxicity testing..." Table 4.1 presents the EPA Marine Acute WQC for the contaminants of concern that were measured in the Panama City Harbor SPP samples (EPA 1986b). The maximum concentrations of contaminants of concern in the SPP samples were several orders of magnitude below the EPA WQC.

TABLE 4.1. Comparison Between EPA Water Quality Criteria Levels and Panama City Harbor Suspended-Particulate-Phase (SPP) Samples

<u>Contaminant</u>	<u>EPA Water Quality Criteria Marine Acute Criteria (µg/L)</u>	<u>SPP Maximum Concentration (µg/L)</u>
Acenaphthene	970	0.00137
Aldrin	1.3	0.004651 U(a)
Arsenic	2388	18.1
BHC	0.34	0.001249(b)
Cadmium	43	0.018
Chlordane	0.09	0.02907 U
Chromium (Hexa)	1,100	0.925
Copper	2.9	0.41
Cyanide	1	4.0 U
DDE	14	0.004624 U
DDT	0.13	0.00123
Dieldrin	0.71	0.004651 U
Endosulfan	0.034	0.004651 U
Endrin	0.037	0.004651 U
Fluoranthene	40	0.0097
Heptachlor	0.053	0.004651 U
Lindane	0.16	0.004651 U
Lead	140	1.09
Mercury	2.1	0.00304
Naphthalene	2,350	0.04387
Nickel	75	2.11
Nitrophenols	4,850	1.45349 U
PCB's	10	0.02907 U
Pentachlorophenol	13	0.02679
Phenol	5,800	1.45349 U
Phthalate Esters	2,944	0.87474(c)
PAH's	300	0.14117(d)
Selenium	410	2.6 U
Silver	2.3	0.009
Toxaphene	0.21	0.02907 U
Zinc	95	2.14

(a) U Analyte was not present above the level of the associated value in all replicates of all test treatments.

(b) Value is for Alpha-BHC; Beta-BHC and Delta-BHC were undetected in the SPP samples.

(c) Value is total of all phthalate ester compounds measured in the SPP samples.

(d) Value is total of detected low- and high-molecular-weight PAHs measured in the SPP samples.

4.3 TIER III EVALUATIONS

4.3.1 Water Column Effects

Estimates of toxicity in the water column were also evaluated by exposing three sensitive marine species (*M. bahia*, *M. beryllina*, and *M. edulis*) to three concentrations of SPP and a dilution water control (reference site water). The results showed no acute toxicity to any of these three species (Table 4.2). No LC₅₀ could be calculated because mortality did not exceed 50% of

TABLE 4.2. Suspended-Particulate-Phase Toxicity Test Results (no statistically significant differences when analyzed by t-test, $\alpha = 0.5$)

Treatment	<u>Mysid <i>M. bahia</i></u>			<u>Silverside Minnow <i>M. beryllina</i></u>			<u>Mussel Larvae <i>M. edulis</i></u>		
	<u>Mean Survival (%)</u>		LC50 as % SPP	<u>Mean Survival (%)</u>		LC50 as % SPP	<u>Mean Survival (%)</u>		LC50 as % SPP
	0% SPP	100% SPP		0% SPP	100% SPP		0% SPP	100% SPP	
PC-1	100.0	94.0	>100	98.0	100.0	>100	91.0	91.4	>100
PC-1A	98.0	96.0	>100	98.0	100.0	>100	89.8	86.8	>100
PC-2	98.0	100.0	>100	100.0	100.0	>100	88.3	88.2	>100
PC-4	98.0	100.0	>100	100.0	98.0	>100	79.1	82.7	>100
PC-5	100.0	100.0	>100	98.0	96.0	>100	78.2	81.9	>100
Reference	100.0	98.0	>100	98.0	98.0	>100	89.3	88.8	>100

the population relative to the control. Under *1991 Implementation Manual* guidelines, the limiting permissible concentration (LPC) of dissolved plus suspended contaminants cannot exceed 0.01 of the acutely toxic concentration at the boundaries of the disposal site after allowing 4 hours for initial mixing. Based on the results of the SPP toxicity tests, disposal of the Panama City Harbor proposed dredged material would be acceptable according to this criteria.

4.3.2 Deposited Sediment (Solid-Phase) Acute Toxicity

Deposited sediment toxicity was determined by exposing three species of marine organisms (*R. abronius*, *A. abdita*, and *N. virens*) to test sediment treatments in 10-day solid-phase tests. If the difference in mortality between proposed dredged material (test treatments) and the reference treatment is statistically significantly different, and if that difference exceeds 10% (20% for *R. abronius*), then the test material does not comply as stated in Appendix A of the *1991 Implementation Manual*. The solid-phase tests of Panama City Harbor sediments (Table 4.3) showed solid-phase acute toxicity to *R. abronius* exposed to test treatment PC-2 when compared to the reference sediment using Dunnett's test. There were no detected statistically significant differences in acute toxicity to either the *A. abdita* or *N. virens* solid-phase tests. The Panama City Harbor sediments treatments, except PC-2, comply with the benthic bioassay criteria.

4.3.3 Deposited Sediment Bioaccumulation

The potential for bioaccumulation of contaminants was evaluated through 28-day solid-phase exposures of *M. nasuta* and *N. virens* to Panama City Harbor sediments followed by chemical analysis of the tissues. The tissue contaminant concentrations were compared to existing Food and Drug Administration (FDA) limits. The tissue concentrations were statistically compared between tissues exposed to proposed dredged material and those exposed to reference sediment. Compliance criteria for bioaccumulation are not as well-defined as for water column or deposited sediment toxicity. If any statistically significant bioaccumulation is detected, other considerations are examined, such as number of compounds elevated, number of species

TABLE 4.3. Comparison of Solid-Phase Acute Toxicity to the Reference Sediment (bold type would indicate mean survival statistically significantly lower than the reference based on Dunnett's test; shading would indicate >20% difference)

<u>Treatment</u>	<u>Mean Percent Survival in 10-day Solid-Phase Test</u>		
	<u><i>A. abdita</i></u>	<u><i>R. abronius</i></u>	<u><i>N. virens</i></u>
PC-1	84.0	93.0	96.0
PC-1A	84.0	95.0	99.0
PC-2	90.0	61.0	97.0
PC-4	88.0	98.0	98.0
PC-5	87.0	91.0	99.0
Reference	88.0	92.0	96.0
<i>A. abdita</i> Control	85.0	NA(a)	NA
<i>R. abronius</i> Control	NA	100.0	NA
<i>N. virens</i> Control	NA	NA	96.0

(a) NA Not applicable.

showing elevated contaminant levels, magnitude of increase in contaminant concentrations, degree or magnitude of the elevations relative to tissues exposed to reference sediment, and related sediment toxicity.

M. nasuta and *N. virens* tissue contaminant concentrations were orders of magnitude below the FDA action limits following exposure to Panama City Harbor sediments (Table 4.4). Although most contaminants were not elevated in *M. nasuta* and *N. virens* tissues, statistically significant elevations of several contaminants were detected when compared to tissues exposed to reference sediment using Dunnett's test (Table 4.5).

One low-molecular-weight PAH (anthracene), several high-molecular-weight PAHs, the pesticides 4,4'-DDD and 4,4'-DDE, Aroclor-1254, and the metals Cr, Pb, and Sb were elevated in *M. nasuta* tissues exposed to some test treatments (Table 4.5). Actual concentrations of some of these compounds (anthracene, 4,4'-DDE, and Sb) were low and below the target detection limits, although above the achieved detection limits. Four of the nine high-molecular-weight PAHs were elevated in *M. nasuta* tissues at magnitudes >10 times above the concentrations present in tissues exposed to the reference sediment. The PCB Aroclor-1254 was found to be statistically significantly elevated in *M. nasuta* tissues at magnitudes ranging from 2.7 to 3.1 times the concentrations present in tissues exposed to the reference sediment. Phenol and substituted phenols, phthalate esters, and butyltins were not statistically significantly elevated in *M. nasuta* tissues exposed to any of the test treatments relative to the tissues exposed to the reference sediment.

TABLE 4.4. Comparison Between FDA Action Levels and Contaminant Levels in *M. nasuta* and *N. virens* Exposed to Panama City Harbor Sediments

<u>Contaminant</u>	<u>FDA Action Level (mg/kg wet weight)</u>	<u>Maximum Concentration (mg/kg wet weight)</u>	
		<u><i>M. nasuta</i></u>	<u><i>N. virens</i></u>
Methyl Mercury	1.0	0.025(a)	0.026(a)
Benzene Hexachloride (BHC)	0.3	0.00107(b)	0.00615(b)
Chlordane	0.3	0.00574 U(c)	0.00496 U
DDT + DDE	5.0	0.00119 UJ(d)	0.00108 U
Dieldrin + Aldrin	0.3	0.00115	0.00058
Endrin	0.3	0.00024 U	0.00021 U
Heptachlor + Heptachlor Epoxide	0.3	0.00059 U	0.00068
Toxaphene	5.0	0.00574 U	0.00496 U
PCBs	2.0	0.04669	0.05593
Dioxin	0.025 (µg/kg)	0.01245	NM(e)

(a) Value is for total mercury; methyl mercury is a fraction of the total but was not analyzed separately.

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

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

(d) UJ Analyte was either undetected or detected below the method detection limit in the summation of 4,4'-DDT and 4,4'-DDE.

(e) NM Not measured.

Two low-molecular-weight PAHs (acenaphthylene and anthracene), four high-molecular-weight PAHs (pyrene, benzo(a)anthracene, chrysene, and benzo(k)fluoranthene), and one metal (Se) were elevated in *N. virens* exposed to some test treatments. A few PAHs that were elevated in *N. virens* tissues could be attributed to the environmentally conservative approach of using values estimated below the achieved detection limit (J flagged). If the actual dry-weight detection limits for each replicate were substituted for J-flagged values, it is likely that fewer significant differences would have been found between test and reference treatments. Chlorinated pesticides, PCBs, phenol and substituted phenols, phthalate esters, and butyltins were not statistically significantly elevated in *N. virens* tissues exposed to any of the test treatments relative to the tissues exposed to the reference sediment.

4.4 CONCLUSIONS AND RECOMMENDATIONS

Based on the Tier III evaluation of the results of this study, ocean disposal of proposed dredged material from the Panama City Harbor should not result in significant adverse water-column or deposited-sediment acute toxicity effects, with the exception of test treatment PC-2. Computer modeling should not be required because concentrations of contaminants in the SPP samples did not exceed WQC limits and there was no water column toxicity. Estimates of

TABLE 4.5. Summary of Acute Toxicity and Bioaccumulation for Panama City Harbor Sediment Treatments Relative to the Reference Sediment

Sediment Treatment	Acute Toxicity	<i>M. nasuta</i> Bioaccumulation				<i>N. virens</i> Bioaccumulation			
		PAH	PEST	PCB	Metals	PAH	PEST	PCB	Metals
PC-1	---(a)	HPAH(b)	DDD,DDE	---	---	HPAH	---	---	---
PC-1A	---	HPAH	DDE	1254(e)	---	HPAH	---	---	---
PC-2	Rhep(d)	HPAH	DDE	1254	Cr	HPAH	---	---	---
PC-4	---	HPAH	DDE	---	Cr,Sb	LPAH(e),HPAH	---	---	Se
PC-5	---	LPAH,HPAH	DDE	---	Cr,Pb	HPAH	---	---	---

- (a) No statistically significant acute toxicity or bioaccumulation.
 (b) HPAH high-molecular-weight polynuclear aromatic hydrocarbons.
 (c) Aroclor-1254.
 (d) Rhep 10-Day solid-phase static test with *R. abronius*.
 (e) LPAH low-molecular-weight polynuclear aromatic hydrocarbons.

water column toxicity were evaluated by exposing three marine species (*M. bahia*, *M. beryllina*, and *M. edulis*). The results of these toxicity tests showed no effect on survival or normal development of bivalve larvae from any of the test treatments or reference treatment. Evaluation of the concentrations of contaminants of concern in the SPP samples shows that concentrations of suspended and dissolved material from the Panama City Harbor test treatments did not exceed the EPA WQC limits.

Deposited sediment toxicity was determined by exposing three species of marine organisms (*A. abdita*, *R. abronius*, and *N. virens*) to test sediment treatments. The 1991 *Implementation Manuals* guidelines concerning determination of compliance for deposited sediment toxicity are based on whether the mortality of organisms exposed to test treatments is statistically significantly different from the 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*.

Toxicological tests conducted by the MSL showed that one station, PC-2, was statistically significantly toxic to *R. abronius* compared to the reference sediment using Dunnett's test. The percent survival for this sediment treatment was 61%, which was statistically significant and was >20% below the reference sediment percent survival of 92%.

The potential for bioaccumulation of contaminants was evaluated through 28-day solid-phase flow-through tests with *M. nasuta* and *N. virens*. The concentrations of contaminants of concern were compared to existing FDA action limits and showed no evidence of bioaccumulation that would exceed FDA limits. The concentrations of contaminants were also compared to the reference sediment using Dunnett's test to determine the presence of statistically significant levels of contaminants relative to the reference sediment. In most cases, PAH, pesticide, and PCB levels in the tissues of organisms exposed to the test treatment were between 2 and 21 times the concentrations observed in tissues exposed to the reference treatment. Elevated metals concentrations in tissues exposed to the test treatments were generally at levels less than twice those found in tissues exposed to the reference treatment, with the exception of Sb. Concentrations of Sb in *M. nasuta* tissues exposed to PC-4 were three times greater than *M. nasuta* tissues exposed to the reference treatment.

The Panama City Harbor test treatments PC-1, PC-1A, and PC-2 are located in the eastern portion of St. Andrew Bay (Figure 4.1). These three test treatments had percentages of fine-grained sediments (silt and clay) ranging from 13% dry weight in PC-1A to 36% dry weight in PC-2. These fine-grained sediments were associated with concentrations of TOC that ranged

FIGURE 4.1. Panama City Harbor Sediment Treatments With Acute Toxicity and/or Bioaccumulation of at Least One Contaminant in the Tissues of at Least One Species (*M. nasuta* or *N. virens*) Compared to the Reference Treatment

from 0.75% to 2.14% in these three test treatments. The fine-grained character and high TOC content in the sediments are associated with relatively low bioaccumulation potential, because organic compounds tend to bind to these sediments and are not as readily available to the marine organisms. As a result of this relationship, test treatments PC-1, PC-1A, and PC-2 had no more than five high-molecular-weight PAHs, two pesticide/PCB compounds, and one metal that were statistically significantly elevated in *M. nasuta* tissues, and only one high-molecular-weight PAH was statistically significantly elevated in *N. virens* tissues.

The Panama City Harbor sediment treatments PC-4 and PC-5 are located in the western arm of St. Andrew Bay (Figure 4.1). The percentages of fine-grained sediment for PC-4 and PC-5 were 13% and 14% dry weight, respectively. The concentrations of TOC in these test treatments ranged from 0.33% to 0.72% dry weight. Due to the higher percentages of coarse-grained sediments (sand and gravel) and the relatively low TOC content, organic compounds such as PAHs may be more bioavailable to marine organisms such as *M. nasuta* and *N. virens*. The tissues of these two organisms exposed to test treatments PC-4 and PC-5 were statistically significantly elevated for two low-molecular-weight PAHs and nine high-molecular-weight PAH compounds, and at magnitudes ranging from 2 to 21 times the concentrations found in the reference treatment.

Proposed dredged material from the Panama City Harbor was evaluated based on four criteria: 1) concentrations and magnifications of contaminants in the test sediment treatments relative to the reference sediment; 2) concentrations of contaminants in the SPP samples and acute toxicity to SPP samples; 3) solid-phase acute toxicity of the test treatments compared to the reference sediment, and 4) concentrations and magnifications of contaminants in the tissues of both *M. nasuta* and *N. virens* exposed to the test treatments relative to tissues exposed to the reference sediment. The matrix in Figure 4.2 presents the results of these evaluations.

Panama City Harbor test treatments resulted in elevated levels of all the contaminants of concern relative to the reference sediment. There was no acute toxicity to water column organisms and contaminant concentrations in SPP samples did not exceed WQC; therefore, the Panama City Harbor sediments meet water column criteria for ocean disposal. According to the 1991 *Implementation Manuals*, a proposed dredging area fails to meet the deposited sediment (solid-phase) criteria for ocean disposal if there is 1) statistically significant acute toxicity relative to reference and 2) a >10% difference (>20% for amphipods) between the test treatment and reference. Following these criteria, test treatment PC-2 does not comply with the deposited sediment criteria due to the acute toxicity to *R. abronius*. However, the acute toxicity of test treatment PC-2 was not statistically significantly different for either the *A. abdita* or *N. virens* acute toxicity tests. Compliance criteria for bioaccumulation are not as well-defined as for water column effects or deposited sediment toxicity. Figure 4.2 lists contaminants showing statistically

significant bioaccumulation, the number of compounds that were bioaccumulated, the number of species that bioaccumulated a compound, and the degree or magnitude of bioaccumulation relative to the reference treatment. A summary of the bioaccumulation information (Figure 4.2) is included to assist the USACE and other resource agencies in providing a regional evaluation of dredged disposal material from Panama City Harbor.

Sediment Chemistry		Acute Toxicity		Significant Bioaccumulation: Numbers of Compounds at Various Magnitudes of Difference from Reference																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
				Any Significant Bioaccumulation								Bioaccumulation >2.5 times Reference								Bioaccumulation >5.5 to 10 times Reference								Bioaccumulation >10 times Reference																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
SEDIMENT TREATMENT	Sediment LPAH > Reference						Sediment HPAH > Reference						Sediment Phenol and Phthalate > Reference						Sediment Pesticide and PCB > Reference						Sediment Metals > Reference						Sediment Butyltin > Reference						Sediments with Solid-Phase Acute Toxicity		Sediments associated with SPP toxicity																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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R Acute Toxicity in the *R. abronius* 10-day

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

FIGURE 4.2. Matrix of Sediment Chemistry, Significant Acute Toxicity, and Bioaccumulation for Panama City Harbor Sediments Relative to the Reference Sediment

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APPENDIX A

FIELD SAMPLING DATA

TABLE A.1. Field Collection Summary for the Test, Reference, and Control Sediment Treatments, Panama City Harbor Project

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Water Depth (ft)</u>
PC-1	30° 08' 03.4" N	085° 37' 37.4" W	-30
PC-1A	30° 07' 54.6" N	085° 37' 44.4" W	-32
PC-2	30° 07' 46.2" N	085° 38' 01.9" W	-33
PC-3	30° 08' 38.1" N	085° 39' 58.7" W	-32
PC-4	30° 09' 31.6" N	085° 42' 28.3" W	-34
PC-5	30° 10' 30.3" N	085° 43' 44.1" W	-27
Reference	30° 05' 50.3" N	085° 40' 06.6" W	-14
<i>A. abdita</i> Control	San Pablo Bay, California		
<i>R. abronius</i> Control	West Beach, Whidbey Island, Washington		
<i>M. nasuta</i> Control	Sequim Bay, Washington		
<i>N. virens</i> Control	Newcastle, Maine		

APPENDIX B

SEDIMENT CHEMISTRY AND QUALITY ASSURANCE DATA

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Grain Size and Total Solids
LABORATORY: Soil Technology, Bainbridge Island, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Plumb 1981	NA	NA	≤20%	1.0%

HOLDING TIMES All samples were analyzed within the specified 6-month holding period.

DETECTION LIMITS The detection limit of 1.0% for both grain size and total solids analysis was met for all samples.

METHOD BLANKS NA

MATRIX SPIKES NA

SRMs NA

REPLICATES The requirement of triplicate analysis for every 10 samples was met. The relative standard deviation (RSD) between triplicates was performed on all 16 grain size fractions and the total gravel, sand, silt, and clay fractions. For the total gravel, sand, silt, and clay fractions, the RSDs ranged from 0% to 3% indicating excellent precision. Four of the 16 size fraction RSDs were outside the ≤20% limit because comparison of small values tends to exaggerate the RSD value. The RSD between triplicates for the total solids analysis was 0%, which is within the QA/QC limits. Overall, RSDs for grain size and total solids indicate acceptable precision of the methods.

SURROGATES NA

ADDITIONAL INFORMATION All samples were corrected for salt interference.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Specific Gravity
LABORATORY: Soil Technology, Bainbridge Island, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
ASTM (1991) D-854	NA	NA	≤20%	NA
HOLDING TIMES	All samples were analyzed within the specified 6-month holding period.			
DETECTION LIMITS	NA			
METHOD BLANKS	NA			
MATRIX SPIKES	NA			
SRMs	NA			
REPLICATES	The requirement of triplicate analysis for every 10 samples was met. Precision was measured by Relative Standard Deviation (RSD) between replicates. The RSD between triplicates was 2%, which is within the 20% established limit.			
SURROGATES	NA			

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Total Organic Carbon
LABORATORY: Global Geochemistry Corporation, Canoga Park, California
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
SW846 EPA 9060 (1986a)	NA	≤20%	≤10%	0.1%

HOLDING TIMES All samples were analyzed within the specified 6-month holding period.

DETECTION LIMITS The detection limit of 0.1% was met for all samples.

METHOD BLANKS The method blanks that were analyzed had concentrations of 0.004% and 0.012%. Because these are less than the detection limit, no blank correction is required.

MATRIX SPIKES NA

SRMs The standard reference material (SRM) MESS-1, obtained from the National Research Council of Canada (NRCC), was analyzed with the sediment samples. The SRM had a concentration of 2.75 which is within 20% of the consensus value.

REPLICATES Precision between triplicates was measured by Relative Standard Deviation (RSD). The RSD was 5%, which is within the 10% value established in the QA plan.

SURROGATES NA

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Total Sulfides and Cyanide
LABORATORY: Analytical Resources Incorporated, Seattle, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Total Sulfides	Plumb 1981	NA	NA	≤30%	0.2 mg/kg
Cyanide	EPA 335.2 (1979)	NA	NA	≤20%	1.0 mg/kg

HOLDING TIMES All samples were analyzed within the specified 28-day holding period.

DETECTION LIMITS The achieved detection limit for the total sulfide analysis was 1.25 mg/kg. Because concentrations in the samples were all well above the achieved detection limit, no corrective action was taken. The achieved detection limit for cyanide was 0.1 mg/kg, which is below the target detection limit.

METHOD BLANKS The concentrations of total sulfide and cyanide measured in the method blank were less than the target detection limit; therefore, the data are acceptable.

MATRIX SPIKES Because matrix spikes were not required for this project; no data quality objectives were established. Analytical Resources Incorporated analyzed matrix spikes for both total sulfides and cyanide, and the data are reported in Appendix B. The percent recoveries were 83% for the matrix spike sample analyzed for total sulfides and 95% for the matrix spike sample analyzed for cyanide.

SRMs NA

REPLICATES The relative standard deviation (RSD) between triplicates for total sulfide analysis was within the established QC limits. Precision between triplicates (RSD) for cyanide analysis could not be determined because all replicates were undetected.

SURROGATES NA

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Ammonia
LABORATORY: University of Washington, Seattle, Washington
MATRIX: Sediment Porewater

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Whitledge et al. 1981	NA	NA	≤30%	0.01 mg/L

HOLDING TIMES The samples were analyzed within the specified 28-day holding period.

DETECTION LIMITS The achieved detection limit for the ammonia analysis was 0.04 mg/L. The concentrations in the samples were all well above the achieved detection limit; therefore, no corrective action was taken.

METHOD BLANKS The concentration of ammonia in the method blank was undetected at a value slightly greater than the target detection limit. The concentrations in the samples were well above the target and achieved detection limits; therefore, no corrective action was taken.

MATRIX SPIKES NA

SRMs NA

REPLICATES The Relative Standard Deviation (RSD) between triplicates was 0.2%, which was within the established QC limits.

SURROGATES NA

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs), Phenol, Substituted Phenols, and Phthalate Esters
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
PAHs	EPA Method 8270 (1986a)	40-120%	≤30%	≤30%	30 µg/kg
Phenol and Substituted Phenols	EPA Method 8270	40-120%	≤30%	≤30%	330 µg/kg
Phthalate Esters	EPA Method 8270	40-120%	≤30%	≤30%	100 µg/kg

HOLDING TIMES All samples were extracted within the 14-day holding period and analyzed within 30 days of extraction.

DETECTION LIMITS The achieved detection limits for the samples analyzed for PAHs were all below the target detection limits. The achieved detection limits for phenol, substituted phenols, and phthalate esters were slightly elevated above the target detection limits set in the QA/QC plan. These elevations do not present a problem because all but one analyte was either undetected or detected below the method detection limit.

METHOD BLANKS The method blank analyzed with the samples was free of contamination, with the exception of naphthalene that was present at <2 times the method detection limit. The data associated with this sample was flagged with a "B."

MATRIX SPIKES The matrix spike recoveries for the low and high PAH compounds and the phthalate esters were all within the 40-120% range. Four of the 11 phenol and substituted phenol compounds had matrix spike recoveries that were out of range. The phenol and substituted phenols were outside the recovery range in the matrix spike samples due to high levels of phenol naturally present in the background sample.

SRMs The percent differences of certified PAHs in the sediment SRM are acceptable, with the exception of two PAHs [benzo(a)pyrene (34%) and benzo(g,h,i)perylene (41%)] which were above the accuracy limit of ≤30%.

REPLICATES

Precision was measured by relative standard deviation (RSD) between triplicates. Three of the eight low PAHs had RSDs that were outside the 30% range. All but one high PAH (fluoranthene) had RSDs outside the 30% range. Two of the six phthalate esters were out of range. No phenol or substituted phenols were detected in any of the replicates; therefore, no RSD values were calculated. In general, levels of the compound which exceeded the RSD limit were relatively low. Comparisons of low values tend to exaggerate the RSD values.

SURROGATES

Four surrogate compounds were analyzed with the samples: 2-fluorophenol, naphthalene-d₈, acenaphthene-d₁₀, and benzo(a)pyrene-d₁₂. The recoveries of the surrogate internal standard (SIS) compounds were acceptable with the exception of 2-fluorophenol with a range of 3% to 54%.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs)
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
EPA Method 8080 (1986a)	40-120%	NA	≤30%	10 - 30 µg/kg

HOLDING TIMES All samples were extracted within the specified 14-day holding period and analyzed within 30 days of extraction.

DETECTION LIMITS The detection limit of 10 µg/kg or 20 µg/kg was met for all the associated pesticides. Chlordane and toxaphene detection limits were elevated above the target detection limit of 30 µg/kg, but all samples were undetected above the detection limit. All the PCBs analyzed had achieved detection limits that were above the target detection limits.

METHOD BLANKS One method blank was analyzed with the samples. No pesticides were detected, indicating that the procedural blank is free of contamination.

MATRIX SPIKES Five of the 18 matrix spike recoveries were elevated above the target range of recovery (40-120%). These five recoveries ranged from 122% to 183%, due to coelution of PCB congeners present in Aroclor 1254.

SRMs Certified concentrations of target pesticides are not available for the sediment SRM; consequently, no pesticide/PCB data are submitted for the SRM.

REPLICATES Precision was measured by relative standard deviation (RSD) between triplicates. RSDs could be calculated only on the three pesticides and one PCB with detected values in all replicates. RSDs ranged from 6% to 16%, which is well within the 30% established limit.

SURROGATES Surrogate percent recoveries for DBOFB and CL₅(112) ranged between 62% and 120%, which were within the 40-120% acceptable recovery range.

NA Not applicable.

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QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Aluminum	ICP/MS (EPA 1990b)	75-125	≤30%	≤20%	5.0
Antimony	ICP/MS	75-125	≤30%	≤20%	0.1
Arsenic	ICP/MS	75-125	≤30%	≤20%	0.1
Beryllium	ICP/MS	75-125	≤30%	≤20%	0.2
Cadmium	ICP/MS	75-125	≤30%	≤20%	0.1
Chromium	ICP/MS	75-125	≤30%	≤20%	0.6
Copper	ICP/MS	75-125	≤30%	≤20%	0.1
Lead	ICP/MS	75-125	≤30%	≤20%	0.1
Mercury	CVAA (Bloom et al. 1984)	75-125	≤30%	≤20%	0.01
Nickel	ICP/MS	75-125	≤30%	≤20%	0.1
Selenium	ICP/MS	75-125	≤30%	≤20%	0.2
Silver	ICP/MS	75-125	≤30%	≤20%	0.1
Thallium	ICP/MS	75-125	≤30%	≤20%	0.1
Zinc	ICP/MS	75-125	≤30%	≤20%	0.3

HOLDING TIMES All samples analyzed for metals, except Hg, were digested and analyzed within the specified 6-month holding period. All Hg samples were digested and analyzed within a holding time of 28 days.

DETECTION LIMITS The achieved detection limits for all the metals were below the target detection limit.

METHOD BLANKS Low levels of Al, Cr, Pb, Hg, and Ni were detected in the method blank. The data associated with these blanks were corrected for the amount in the method blank; therefore, no corrective action was taken.

MATRIX SPIKES All matrix spike recoveries were within the criteria of 75-125%, except for Ag (72%), Se (61%), and Sb (44%).

SRMs The standard reference material (SRM) 1646-1 was analyzed for all the metals except mercury (SRM 1646-2). The values were all within the 30% limit set in the QA plan.

REPLICATES Precision between triplicates was measured by Relative Standard Deviation (RSD). Five (Ag, Be, Cu, Pb, and Se) of the 11 RSD calculations were out of the 20% range established as a data quality objective. All RSD exceedences, except for Pb, were due to the comparison of small values which tends to exaggerate RSD values.

SURROGATES

NA

**ADDITIONAL
INFORMATION**

The metals Cd, Se, and Ag were analyzed by ICP/MS, and not by GFAA as required in the QA Plan, because of acceptable ICP/MS Quality Control (QC) data (matrix spike recoveries, RSDs, acceptable detection limits, and non-contaminated blanks). In the case of Cd, the recovery of the SRM was also acceptable.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

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

HOLDING TIMES All samples were analyzed within the specified 14-day holding period.

DETECTION LIMITS The detection limit of 10 µg/kg was met for all samples.

METHOD BLANKS No butyltins were detected in the method blank, indicating that the blank was free of contamination.

MATRIX SPIKES One sample was spiked with di- and tri- butyltin. Matrix spike recoveries were 116% and 110% for tributyltin and dibutyltin, respectively, and were within the QC limits of 40-120%.

SRMs The standard reference material (SRM) PACS-1 was analyzed with the sediment samples. The SRM concentrations were within the 30% limit except for monobutyltin.

REPLICATES Precision between triplicates was measured by Relative Standard Deviation (RSD). No butyltins were detected; therefore, RSDs were not calculated.

SURROGATES One compound, triphenyltin chloride, is added prior to extraction to assess the efficiency of the method. Recoveries ranged from 57% to 111%, which is within the QC limits of 40-120%.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Dioxins
LABORATORY: Battelle Columbus Operations, Columbus, Ohio
MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
EPA Method 8290 (1990a)	40-120%	NA	≤30%	1.0 ng/kg

HOLDING TIMES All samples were analyzed within the specified 14-day holding period.

DETECTION LIMITS The detection limit of 1.0 ng/kg was met for all samples, except the dioxin congener OCDF that had an achieved detection limit of 1.3 ng/kg. The congener OCDD had an achieved detection limit of <5.0 ng/kg. The detection limit specified in EPA Method 8290 is 5 ng/kg, and not 1.0 ng/kg as specified in the QA Plan.

METHOD BLANKS The method blank that was analyzed was undetected for all the dioxin congeners, except for OCDD that was detected at 2.45 ng/kg. This concentration was due to the mass ratio being out of limits. The concentrations in the samples were all well above the achieved detection limit; therefore, no corrective action was taken.

MATRIX SPIKES Matrix spike recoveries for the dioxin analysis ranged from 65% to 104%, which were within the 40-120% acceptable range.

SRMs NA

REPLICATES Precision was measured by Relative Percent Difference (RPD) and I-STAT measurements between the percent recoveries of the matrix spike and matrix spike duplicate samples. All RPD values ranged from 1% to 12%, which were well within the acceptable 30% limit.

SURROGATES Fifteen labeled compounds and one clean-up standard were spiked into the sediment samples to assess the surrogate percent recovery of the compounds. Seventeen of the 80 surrogate percent recoveries were outside the targeted 40-120% range. All but one of the surrogate percent recoveries for PC-1 were outside the 40-120% range. These percent recoveries ranged from 19% to 39%.

NA Not applicable.

TABLE B.1. Summary of Grain Size Analysis of Sediment and Quality Control Data, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Gravel >2000 μm</u>	<u>Sand 62.5-2000 μm</u>	<u>Silt 3.9-62.5 μm</u>	<u>Clay <3.9 μm</u>
PC-1	4	78	5	13
PC-1A	4	83	3	10
PC-2 Replicate 1	1	63	14	22
PC-2 Replicate 2	1	63	14	22
PC-2 Replicate 3	1	62	14	23
PC-3	19	79	0	2
PC-4	1	86	4	9
PC-5	1	85	5	9
Reference	0	96	1	3

Quality Control Data

Analytical Replicates

PC-2 Replicate 1	1	63	14	22
PC-2 Replicate 2	1	63	14	22
PC-2 Replicate 3	1	62	14	23
RSD	0%	1%	0%	3%

TABLE B.2. Grain Size Analysis of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	phi μm >3350	Percent in Size Fraction (dry weight)																
		3350- 2000	2000- 1000	1000- 250	250- 125	125- 62.5	62.5- 48	48- 31.2	4.5 31.2	5 23	5.5 15.6	6 15.6	7 3.9	8 1.9	9 0.9	10 0.4	11 <0.4	
PC-1	3	1	3	40	28	7	1	0	0	0	1	2	1	2	3	2	6	
PC-1A	1	3	13	45	20	5	0	1	0	0	0	1	1	1	2	2	5	
PC-2 Replicate 1	0	1	3	20	24	16	1	1	2	2	2	4	4	3	4	3	12	
PC-2 Replicate 2	0	1	4	20	23	16	2	1	2	2	2	4	3	4	4	3	11	
PC-2 Replicate 3	0	1	3	20	23	16	1	2	1	3	3	4	3	3	5	3	12	
PC-3(a)	7	12	25	39	14	1	0	0	0	0	0	0	0	0	1	0	1	
PC-4	0	1	2	41	38	5	1	0	1	0	0	1	1	2	2	2	4	
PC-5	1	0	0	28	49	8	1	0	1	0	0	2	1	1	1	1	5	
Reference	0	0	1	56	36	3	1	0	0	0	0	0	0	0	1	0	2	

(a) Sediment collected from station PC-3 was analyzed for grain size and specific gravity only.

**TABLE B.3. Quality Control Summary for Grain Size Analysis in Sediment, Dry Weight,
Panama City Harbor Project**

Sediment Treatment	phi µm	Percent in Size Fraction (dry weight)													
		4	4.5	5	5.5	6	7	8	9	10	11				
	>3350	62.5- 48	62.5- 48	31.2- 23	23.0- 15.6	15.6- 7.8	7.8- 3.9	3.9- 1.9	1.9- 0.9	0.9- 0.4	<0.4				
Analytical Replicates															
PC-2 Replicate 1	0	1	1	1	2	4	4	3	4	3	12				
PC-2 Replicate 2	0	1	2	1	2	4	3	4	4	3	11				
PC-2 Replicate 3	0	1	1	2	1	4	3	3	5	3	12				
RSD	0%	0%	43%(a)	43%(a)	35%(a)	0%	17%	17%	13%	0%	5%				

(a) Value exceeds relative precision range of ≤20%.

TABLE B.4. Specific Gravity, Total Solids and Total Organic Carbons (TOC)
Analysis of Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Specific Gravity</u>	<u>TOC (percent)</u>	<u>Total Solids (percent)</u>
Target DL ^(a)	NA ^(b)	0.1	1.0
Achieved DL	NA	0.1	1.0
PC-1	2.66	1.06	58
PC-1A	2.66	0.75	68
PC-2 Replicate 1	2.74	2.14	38
PC-2 Replicate 2	2.65	NA	38
PC-2 Replicate 3	2.70	NA	38
PC-3 ^(c)	2.76	NA	76
PC-4	2.71	0.72	68
PC-5	2.59	0.33	57
Reference Replicate 1	2.66	0.11	78
Reference Replicate 2	NA	0.12	NA
Reference Replicate 3	NA	0.11	NA

(a) DL Detection limit.

(b) NA Not applicable.

(c) Sediment collected from station PC-3 was analyzed for grain size and specific gravity only.

TABLE B.5. Quality Control Summary for Specific Gravity, Total Solids and Total Organic Carbons (TOC) in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Specific Gravity</u>	<u>TOC (percent)</u>	<u>Total Solids (percent)</u>
<u>Method Blanks</u>			
Blank	NA ^(a)	0.004	NA
Blank	NA	0.012	NA
<u>Standard Reference Materials</u>			
Consensus Value	NC ^(b)	2.6 ±0.2	NC
MESS-1	NA	2.75	NA
<u>Analytical Replicates</u>			
PC-2 Replicate 1	2.74	2.14	38
PC-2 Replicate 2	2.65	NA	38
PC-2 Replicate 3	2.70	NA	38
RSD	2%	NA	0%
Reference Replicate 1	2.66	0.11	78
Reference Replicate 2	NA	0.12	NA
Reference Replicate 3	NA	0.11	NA
RSD	NA	5%	NA

(a) NA Not applicable.

(b) NC Not certified.

TABLE B.6. Cyanide and Total Sulfides Analysis of Sediment, Dry Weight,
Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Cyanide mg/kg</u>	<u>Total Sulfides mg/kg</u>
Target DL ^(a)	1.0	0.2
Achieved DL	0.1	1.25
PC-1 Replicate 1	0.177 U ^(b)	28.3
PC-1 Replicate 2	NA ^(c)	29.8
PC-1 Replicate 3	NA	43.7
PC-1A	0.142 U	67.4
PC-2	0.272 U	295
PC-4 Replicate 1	0.149 U	92.0
PC-4 Replicate 2	0.151 U	NA
PC-4 Replicate 3	0.150 U	NA
PC-5	0.172 U	122
Reference	0.120 U	2.0 U

(a) DL Detection limit.

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

(c) NA Not applicable.

**TABLE B.7. Quality Control Summary for Cyanide and Total Sulfide
Analysis in Sediment, Dry Weight, Panama City Harbor Project**

<u>Sediment Treatment</u>	<u>Cyanide mg/kg</u>	<u>Total Sulfide mg/kg</u>
<u>Method Blank</u>		
Blank	0.1 U ^(a)	1.25 U
<u>Matrix Spikes</u>		
PC-4 Replicate 1	0.149 U	92.0
PC-4 MS	103	NA ^(b)
Concentration Recovered	103	NA
Amount Spiked	109	NS ^(c)
Percent Recovery	95%	NA
PC-1 Replicate 1	0.177 U	28.3
PC-1 MS	NA	474
Concentration Recovered	NA	445.7
Amount Spiked	NS	537
Percent Recovery	NA	83%
<u>Analytical Replicates</u>		
PC-1 Replicate 1	0.177 U	28.3
PC-1 Replicate 2	NA	29.8
PC-1 Replicate 3	NA	43.7
RSD	NA	25%
PC-4 Replicate 1	0.149 U	92.0
PC-4 Replicate 2	0.151 U	NA
PC-4 Replicate 3	0.150 U	NA
RSD	NA	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

TABLE B.8. Ammonia Analysis of Sediment Porewater, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>NH₄ Ammonium (mg/L)</u>	<u>NH₃-N Ammonia (mg/L)</u>
Target DL ^(a)	NA ^(b)	0.01
Achieved DL	NA	0.04
PC-1	2.39	1.86
PC-1A	2.67	2.08
PC-2	6.34	4.93
PC-4 Replicate 1	3.56	2.77
PC-4 Replicate 2	3.56	2.77
PC-4 Replicate 3	3.58	2.78
PC-5	5.66	4.40
Reference	6.76	5.26

(a) DL Detection limit.

(b) NA Not applicable.

TABLE B.9. Quality Control Summary for Ammonia Analysis of Sediment Porewater, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>NH₄ Ammonium (mg/L)</u>	<u>NH₃-N Ammonia (mg/L)</u>
<u>Method Blank</u>		
Blank	NA ^(a)	0.04 U ^(b)
<u>Analytical Replicates</u>		
PC-4 Replicate 1	3.56	2.77
PC-4 Replicate 2	3.56	2.77
PC-4 Replicate 3	3.58	2.78
RSD	0.3%	0.2%

(a) NA Not applicable.

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

TABLE B.10. Total Polynuclear Aromatic Hydrocarbons (PAH) Analysis of Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
PC-1 Replicate 1	131.27	310.47	441.74
PC-1 Replicate 2	96.83	273.98	370.81
PC-1 Replicate 3	113.70	767.47	881.17
PC-1A	55.98	181.51	237.49
PC-2	164.73	365.39	530.12
PC-4	19.45	70.84	90.29
PC-5	87.03	932.80	1019.83
Reference	4.71	5.83	10.54

TABLE B.11. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAH) Analysis of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	LPAH ($\mu\text{g/kg}$ dry weight)							
	Naphthalene	2-Methylnaphthalene	1-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Target DL (a)	30	30	30	30	30	30	30	30
Achieved DL Low	0.77	1.40	1.40	2.19	1.69	1.34	2.27	2.12
Achieved DL High	1.48	2.70	2.70	4.23	3.25	2.58	4.37	4.09
PC-1 Replicate 1	29.69 B ^(b)	14.69	7.77	4.58	6.75	7.30	48.13	12.36
PC-1 Replicate 2	25.14 B	13.79	6.62	5.16	3.83	5.55	24.80	11.94
PC-1 Replicate 3	23.55 B	14.04	7.33	8.26	3.65	5.49	35.15	16.23
PC-1A	14.59 B	6.16	3.00	6.15	1.69 J ^(c)	2.35	12.34	9.70
PC-2	67.29 B	12.72	6.60	14.21	3.78	5.04	33.11	21.98
PC-4	5.79 B	1.91	1.04 J	1.74 J	0.48 J	0.84 J	4.37	3.28
PC-5	5.10 B	2.39	1.25 J	22.54	2.41	3.47	18.60	31.27
Reference	2.07 B	0.86 J	0.51 J	0.21 J	1.69 U ^(d)	1.34 U	0.72 J	0.34 J

(a) DL Detection limit.

(b) B Analyte found in the procedural blank; results presented are not corrected for the amount in the blank.

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

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

TABLE B.12. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAH) Analysis of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	HPAH ($\mu\text{g}/\text{kg}$ 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,d]pyrene	Dibenzo[a,h]anthracene	Benzo[g,h,i]perylene
Target DL (a)	30	30	30	30	30	30	30	30	30	30
Achieved DL Low	4.36	3.89	2.40	2.96	2.26	2.69	1.60	3.81	2.23	4.13
Achieved DL High	8.39	7.50	4.62	5.69	4.35	5.17	3.08	7.33	4.30	7.95
PC-1 Replicate 1	64.59	63.82	22.52	25.35	38.11	22.99	23.88	19.07	7.20	22.94
PC-1 Replicate 2	40.48	46.14	19.44	16.57	47.52	49.10	18.29	17.01	3.57	15.86
PC-1 Replicate 3	62.92	268.99	44.60	38.38	78.57	36.18	116.22	33.11	17.70	70.80
PC-1A	24.22	22.09	16.68	14.21	28.09	17.65	25.23	13.85	4.44	15.05
PC-2	60.76	58.25	31.55	28.83	57.64	30.00	35.32	29.83	6.79	26.42
PC-4	10.03	8.61	5.64	6.69	12.61	7.72	6.61	5.95	1.60 J(b)	5.38
PC-5	51.38	62.48	59.23	113.89	213.43	139.08	145.72	80.37	17.99	49.23
Reference	0.98 J	0.92 J	0.36 J	0.47 J	0.76 J	0.46 J	0.39 J	0.56 J	0.30 J	0.63 J

(a) DL Detection limit.

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

TABLE B.13. Quality Control Summary for Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAH) Analysis in Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	LPAH ($\mu\text{g/kg}$ dry weight)							
	Naphthalene	2-Methylnaphthalene	1-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
<u>Method Blank</u>								
Blank	1.77 B ^(a)	0.70 J ^(b)	1.77 U ^(c)	2.81 U	2.16 U	1.71 U	2.91 U	2.72 U
<u>Matrix Spike</u>								
Reference	2.07 B	0.86 J ^(d)	0.51 J	0.21 J	1.69 U	1.34 U	0.72 J	0.34 J
Reference MS	84.78	NA	NA	80.48	81.17	87.44	92.96	87.44
Concentration Recovered	82.71	NA	NA	80.27	81.17	87.44	92.24	87.10
Amount Spiked	84.32	NS ^(e)	NS	84.32	84.32	84.32	84.32	84.32
Percent Recovery	98%	NA	NA	95%	96%	104%	109%	103%
<u>Standard Reference Material</u>								
Certified Value	NC ^(f)	NC	NC	NC	NC	NC	577 $\pm$ 59	202 $\pm$ 42
NIST 1941	NA	NA	NA	NA	NA	NA	594.66	191.24
<u>Analytical Replicates</u>								
PC-1 Replicate 1	29.69 B	14.69	7.77	4.58	6.75	7.30	48.13	12.36
PC-1 Replicate 2	25.14 B	13.79	6.62	5.16	3.83	5.55	24.80	11.94
PC-1 Replicate 3	23.55 B	14.04	7.33	8.26 ^(g)	3.65 ^(g)	5.49	35.15 ^(g)	16.23
RSD	12%	3%	8%	33%	37%	17%	32%	18%

- (a) B Analyte found in the procedural blank; results presented are not corrected for the amount in the blank.
(b) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
(c) U Analyte was not present above the associated value.
(d) NA Not applicable.
(e) NS Not spiked.
(f) NC Not certified.
(g) Value exceeds relative precision range of $\leq 30\%$.

TABLE B.14. Quality Control Summary for High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAH) Analysis in Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	HPAH ($\mu\text{g}/\text{kg}$ 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,d]pyrene	Dibenzo[a,h]anthracene	Benzo[g,h,i]perylene
Method Blank										
Blank	0.17 J ^(a)	0.49 J	3.07 U ^(b)	3.79 U	2.89 U	3.44 U	2.05 U	4.87 U	2.86 U	5.28 U
Matrix Spike										
Reference	0.98 J	0.92 J	0.36 J	0.47 J	0.76 J	0.46 J	0.39 J	0.56 J	0.30 J	0.63 J
Reference MS	98.29	93.84	82.44	83.57	84.80	83.27	74.49	74.56	73.59	79.03
Concentration Recovered	97.31	92.92	82.08	83.10	84.04	82.81	74.10	74.09	73.29	78.40
Amount Spiked	84.32	84.32	84.32	84.32	84.32	84.32	84.32	84.32	84.32	84.32
Percent Recovery	115%	110%	97%	99%	100%	98%	88%	88%	87%	93%
Standard Reference Material										
Certified Value	1220 ± 240	1080 ± 200	550 ± 79	NC ^(c)	780 ± 190	444 ± 49	670 ± 130	569 ± 40	NC	516 ± 83
NIST 1941	1263.14	1089.2	474.77	NA ^(d)	867.24	566.59	440.92 ^(e)	505.23	NA	307.00 ^(e)
Analytical Replicates										
PC-1 Replicate 1	64.59	63.82	22.52	25.35	38.11	22.99	23.88	19.07	7.20	22.94
PC-1 Replicate 2	40.48	46.14	19.44	16.57	47.52	49.10	18.29	17.01	3.57	15.86
PC-1 Replicate 3	62.92	268.99 ^(f)	44.60	38.38 ^(f)	78.57 ^(f)	36.18 ^(f)	116.22 ^(f)	33.11 ^(f)	17.70 ^(f)	70.80 ^(f)
RSD	24%	98%	48%	41%	39%	36%	104%	38%	77%	82%

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

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

(c) NC Not certified.

(d) NA Not applicable.

(e) Value exceeds SRM goal of $\leq 30\%$.

(f) Value exceeds relative precision range of $\leq 30\%$.

TABLE B.15. Phenols and Substituted Phenol Analysis of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Phenols ($\mu\text{g/kg}$ dry weight)										
	Phenol	2-chloro-phenol	2-nitro-phenol	2,4-di-methyl phenol	2,4-dichloro-phenol	Para-chloro-meta-cresol	2,4,6-tri-chloro-phenol	2,4-dinitro-phenol	4-nitro-phenol	4,6-dinitro-o-cresol	Penta-chloro-phenol
Target DL (a)	330	330	330	330	330	330	330	330	330	330	330
Achieved DL Low	312.72	312.72	312.72	312.72	312.72	312.72	312.72	312.72	312.72	312.72	312.72
Achieved DL High	602.06	602.06	602.06	602.06	602.06	602.06	602.06	602.06	602.06	602.06	602.06
PC-1 Replicate 1	2785.40	424.93 U ^(b)	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	22.99 J ^(c)
PC-1 Replicate 2	422.61 U	3.40 J	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U
PC-1 Replicate 3	128.90 J	3.85 J	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	4.01 J
PC-1A	130.26 J	362.16 U	362.16 U	362.16 U	362.16 U	362.16 U	362.16 U	362.16 U	362.16 U	362.16 U	1.70 J
PC-2	159.37 J	602.06 U	602.06 U	602.06 U	602.06 U	602.06 U	602.06 U	602.06 U	602.06 U	602.06 U	4.37 J
PC-4	368.95 J	377.32 U	377.32 U	377.32 U	377.32 U	377.32 U	377.32 U	377.32 U	377.32 U	377.32 U	6.55 J
PC-5	94.35 J	380.17 U	380.17 U	380.17 U	380.17 U	380.17 U	380.17 U	380.17 U	380.17 U	380.17 U	380.17 U
Reference	1002.93	21.58 J	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U

(a) DL Detection limit.

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

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

TABLE B.16. Quality Control Summary for Phenols and Substituted Phenol Analysis in Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Phenols ($\mu\text{g/kg}$ dry weight)									
	Phenol	2-chloro-phenol	2-nitro-phenol	2,4-di-methyl phenol	2,4-dichloro-phenol	Para-chloro-meta-cresol	2,4,6-tri-chloro-phenol	2,4-dinitro-phenol	4-nitro-phenol	4,6-dinitro-cresol
Method Blank										
Blank	400.25 U ^(a)	400.25 U	400.25 U	400.25 U	400.25 U	400.25 U	400.25 U	400.25 U	400.25 U	400.25 U
Matrix Spike										
Reference	1002.93	21.58 J ^(b)	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U	312.72 U
Reference MS	2389.17	1633.12	1069.82	96.74	889.77	773.45	495.41	920.60	827.58	1231.57
Concentration Recovered	1386.24	1611.54	1069.82	96.74	889.77	773.45	495.41	920.60	827.58	1231.57
Amount Spiked	1054.05	1054.05	1054.05	1054.05	1054.05	1054.05	1086.31	1076.19	1054.05	1054.05
Percent Recovery	132% ^(c)	153% ^(c)	101%	9% ^(c)	84%	73%	46%	86%	79%	117%
Analytical Replicates										
PC-1 Replicate 1	2785.40	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U	424.93 U
PC-1 Replicate 2	422.61 U	3.40 J	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U	422.61 U
PC-1 Replicate 3	128.90 J ^(d)	3.85 J	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U	422.37 U
RSD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) U Analyte was not present above 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) NA Not applicable.

TABLE B.17. Phthalate Ester Analysis of Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Phthalates (µg/kg dry weight)</u>					
	<u>Dimethyl phthalate</u>	<u>Diethyl phthalate</u>	<u>Di-n-butyl phthalate</u>	<u>Butyl benzyl phthalate</u>	<u>Bis (2-ethylhexyl) phthalate</u>	<u>Di-n-octyl phthalate</u>
Target DL (a)	100	100	100	100	100	100
Achieved DL Low	62.54	62.54	62.54	62.54	62.54	62.54
Achieved DL High	120.41	120.41	120.41	120.41	120.41	120.41
PC-1 Replicate 1	84.99 U ^(b)	21.06 J ^(c)	6.60 J	5.65 J	27.42 J	1.81 J
PC-1 Replicate 2	84.52 U	66.16 J	1.95 J	1.59 J	18.37 J	2.00 J
PC-1 Replicate 3	84.47 U	39.16 J	2.77 J	84.47 U	18.93 J	1.92 J
PC-1A	72.43 U	32.54 J	2.10 J	4.60 J	17.55 J	2.29 J
PC-2	120.41 U	56.66 J	120.41 U	14.20 J	62.20 J	120.41 U
PC-4	75.46 U	17.67 J	2.18 J	3.98 J	22.42 J	3.04 J
PC-5	0.99 J	18.79 J	2.75 J	5.45 J	45.30 J	4.46 J
Reference	1.08 J	14.28 J	2.51 J	2.60 J	43.45 J	12.69 J

(a) DL Detection limit.

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

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

TABLE B.18. Quality Control Summary for Phthalate Ester Analysis in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Phthalates ($\mu\text{g}/\text{kg}$ dry weight)</u>					
	<u>Dimethyl phthalate</u>	<u>Diethyl phthalate</u>	<u>Di-n-butyl phthalate</u>	<u>Butyl benzyl phthalate</u>	<u>Bis (2-ethylhexyl) phthalate</u>	<u>Di-n-octyl phthalate</u>
<u>Method Blank</u>						
Blank	80.05 U ^(a)	18.02 J ^(b)	1.18 J	1.74 J	5.87 J	0.26 J
<u>Matrix Spike</u>						
Reference	1.08 J	14.28 J	2.51 J	2.60 J	43.45 J	12.69 J
Reference MS	1083.75	1184.72	1095.48	1150.39	1210.98	991.20
Concentration Recovered	1082.67	1150.44	1092.97	1147.79	1167.53	978.51
Amount Spiked	1054.05	1081.04	1054.05	1054.05	1054.05	1054.05
Percent Recovery	103%	106%	104%	109%	111%	93%
<u>Analytical Replicates</u>						
PC-1 Replicate 1	84.99 U	21.06 J	6.60 J	5.65 J	27.42 J	1.81 J
PC-1 Replicate 2	84.52 U	66.16 J	1.95 J	1.59 J	18.37 J	2.00 J
PC-1 Replicate 3	84.47 U	39.16 J	2.77 J	84.47 U	18.93 J	1.92 J
RSD	NA ^(c)	54% ^(d)	66% ^(d)	NA	24%	5%

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

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

(c) NA Not applicable.

(d) Value exceeds relative precision range of $\leq 30\%$.

TABLE B.19. Surrogate Recoveries and Quality Control Data for Polynuclear Aromatic Hydrocarbons (PAH), Phenols, and Phthalate Ester in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Surrogate Percent Recovery</u>			
	<u>2-fluoro-phenol</u>	<u>Naptha-lene d8</u>	<u>Acenaph-thene d10</u>	<u>Benzo[a]pyrene d12</u>
PC-1 Replicate 1	3 ^(a)	55	74	57
PC-1 Replicate 2	32 ^(a)	59	76	69
PC-1 Replicate 3	32 ^(a)	62	78	75
PC-1A	54	65	82	77
PC-2	35 ^(a)	64	76	68
PC-4	10 ^(a)	57	71	71
PC-5	30 ^(a)	57	70	77
Reference	8 ^(a)	54	70	63
<u>Quality Control Data</u>				
<u>Method Blank</u>				
Blank	48	71	67	45
<u>Matrix Spike</u>				
Reference	8 ^(a)	54	70	63
Reference MS	26 ^(a)	54	71	67
<u>Analytical Replicates</u>				
PC-1 Replicate 1	3 ^(a)	55	74	57
PC-1 Replicate 2	32 ^(a)	59	76	69
PC-1 Replicate 3	32 ^(a)	62	78	75
RSD	75% ^(b)	6%	3%	14%

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

(b) Value exceeds relative precision range of $\leq 30\%$.

TABLE B.20. Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4'-DDT) of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)							
	Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta-BHC	Dieldrin	4,4'-DDD	4,4'-DDE
Target DL (a)	10	10	10	30	10	10	10	10
Achieved DL High	1.293	0.618	0.618	62.095	0.618	1.239	1.816	0.790
Achieved DL Low	0.671	0.321	0.321	32.253	0.321	0.644	0.943	0.411
PC-1 Replicate 1	0.912 U ^(b)	0.436 U	0.436 U	43.826 U	0.436 U	0.875 U	8.860	2.258
PC-1 Replicate 2	0.907 U	0.433 U	0.433 U	43.587 U	0.433 U	0.870 U	7.893	2.479
PC-1 Replicate 3	0.907 U	0.433 U	0.433 U	43.562 U	0.433 U	0.869 U	8.589	2.518
PC-1A	0.777 U	0.371 U	0.371 U	37.352 U	0.371 U	0.745 U	2.220	0.998
PC-2	1.293 U	0.618 U	0.618 U	62.095 U	0.618 U	1.239 U	8.775	3.259
PC-4	0.810 U	0.387 U	0.387 U	38.916 U	0.387 U	0.777 U	0.762 J ^(c)	0.555
PC-5	0.816 U	0.390 U	0.390 U	39.210 U	0.390 U	0.782 U	1.082 J	0.640
Reference	0.671 U	0.321 U	0.321 U	32.253 U	0.321 U	0.644 U	0.545 J	0.411 U

(a) DL Detection limit.

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

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

TABLE B.21. Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene) of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Pesticides ($\mu\text{g/kg}$ dry weight)									
	Endo-sulfan I	Endo-sulfan II	Endo-sulfan sulfate	Endrin	Endrin Aldehyde	Hepta-chlor	Hepta-chlor-epoxide	Lindane	Methoxy-chlor	Toxaphene
Target DL (a)	20	20	20	10	10	20	20	10	20	30
Achieved DL High	6.209	6.209	6.209	3.533	6.209	1.681	1.429	0.618	6.209	62.095
Achieved DL Low	3.225	3.225	3.225	1.835	3.225	0.873	0.742	0.321	3.225	32.253
PC-1 Replicate 1	4.383 U ^(b)	4.383 U	4.383 U	2.494 U	4.383 U	1.187 U	1.009 U	0.436 U	4.383 U	43.826 U
PC-1 Replicate 2	4.359 U	4.359 U	4.359 U	2.480 U	4.359 U	1.180 U	1.003 U	0.433 U	4.359 U	43.587 U
PC-1 Replicate 3	4.356 U	4.356 U	4.356 U	2.479 U	4.356 U	1.179 U	1.003 U	0.433 U	4.356 U	43.562 U
PC-1A	3.735 U	3.735 U	3.735 U	2.125 U	3.735 U	1.011 U	0.860 U	0.371 U	3.735 U	37.352 U
PC-2	6.209 U	6.209 U	6.209 U	3.533 U	6.209 U	1.681 U	1.429 U	0.618 U	6.209 U	62.095 U
PC-4	3.892 U	3.892 U	3.892 U	2.214 U	3.892 U	1.054 U	0.896 U	0.387 U	3.892 U	38.916 U
PC-5	3.921 U	3.921 U	3.921 U	2.231 U	3.921 U	1.062 U	0.902 U	0.390 U	3.921 U	39.210 U
Reference	3.225 U	3.225 U	3.225 U	1.835 U	3.225 U	0.873 U	0.742 U	0.321 U	3.225 U	32.253 U

(a) DL Detection limit.

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

TABLE B.22. Quality Control Summary for Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4'-DDT) in Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Pesticides ($\mu\text{g}/\text{kg}$ dry weight)						
	Aldrin	Alpha-BHC	Beta-BHC	Chlor-dane	Delta-BHC	Dieldrin	4,4'-DDD 4,4'-DDE 4,4'-DDT
Method Blank							
Blank	0.859 U(a)	0.411 U	0.411 U	41.280 U	0.411 U	0.824 U	0.525 U 1.287 U
Matrix Spike							
Reference	0.671 U	0.321 U	0.321 U	32.253 U	0.321 U	0.644 U	0.545 J(b)
Reference MS	6.300	9.873	9.089	NA	11.118	15.444	12.815
Concentration Recovered	6.300	9.873	9.089	NA	11.118	15.444	12.270
Amount Spiked	8.432	8.432	8.875	NS(d)	8.432	8.432	8.788
Percent Recovery	75%	117%	102%	NA	132%(e)	183%(e)	8.437 139%(e)
Analytical Replicates							
PC-1 Replicate 1	0.912 U	0.436 U	0.436 U	43.826 U	0.436 U	0.875 U	2.258
PC-1 Replicate 2	0.907 U	0.433 U	0.433 U	43.587 U	0.433 U	0.870 U	2.479
PC-1 Replicate 3	0.907 U	0.433 U	0.433 U	43.562 U	0.433 U	0.869 U	2.518
RSD	NA	NA	NA	NA	NA	NA	6% 13%

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

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

(c) NA Not applicable.

(d) NS Not spiked.

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

TABLE B.23. Quality Control Summary for Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene) in Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Pesticides ($\mu\text{g/kg}$ dry weight)									
	Endo-sulfan I	Endo-sulfan II	Endo-sulfan-sulfate	Endrin	Endrin Aldehyde	Hepta-chlor	Hepta-chlor-epoxide	Lindane	Methoxy-chlor	Toxaphene
Method Blank										
Blank	4.128 U(a)	4.128 U	4.128 U	2.349 U	4.128 U	1.118 U	0.950 U	0.411 U	4.128 U	41.280 U
Matrix Spike										
Reference	3.225 U	3.225 U	3.225 U	1.835 U	3.225 U	0.873 U	0.742 U	0.321 U	3.225 U	32.253 μg (b)
Reference MS	8.042	10.251	8.860	8.835	7.542	9.574	8.173	9.097	10.14	NA
Concentration Recovered	8.042	10.251	8.860	8.835	7.542	9.574	8.173	9.097	10.14	NA
Amount Spiked	8.432	8.432	8.432	8.631	8.428	8.432	8.437	8.432	8.432	NS (c)
Percent Recovery	95%	122% (d)	105%	102%	89%	114%	97%	108%	120%	NA
Analytical Replicates										
PC-1 Replicate 1	4.383 U	4.383 U	4.383 U	2.494 U	4.383 U	1.187 U	1.009 U	0.436 U	4.383 U	43.826 U
PC-1 Replicate 2	4.359 U	4.359 U	4.359 U	2.480 U	4.359 U	1.180 U	1.003 U	0.433 U	4.359 U	43.587 U
PC-1 Replicate 3	4.356 U	4.356 U	4.356 U	2.479 U	4.356 U	1.179 U	1.003 U	0.433 U	4.356 U	43.562 U
RSD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

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

TABLE B.24. Polychlorinated Biphenyls (PCB) Analysis of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	PCBs ($\mu\text{g}/\text{kg}$ dry weight)					
	Aroclor 1221	Aroclor 1232	Aroclor 1242/1016	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL ^(a)	20	20	20	20	20	20
Achieved DL High	62.095	62.095	62.095	62.095	62.095	62.095
Achieved DL Low	32.253	32.253	32.253	32.253	32.253	32.253
PC-1 Replicate 1	43.826 U ^(b)	43.826 U	43.826 U	43.826 U	38.266 J ^(c)	43.826 U
PC-1 Replicate 2	43.587 U	43.587 U	43.587 U	43.587 U	40.891 J	43.587 U
PC-1 Replicate 3	43.562 U	43.562 U	43.562 U	43.562 U	29.514 J	43.562 U
PC-1A	37.352 U	37.352 U	37.352 U	37.352 U	11.308 J	37.352 U
PC-2	62.095 U	62.095 U	62.095 U	62.095 U	24.158 J	62.095 U
PC-4	38.916 U	38.916 U	38.916 U	38.916 U	38.916 U	38.916 U
PC-5	39.210 U	39.210 U	39.210 U	39.210 U	39.210 U	39.210 U
Reference	32.253 U	32.253 U	32.253 U	32.253 U	32.253 U	32.253 U

(a) DL Detection limit.

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

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

**TABLE B.25. Quality Control Summary for Polychlorinated Biphenyls (PCB)
Analysis of Sediment, Dry Weight, Panama City Harbor Project**

<u>Sediment Treatment</u>	<u>PCBs ($\mu\text{g/kg}$ dry weight)</u>					
	<u>Aroclor 1221</u>	<u>Aroclor 1232</u>	<u>Aroclor 1242/1016</u>	<u>Aroclor 1248</u>	<u>Aroclor 1254</u>	<u>Aroclor 1260</u>
<u>Method Blank</u>						
Blank	41.280 U ^(a)	41.280 U	41.280 U	41.280 U	41.280 U	41.280 U
<u>Matrix Spike</u>						
Reference	32.253 U ^(b)	32.253 U	32.253 U	32.253 U	32.253 U	32.253 U
Reference MS	NA	NA	NA	NA	174.902	NA
Concentration Recovered	NA	NA	NA	NA	174.902	NA
Amount Spiked	NS ^(c)	NS	NS	NS	179.189	NS
Percent Recovery	NA	NA	NA	NA	98%	NA
<u>Analytical Replicates</u>						
PC-1 Replicate 1	43.826 U	43.826 U	43.826 U	43.826 U	38.266 J ^(d)	43.826 U
PC-1 Replicate 2	43.587 U	43.587 U	43.587 U	43.587 U	40.891 J	43.587 U
PC-1 Replicate 3	43.562 U	43.562 U	43.562 U	43.562 U	29.514 J	43.562 U
RSD	NA	NA	NA	NA	16%	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

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

TABLE B.26. Surrogate Recoveries and Quality Control Data for Chlorinated Pesticides and Polychlorinated Biphenyls (PCB) in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Surrogate Percent Recoveries</u>	
	<u>DBOFB</u>	<u>CL5(112)</u>
PC-1 Replicate 1	37	67
PC-1 Replicate 2	93	80
PC-1 Replicate 3	120	80
PC-1A	108	69
PC-2	105	71
PC-4	92	78
PC-5	87	75
Reference	74	77
<u>Quality Control Data</u>		
<u>Method Blank</u>		
Blank	62	68
<u>Matrix Spike</u>		
Reference	74	77
Reference MS	75	85
<u>Analytical Replicates</u>		
PC-1 Replicate 1	97	67
PC-1 Replicate 2	93	80
PC-1 Replicate 3	120	80
RSD	14%	10%

TABLE B.27. Metals Analysis (alphabetical, Ag - Hg) of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Metals (mg/kg dry weight)							
	Ag	Al	As	Be	Cd	Cr	Cu	Hg
Target DL (a)	0.1	5.0	0.1	0.2	0.1	0.6	0.1	0.01
Achieved DL	0.01	0.1	0.01	0.01	0.01	0.01	0.01	0.0016
PC-1	0.05	2720	4.86	0.32	0.03	20.60	5.80	0.0594
PC-1A	0.07	7030	3.46	0.21	0.02	13.40	4.75	0.0320
PC-2	0.15	14000	7.90	0.7	0.14	33.70	9.93	0.0840
PC-4	0.06	3210	3.09	0.19	0.01	10.30	2.97	0.0235
PC-5	0.04	4070	1.95	0.14	0.02	9.82	2.91	0.0286
Reference Replicate 1	0.01	1680	0.65	0.01	0.01 U ^(b)	2.11	0.95	0.0031
Reference Replicate 2	0.01	1800	0.71	0.02	0.01 U	2.19	0.83	0.0033
Reference Replicate 3	0.02	1750	0.72	0.01	0.01 U	2.08	0.45	0.0032

(a) DL Detection limit.

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

TABLE B.28. Metals Analysis (alphabetical, Ni - Zn) of Sediment, Dry Weight, Panama City Harbor Project

Sediment Treatment	Metals (mg/kg dry weight)					
	Ni	Pb	Se	Sb	Tl	Zn
Target DL (a)	0.1	0.1	0.2	0.1	0.1	0.3
Achieved DL	0.01	0.01	0.05	0.01	0.01	0.05
PC-1	5.15	8.32	0.05 U ^(b)	0.140	0.15	20.4
PC-1A	3.24	6.18	0.11	0.065	0.095	14.3
PC-2	9.55	24.13	0.7	0.160	0.27	40.6
PC-4	2.99	6.86	0.05 U	0.057	0.13	13.8
PC-5	2.39	9.00	0.05 U	0.053	0.035	19.5
Reference Replicate 1	0.71	1.76	0.05 U	0.020	0.01 U	3.83
Reference Replicate 2	0.70	1.09	0.05 U	0.016	0.01 U	3.87
Reference Replicate 3	0.71	5.19	0.05 U	0.027	0.06	2.83

(a) DL Detection limit.

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

TABLE B.29. Quality Control Summary for Metals (alphabetical, Ag - Hg) in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Metals (mg/kg dry weight)</u>							
	<u>Ag</u>	<u>Al</u>	<u>As</u>	<u>Ba</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Hg</u>
<u>Method Blank</u>								
Blank	0.01 U ^(a)	30	0.01 U	0.01 U	0.01 U	0.20	0.01 U	0.0008
<u>Matrix Spike</u>								
PC-1A	0.07	7030	3.46	0.21	0.02	13.4	4.75	0.032
PC-1A MS	0.78	NA ^(b)	25.8	2.87	0.96	61.8	56.0	0.134
Concentration Recovered	0.71	NA	22.34	2.66	0.94	48.4	51.25	0.102
Amount Spiked	0.99	NS ^(c)	23.58	2.36	0.99	58.96	58.96	0.118
Percent Recovery	72% ^(d)	NA	95%	113%	95%	82%	87%	86%
<u>Standard Reference Material</u>								
Certified Value	NC ^(e)	62500 ±2000	11.6 ±1.3	NC	0.36 ±0.07	76 ±3	18 ±3	0.063 ±0.012
1646-1	0.4	63000	11.2	2.03	0.36	69.2	17.5	0.0667
1646-2	NA	NA	NA	NA	NA	NA	NA	0.0654
<u>Analytical Replicates</u>								
Reference Replicate 1	0.01	1680	0.65	0.01	0.01 U	2.11	0.95	0.0031
Reference Replicate 2	0.01	1800	0.71	0.02	0.01 U	2.19	0.83	0.0033
Reference Replicate 3	0.02	1750	0.72	0.01	0.01 U	2.08	0.45	0.0032
RSD	43% ^(f)	3%	5%	43% ^(f)	NA	3%	35% ^(f)	3%

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

(b) NA Not applicable.

(c) NS Not spiked.

(d) Recovery outside quality control range (75%-125%).

(e) NC Not certified.

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

TABLE B.30. Quality Control Summary for Metals (alphabetical, Ni - Zn) in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Metals (mg/kg dry weight)</u>					
	<u>Ni</u>	<u>Pb</u>	<u>Se</u>	<u>Sb</u>	<u>Tl</u>	<u>Zn</u>
<u>Method Blank</u>						
Blank	0.092	1.10	0.05 U ^(a)	0.01 U	0.01 U	2.04
<u>Matrix Spike</u>						
PC-1A	3.24	6.18	0.11	0.065	0.095	14.3
PC-1A MS	51.4	67.9	4.88	0.58	2.81	NA ^(b)
Concentration Recovered	48.16	61.72	4.77	0.52	2.715	NA
Amount Spiked	58.96	58.96	7.88	1.18	2.36	NS ^(c)
Percent Recovery	82%	105%	61% ^(d)	44% ^(d)	115%	NA
<u>Standard Reference Material</u>						
Certified Value	32 ±3	28.2 ±1.8	NC ^(e)	NC	NC	138 ±6
1646-1	24.9	29.9	0.71	0.24	0.63	108
1646-2	NA	NA	NA	NA	NA	NA
<u>Analytical Replicates</u>						
Reference Replicate 1	0.71	1.76	0.05 U	0.020	0.01 U	3.83
Reference Replicate 2	0.70	1.09	0.05 U	0.016	0.01 U	3.87
Reference Replicate 3	0.71	5.19	0.05 U	0.027	0.06	2.83
RSD	1%	82% ^(f)	NA	27% ^(f)	NA	17%

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

(b) NA Not applicable.

(c) NS Not spiked.

(d) Recovery outside quality control range (75%-125%).

(e) NC Not certified.

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

TABLE B.31. Butyltin Analysis of Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	Surrogate Percent Recovery Tri-pentyltin	<u>Butyltins ($\mu\text{g/kg}$ dry weight)</u>		
		<u>Tri-butyltin</u>	<u>Di-butyltin</u>	<u>Mono-butyltin</u>
Target DL ^(a)	NA ^(b)	10	10	10
Achieved High DL	NA	2.7	2.2	3.8
Achieved Low DL	NA	1.6	1.3	2.3
PC-1	107	3.7	1.2 J ^(c)	2.6 U ^(d)
PC-1A Replicate 1	57	1.6 J	2.2 U	3.8 U
PC-1A Replicate 2	101	2.0 U	1.5 U	2.6 U
PC-1A Replicate 3	96	2.0 U	1.0 J	4.0
PC-2	99	11.1	2.6 U	2.5 U
PC-4	103	1.1 J	1.3 U	2.3 U
PC-5	102	5.1	2.3 U	2.4 U
Reference	105	1.8 U	2.2 U	2.6 U

(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 Analyte was not present above the associated value.

TABLE B.32. Quality Control Summary for Butyltins in Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	Surrogate Percent Recovery Tri- pentyltin	<u>Butyltins (ug/kg dry weight)</u>		
		<u>Tri- butyltin</u>	<u>Di- butyltin</u>	<u>Mono- butyltin</u>
<u>Method Blank</u>				
Blank	111	1.9 U ^(a)	1.5 U	2.7 U
<u>Matrix Spike</u>				
PC-5	102	5.1	2.3 U	2.4 U
PC-5 MS	104	50.5	43.0	NA ^(b)
Concentration Recovered	NA	45.4	43	NA
Amount Spiked	NS ^(c)	39.2	39.2	NS
Percent Recovery	NA	116%	110%	NA
<u>Standard Reference Material</u>				
Certified Value	NC ^(d)	1270	1160	280
	NA	±220	±180	±170
PACS-1	108	1114	858	565 ^(e)
<u>Analytical Replicates</u>				
PC-3 Replicate 1	57	1.6 J ^(f)	2.2 U	3.8 U
PC-3 Replicate 2	101	2.0 U	1.5 U	2.6 U
PC-3 Replicate 3	96	2.0 U	1.0 J	4.0
RSD	28%	NA	NA	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

(d) NC Not certified.

(e) Value exceeds SRM goal of ≤30%.

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

TABLE B.33. Total Polychlorinated Dibenzodioxins (PCDD) and Dibenzofurans (PCDF) Analysis of Sediment, Dry Weight, Panama City Harbor Project

<u>Sediment</u> <u>Treatment</u>	<u>Dioxins and Furans (ng/kg dry weight)</u>							
	<u>Total</u> <u>TCDD</u>	<u>Total</u> <u>PeCDD</u>	<u>Total</u> <u>HxCDD</u>	<u>Total</u> <u>HpCDD</u>	<u>Total</u> <u>TCDF</u>	<u>Total</u> <u>PeCDF</u>	<u>Total</u> <u>HxCDF</u>	<u>Total</u> <u>HpCDF</u>
PC-1	4.78	4.33	72.05	453.38	13.82	7.52	19.64	72.00
PC-2	6.53	4.08	65.79	292.11	28.32	8.37	0.71	47.37

TABLE B.34. Polychlorinated Dibenzodioxins (PCDD) Analysis of Sediment (2378-TCDD - OCDD), Dry Weight, Panama City Harbor Project

<u>Sediment</u> <u>Treatment</u>	<u>Dioxins (ng/kg dry weight)</u>						
	<u>2378-</u> <u>TCDD</u>	<u>12378-</u> <u>PeCDD</u>	<u>123478-</u> <u>HxCDD</u>	<u>123678-</u> <u>HxCDD</u>	<u>123789-</u> <u>HxCDD</u>	<u>1234678-</u> <u>HpCDD</u>	<u>OCDD</u>
PC-1	0.86	0.72	0.74	4.97	3.05	123.52	1717.19
PC-2	1.45	0.74	0.87	3.74	3.21	94.74	1028.32

TABLE B.35. Quality Control Summary for Polychlorinated Dibenzodioxins (PCDD) Analysis of Sediment (2378-TCDD - OCDD), Wet Weight, Panama City Harbor Project

Sediment Treatment	Dioxins (ng/kg wet weight)						
	2378-TCDD	12378-PeCDD	123478-HxCDD	123678-HxCDD	123789-HxCDD	1234678-HpCDD	OCDD
Target DL ^(a)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Achieved DL	0.3	0.3	0.9	0.5	0.8	0.7	≤5.0
Method Blank							
Blank	0.3 U ^(b)	0.3 U	0.9 U	0.5 U	0.8 U	0.7 U	2.45 ^(c)
Matrix Spikes							
PC-1	0.50	0.42	0.43	2.88	1.77	71.64	995.97
PC-1 MS	17	97	83	77	84	140	889
Amount Spiked	20	100	100	100	100	100	200
Percent Recovery ^(d)	83%	97%	83%	75%	83%	82%	74%
PC-1	0.50	0.42	0.43	2.88	1.77	71.64	995.97
PC-1 MSD	16	93	78	76	86	149	809
Amount Spiked	20	100	100	100	100	100	200
Percent Recovery ^(d)	78%	93%	78%	74%	85%	87%	68%
RPD	6%	4%	6%	1%	2%	6%	8%
I-Stat	0.03	0.02	0.03	0.01	0.01	0.03	0.04

(a) DL Detection limit.

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

(c) Mass ratio out of limits. This value is lower than the detection limit, however, the accuracy of the quantification at levels lower than the detection limits cannot be guaranteed.

(d) Percent recovery = [(matrix spike concentration)/(amount spiked + original sample concentration)]*100.

TABLE B.36. Polychlorinated Dibenzofurans (PCDF) Analysis of Sediment (2378-TCDF - OCDF), Dry Weight, Panama City Harbor Project

Sediment Treatment	Furans (ng/kg dry weight)									
	2378-TCDF	12378-PeCDF	23478-PeCDF	123478-HxCDF	123678-HxCDF	123789-HxCDF	234678-HxCDF	1234678-HpCDF	1234789-HpCDF	OCDF
PC-1	5.88	0.69 U ^(a)	1.90 U	0.81	0.78	0.76	0.69 U	18.33	1.05	88.83
PC-2	9.21	0.45	1.58 U	0.71	1.32 U	2.11 U	0.53 U	11.63	0.92	57.89

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

TABLE B.37. Quality Control Summary for Chlorinated Dibenzofurans (PCDF) Analysis of Sediment (2378-TCDF - OCDF), Wet Weight, Panama City Harbor Project

Sediment Treatment	Furans (ng/kg wet weight)									
	2378-TCDF	12378-PeCDF	23478-PeCDF	123478-HxCDF	123678-HxCDF	123789-HxCDF	234678-HxCDF	1234678-HxCDF	1234789-HxCDF	OCDF
Target DL (a)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Achieved DL	0.1	0.3	0.6	0.7	0.5	0.8	0.2	0.9	0.5	1.3
Method Blank										
Blank	0.1 U ^(b)	0.3 U	0.6 U	0.7 U	0.6 U	1.0 U	0.5 U	0.9 U	0.5 U	1.3 U
Matrix Spike										
PC-1	3.41	0.40 U	1.10 U	0.47	0.45	0.44	0.40 U	10.63	0.61	51.52
PC-1 MS	21	94	93	104	99	99	95	84	89	184
Amount Spiked	20	100	100	100	100	100	100	100	100	200
Percent Recovery (c)	90%	94%	93%	104%	99%	99%	95%	76%	88%	73%
PC-1	3.41	0.40 U	1.10 U	0.47	0.45	0.44	0.40 U	10.63	0.61	51.52
PC-1 MSD	20	93	87	98	96	94	93	87	91	163
Amount Spiked	20	100	100	100	100	100	100	100	100	200
Percent Recovery (c)	85%	93%	87%	98%	96%	94%	93%	79%	90%	65%
RPD	6%	1%	7%	6%	3%	5%	2%	4%	2%	12%
I-Stat	0.03	0.01	0.03	0.03	0.02	0.03	0.01	0.02	0.01	0.06

(a) DL Detection limit.

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

(c) Percent recovery = [(matrix spike concentration)/(amount spiked + original sample concentration)]*100.

TABLE B.38. Surrogate Percent Recovery and Quality Control Data of Polychlorinated Dibenzodioxins (PCDD), Wet Weight, Panama City Harbor Project

Sediment Treatment	Dioxin Labelled Compounds (ng/kg wet weight)					
	2378-TCDD-C13	12378-PeCDD-C13	123478-HxCDD-C13	123678-HxCDD-C13	1234678-HpCDD-C13	OCDD-C13
PC-1	35 ^(a)	41	35 ^(a)	37 ^(a)	26 ^(a)	21 ^(a)
PC-2	82	84	81	86	66	49
<u>Quality Control Data</u>						
<u>Method Blank</u>						
Blank	56	72	64	61	58	41
<u>Matrix Spike</u>						
PC-1 MS	59	59	58	56	49	39 ^(a)
PC-1 MSD	95	99	78	87	69	55

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

TABLE B.39. Surrogate Percent Recovery and Quality Control Summary of Polychlorinated Dibenzofurans (PCDF), Wet Weight, Panama City Harbor Project

Sediment Treatment	Furans Labelled Compounds (ng/kg wet weight)										Cleanup Standard
	2378- ICDF-C13	12378- PeCDF-C13	23478- PeCDF-C13	123478- HxCDF-C13	123478- HxCDF-C13	123678- HxCDF-C13	123789- HxCDF-C13	234678- HxCDF-C13	1234678- HxCDF-C13	1234789- HxCDF-C13	2378- ICOD-37CL4
PC-1	25 (a) 58	25 (a) 55	29 (a) 59	26 (a) 61	27 (a) 61	24 (a) 63	25 (a) 60	22 (a) 54	19 (a) 52	38 (a) 88	
Quality Control Data											
Method Blank											
Blank	47	48	53	58	60	55	52	58	46	63	
Matrix Spike											
PC-1 MS	42	42	48	47	42	43	45	43	37 (a) 50	64	
PC-1 MSD	68	66	77	60	63	59	61	52	50	93	

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

APPENDIX C

SUSPENDED-PARTICULATE-PHASE (SPP) CHEMISTRY
AND QUALITY ASSURANCE DATA

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Cyanide
LABORATORY: Analytical Resources Incorporated, Seattle, Washington
MATRIX: Suspended-Particulate-Phase (SPP) Water

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit</u>
EPA 335.2 (1979)	NA	NA	≤20%	4.0 µg/L

HOLDING TIMES All samples were analyzed within the specified 28-day holding period.

DETECTION LIMITS The detection limit of 4.0 µg/L was met for all samples.

METHOD BLANKS The concentration of cyanide in the method blank was less than the target detection limit; therefore, the data are acceptable.

MATRIX SPIKES Matrix spikes were not required for this project; therefore, no data quality objectives were established. Analytical Resources Incorporated analyzed a matrix spike for cyanide analysis; the percent recovery for the matrix spike sample analyzed was 77%.

SRMs NA

REPLICATES Precision between replicates was assessed by the Relative Standard Deviation (RSD) between triplicates. RSD for cyanide could not be determined because all replicates were undetected.

SURROGATES NA

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Ammonia
LABORATORY: University of Washington, Seattle, Washington
MATRIX: Suspended-Particulate-Phase (SPP) Water

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit</u>
Whitledge et al.1981	NA	NA	≤30%	0.01 mg/L

HOLDING TIMES All samples were analyzed within the specified 28-day holding period.

DETECTION LIMITS The achieved detection limit for the ammonia analysis was 0.04 mg/L. The concentrations in the samples were all well above the achieved detection limit; therefore, no corrective action was taken.

METHOD BLANKS The concentration of ammonia in the method blank was undetected at a value slightly greater than the target detection limit. The concentrations in the samples were well above the target and achieved detection limits; therefore, no corrective action was taken.

MATRIX SPIKES NA

SRMs NA

REPLICATES The Relative Standard Deviation (RSD) between triplicates was 8%, which was within the established QC limits.

SURROGATES NA

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs), Phenol, Substituted Phenols, and Phthalate Esters
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: Suspended-Particulate-Phase (SPP) Water

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit</u>
PAHs	EPA Method 8270 (1986a)	40-120%	NA	≤30%	20 ng/L
Phenols	EPA Method 8270	40-120%	NA	≤30%	1000 ng/L
Phthalate Esters	EPA Method 8270	40-120%	NA	≤30%	200 ng/L

HOLDING TIMES All samples were extracted within the 7-day holding period and analyzed within 40 days of extraction.

DETECTION LIMITS The achieved detection limits for PAHs were generally within the target detection limits. The achieved detection limits for phenol, substituted phenols, and phthalate esters were slightly elevated above the target detection limits set in the QA/QC plan. These elevations do not present a problem due to the majority of samples being undetected.

METHOD BLANKS The procedural blank analyzed with the samples had detected levels of naphthalene, 2-methylnaphthalene, phenanthrene, diethyl phthalate, and bis(2-ethylhexyl)phthalate in the blank. The data associated with this sample were flagged with a "B."

MATRIX SPIKES The recoveries of target PAHs and phthalate esters in the matrix spike are good, ranging from 26% to 140%. Five of the 16 PAHs and none of the 6 phthalate ester matrix spike recoveries were outside the 40-120% acceptable range. The recoveries of target phenol and substituted phenols in the matrix spike were poor, ranging from 1% to 184%. The recovery of the phenol and substituted phenol compounds are acceptable in the blank spike (Milli-Q water) processed with the water samples, indicating that matrix interferences resulted in the poor recovery of the phenol and substituted phenol compounds.

SRMs NA

REPLICATES Precision was measured by relative standard deviation (RSD) between triplicates. Precision between replicates analyzed for PAHs was excellent, with no RSD values outside the 30% range. RSDs for phenol and substituted phenols could not be determined because all replicates were undetected. Two of the six RSDs from the phthalate analysis were out of range.

SURROGATES

Four surrogate compounds were analyzed with the samples: 2-fluorophenol, naphthalene-d₈, acenaphthene-d₁₀, and benzo(a)pyrene-d₁₂. Two of these surrogates (acenaphthene-d₁₀ and naphthalene-d₁₂) showed acceptable recovery of the surrogate internal standard (SIS) compounds. The recoveries of 2-fluorophenol and benzo(a)pyrene-d₁₂ were poor, and believed to be due to matrix interferences of the water samples.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs)
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: Suspended-Particulate-Phase (SPP) Water

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit</u>
Pesticides	EPA Method 8080 (1986a)	40-120%	NA	≤30%	5 ng/L
Toxaphene	EPA Method 8080	40-120%	NA	≤30%	50 ng/L
PCBs	EPA Method 8080	40-120%	NA	≤30%	50 ng/L

HOLDING TIMES All samples were extracted within the 7-day holding period and analyzed within 40 days of extraction.

DETECTION LIMITS The achieved detection limits for all analytes were within the target detection limits except for chlordane and methoxychlor. These elevations do not present a problem because all the samples were undetected for these analytes.

METHOD BLANKS The procedural blank analyzed with the samples was free of contamination.

MATRIX SPIKES Three of the 18 matrix spike recoveries had values outside the 40-120% range set in the QA/QC plan. These three recoveries ranged from 121% to 148%, due to coelution of PCB congeners present in Aroclor 1254.

SRMs NA

REPLICATES Precision was measured by relative standard deviation (RSD) between triplicates. RSDs could be calculated only on the two pesticides with detected values in all replicates. RSDs were 15% and 39% and were calculated from "J" values detected below the method detection limit. This tends to exaggerate the RSD values due to comparison of small values.

SURROGATES Two surrogate compounds were analyzed with the samples: DBOFB and CL₅(112). The 22 surrogate recoveries ranged from 34% to 116%. Only three of these were below the established range of 40-120%, and were associated with the method blank and matrix spike sample.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: Suspended-Particulate-Phase (SPP) Water

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit</u>
Arsenic	HAA (EPA 1986a)	75-125	≤30%	≤20%	1.0 µg/L
Cadmium	GFAA (EPA 1986a)	75-125	≤30%	≤20%	0.1 µg/L
Chromium	GFAA	75-125	≤30%	≤20%	1.0 µg/L
Copper	GFAA	75-125	≤30%	≤20%	0.1 µg/L
Lead	GFAA	75-125	≤30%	≤20%	0.1 µg/L
Mercury	CVAF	75-125	≤30%	≤20%	0.001 µg/L
Nickel	GFAA	75-125	≤30%	≤20%	0.1 µg/L
Selenium	GFAA	75-125	≤30%	≤20%	2.0 µg/L
Silver	GFAA	75-125	≤30%	≤20%	0.01 µg/L
Zinc	GFAA	75-125	≤30%	≤20%	2.0 µg/L

HOLDING TIMES All samples analyzed for metals, except Hg, were analyzed within the specified 6-month holding period. All Hg samples were analyzed within the holding time of 28 days.

DETECTION LIMITS The achieved detection limits for all the metals were below the target detection limit, except for selenium. The concentrations in the samples were undetected; therefore, no corrective action was taken.

METHOD BLANKS The procedural blank analyzed with the water samples had low concentrations of all the metals except selenium. The method blank analyzed with the samples had low levels of silver, cadmium, chromium, mercury, nickel, and zinc. The data associated with these blanks were corrected for the amount in the method blank; therefore, no corrective action was taken.

MATRIX SPIKES Matrix spike recoveries ranged between 79% and 114%, which is within the 75-125% range.

SRMs The standard reference material (SRM) 1641b was analyzed for mercury. SRM CASS-2 was analyzed for all the other metals. The values were all within the 30% limit set in the QA plan.

REPLICATES Precision between triplicates was measured by Relative Standard Deviation (RSD). Calculable RSDs ranged from 2% to 18%, which were within the 20% range set in the data quality objectives.

TABLE C.1. Ammonia and Cyanide Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>NH₄ Ammonium (mg/L)</u>	<u>NH₃-N Ammonia (mg/L)</u>	<u>Cyanide (µg/L)</u>
Target DL ^(a)	NA ^(b)	0.01	4.0
Achieved DL	NA	0.04	4.0
PC-1	0.23	0.18	4.0 U ^(c)
PC-1A Replicate 1	0.20	0.16	4.0 U
PC-1A Replicate 2	NA	NA	4.0 U
PC-1A Replicate 3	NA	NA	4.0 U
PC-2	0.63	0.49	4.0 U
PC-4 Replicate 1	0.22	0.17	4.0 U
PC-4 Replicate 2	0.24	0.18	NA
PC-4 Replicate 3	0.25	0.20	NA
PC-5	0.43	0.33	4.0 U
Reference	0.82	0.64	4.0 U

(a) DL Detection limit.

(b) NA Not applicable.

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

TABLE C.2. Quality Control Summary for Ammonia and Cyanide in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>NH₄ Ammonium (mg/L)</u>	<u>NH₃-N Ammonia (mg/L)</u>	<u>Cyanide (ug/L)</u>
<u>Blank</u>			
Method Blank	NA ^(a)	0.04 U ^(b)	4.0 U
<u>Matrix Spike</u>			
PC-1A	0.20	0.16	4.0 U
PC-1A MS	NA	NA	56.0
Concentration Recovered	NA	NA	56.0
Amount Spiked	NS ^(c)	NS	73.0
Percent Recovery	NA	NA	77%
<u>Analytical Replicates</u>			
PC-1A Replicate 1	NA	NA	4.0 U
PC-1A Replicate 2	NA	NA	4.0 U
PC-1A Replicate 3	NA	NA	4.0 U
RSD	NA	NA	NA
PC-4 Replicate 1	0.22	0.17	4.0
PC-4 Replicate 2	0.24	0.18	NA
PC-4 Replicate 3	0.25	0.20	NA
RSD	6%	8%	NA

(a) NA Not applicable.

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

(c) NS Not spiked.

TABLE C.3. Total Polynuclear Aromatic Hydrocarbons (PAH) Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>Total PAH (ng/L)</u>		
	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
PC-1 Replicate 1	36.16	16.52	52.68
PC-1 Replicate 2	56.54	25.97	82.51
PC-1 Replicate 3	53.20	26.84	80.04
PC-1A	109.11	32.06	141.17
PC-2	56.39	18.68	75.07
PC-4	68.86	10.96	79.82
PC-5	58.77	76.28	135.05
Reference	77.00	12.28	89.28

TABLE C.4. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAH) Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	LPAHs (ng/L)							
	Naphthalene	2-Methylnaphthalene	1-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Target DL (a)	20	20	20	20	20	20	20	20
Achieved High DL	7.64	7.64	7.64	9.65	6.14	7.21	8.19	12.03
Achieved Low DL	6.88	6.88	6.88	8.64	5.53	6.49	7.37	10.84
PC-1 Replicate 1	19.18 B ^(b)	6.87 JB ^(c)	4.99 J ^(d)	8.64 U ^(e)	5.53 U	6.49 U	5.12 JB	10.84 U
PC-1 Replicate 2	25.43 B	11.85 B	7.89	9.02 U	5.78 U	3.56 J	6.21 JB	1.60 J
PC-1 Replicate 3	22.78 B	11.23 B	6.70 J	9.02 U	1.03 J	3.08 J	6.04 JB	2.34 J
PC-1A	43.87 B	24.73 B	15.91	0.87 J	1.37 J	8.47	11.86 B	2.03 J
PC-2	23.12 B	11.62 B	7.74	9.54 U	1.35 J	4.32 J	7.03 JB	1.21 J
PC-4	31.31 B	15.49 B	9.66	9.30 U	5.95 U	4.71 J	6.67 JB	1.02 J
PC-5	18.85 B	11.43 B	8.13	2.98 J	6.01 U	5.69 J	8.34 B	3.35 J
Reference	33.13 B	15.47 B	15.54	9.43 U	6.04 U	3.60 J	7.78 JB	1.48 J

(a) DL Detection limit.

(b) B Analyte found in the procedural blank; results presented are not corrected for the amount in the blank.

(c) JB Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL), and found in the procedural blank; results presented are not corrected for the amount in the blank.

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

(e) U Analyte was not present above the associated value.

TABLE C.5. High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAH) Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	HPAHs (ng/L)									
	Fluor-anthene	Pyrene	Benzo[a]anthracene	Chrysene	Benzo[b]fluor-anthene	Benzo[k]fluor-anthene	Benzo[a]pyrene	Indeno-[1,2,3-c,d]pyrene	Dibenzo[a,h]anthracene	Benzo[g,h,i]perylene
Target DL (a)	20	20	20	20	20	20	20	20	20	20
Achieved High DL	6.83	6.83	31.42	20.09	15.35	13.96	6.69	21.63	22.55	20.89
Achieved Low DL	6.15	6.15	28.29	18.09	13.83	12.57	6.02	19.48	20.31	18.81
PC-1 Replicate 1	4.03 J ^(b)	4.93 J	28.29 U ^(c)	1.99 J	3.10 J	2.47 J	6.02 U	19.48 U	20.31 U	18.81 U
PC-1 Replicate 2	4.46 J	5.00 J	1.61 J	1.61 J	3.45 J	1.93 J	6.28 U	2.94 J	1.77 J	3.20 J
PC-1 Replicate 3	3.97 J	4.66 J	2.40 J	1.89 J	3.30 J	2.19 J	1.82 J	2.49 J	1.40 J	2.72 J
PC-1A	6.39	4.45 J	1.79 J	3.19 J	4.67 J	2.81 J	6.69 U	3.15 J	2.38 J	3.23 J
PC-2	3.91 J	3.19 J	0.99 J	1.76 J	3.24 J	1.61 J	6.65 U	2.01 J	22.42 U	1.97 J
PC-4	3.45 J	2.39 J	30.45 U	1.56 J	2.25 J	1.31 J	6.48 U	20.96 U	21.85 U	20.24 U
PC-5	9.70	11.73	1.10 J	6.24 J	22.74	11.97 J	6.53 U	6.36 J	2.39 J	4.05 J
Reference	3.07 J	2.18 J	0.53 J	1.80 J	1.97 J	1.22 J	6.57 U	21.26 U	22.17 U	1.51 J

(a) DL Detection limit.

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

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

TABLE C.6. Quality Control Summary for Analysis of Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAH) in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>LPAH (ng/L)</u>							
	<u>Naphthalene</u>	<u>2-Methylnaphthalene</u>	<u>1-Methylnaphthalene</u>	<u>Acenaphthylene</u>	<u>Acenaphthene</u>	<u>Fluorene</u>	<u>Phenanthrene</u>	<u>Anthracene</u>
<u>Blanks</u>								
Method Blank ^(a)	18.51 B ^(b)	7.34 J ^(c)	18.55 U ^(d)	29.38 U	22.62 U	17.94 U	30.42 U	28.43 U
Procedural Blank ^(e)	33.47 B	9.96 B	5.53 J	4.06 J	5.84 U	3.43 J	11.86 B	1.18 J
<u>Matrix Spike</u>								
PC-1 Replicate 1	19.18 B	6.87 JB ^(f)	4.99 J	8.64 U	5.53 U	6.49 U	5.12 JB	10.84 U
PC-1 Replicate 1 MS	845.55	NA ^(g)	NA	715.11	825.67	903.46	947.62	330.19
Concentration Recovered	826.37	NA	NA	715.11	825.67	903.46	942.5	330.19
Amount Spiked	857.14	NS ^(h)	NS	857.14	857.14	857.14	857.14	857.14
Percent Recovery	96%	NA	NA	83%	96%	105%	110%	39% ⁽ⁱ⁾
<u>Analytical Replicates</u>								
PC-1 Replicate 1	19.18 B	6.87 JB	4.99 J	8.64 U	5.53 U	6.49 U	5.12 JB	10.84 U
PC-1 Replicate 2	25.43 B	11.85 B	7.89	9.02 U	5.78 U	3.56 J	6.21 JB	1.60 J
PC-1 Replicate 3	22.78 B	11.23 B	6.70 J	9.02 U	1.03 J	3.08 J	6.04 JB	2.34 J
RSD	14%	27%	22%	NA	NA	NA	10%	NA

- (a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water samples. The sediment and water samples were extracted together.
- (b) B Analyte found in the procedural blank; results presented are not corrected for the amount in the blank.
- (c) J Analyte detected below method detection limit (MDL), but above instrument detection level (IDL).
- (d) U Analyte was not present above the associated value.
- (e) Procedural blank was processed and analyzed following the same procedures as the water samples.
- (f) JB Analyte detected below method detection limit (MDL), but above the instrument detection limit (IDL), and found in the procedural blank; results presented are not corrected for the amount in the blank.
- (g) NA Not applicable.
- (h) NS Not spiked.
- (i) Value outside of quality control range (40% - 120%).

TABLE C.7. Quality Control Summary for Analysis of High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAH) in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

	HPAHs (ng/L)									
Water Treatment	Fluor-anthene	Pyrene	Benzo[a]anthracene	Chrysene	Benzo[b]fluor-anthene	Benzo[k]fluor-anthene	Benzo[a]pyrene	Indeno [1,2,3-c,d]pyrene	Dibenzo [a,h]anthracene	Benzo [g,h,i]perylene
Blanks										
Method Blank (a)	1.82 J ^(b)	5.15 J	32.12 U ^(c)	39.60 U	30.25 U	35.97 U	21.42 U	50.95 U	29.90 U	55.27 U
Procedural Blank (d)	1.89 J	1.70 J	29.86 U	19.09 U	14.59 U	13.27 U	6.35 U	20.56 U	21.43 U	19.85 U
Matrix Spike										
PC-1 Replicate 1	4.03 J	4.93 J	28.29 U	1.99 J	3.10 J	2.47 J	6.02 U	19.48 U	20.31 U	18.81 U
PC-1 Replicate 1 MS	960.75	908.21	760.62	924.52	951.17	992.07	223.30	1117.09	1200.0	1105.0
Concentration Recovered	956.72	903.28	760.62	922.53	948.07	989.6	223.30	1117.09	1200.0	1105.0
Amount Spiked	857.14	857.14	857.14	857.14	857.14	857.14	857.14	857.14	857.14	857.14
Percent Recovery	112%	105%	89%	108%	111%	115%	26% (e)	130% (e)	140% (e)	129% (e)
Analytical Replicates										
PC-1 Replicate 1	4.03 J	4.93 J	28.29 U	1.99 J	3.10 J	2.47 J	6.02 U	19.48 U	20.31 U	18.81 U
PC-1 Replicate 2	4.46 J	5.00 J	1.61 J	1.61 J	3.45 J	1.93 J	6.28 U	2.94 J	1.77 J	3.20 J
PC-1 Replicate 3	3.97 J	4.66 J	2.40 J	1.89 J	3.30 J	2.19 J	1.82 J	2.49 J	1.40 J	2.72 J
RSD	6%	4%	NA (f)	11%	5%	12%	NA	NA	NA	NA

(a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing the average volume size of the water samples. The sediment and water samples were extracted together.

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

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

(d) Procedural blank was processed and analyzed following the same procedures as the water samples.

(e) Value outside of quality control range (40% - 120%).

(f) NA Not applicable.

TABLE C.8. Phenol and Substituted Phenol Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Phenols (ng/L)										
	Phenol	2-chloro-phenol	2-nitro-phenol	2,4-di-methyl-phenol	2,4-di-chloro-phenol	Para-chloro-meta-cresol	2,4,6-tri-chloro-phenol	2,4-di-nitro-phenol	4-nitro-phenol	4,6-dinitro-cresol	Penta-chloro-phenol
Target DL (a)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Achieved DL High	1453.49	1453.49	1453.49	1453.49	1453.49	1453.49	1453.49	1453.49	1453.49	1453.49	1453.49
Achieved DL Low	1308.90	1308.90	1308.90	1308.90	1308.90	1308.90	1308.90	1308.90	1308.90	1308.90	1308.90
PC-1 Replicate 1	1308.90 U ^(b)	1308.90 U	1308.90 U	1308.90 U	1308.90 U	1308.90 U	1308.90 U	1308.90 U	1308.90 U	1308.90 U	1308.90 U
PC-1 Replicate 2	1366.12 U	1366.12 U	8.28 J ^(c)	12.28 J	1366.12 U	1366.12 U	1366.12 U	1366.12 U	1366.12 U	1366.12 U	11.23 J
PC-1 Replicate 3	1366.12 U	1366.12 U	10.48 J	7.99 J	1366.12 U	1366.12 U	1366.12 U	1366.12 U	1366.12 U	1366.12 U	7.31 J
PC-1A	1453.49 U	1453.49 U	9.53 J	23.64 J	1453.49 U	1453.49 U	1453.49 U	1453.49 U	1453.49 U	1453.49 U	6.16 J
PC-2	1445.09 U	1445.09 U	1445.09 U	11.51 J	1445.09 U	1445.09 U	1445.09 U	1445.09 U	1445.09 U	1445.09 U	5.02 J
PC-4	1408.45 U	1408.45 U	8.34 J	14.83 J	1408.45 U	1408.45 U	1408.45 U	1408.45 U	1408.45 U	1408.45 U	1408.45 U
PC-5	1420.45 U	1420.45 U	7.74 J	16.34 J	1420.45 U	1420.45 U	1420.45 U	1420.45 U	1420.45 U	1420.45 U	26.79 J
Reference	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U	1428.57 U

(a) DL Detection limit.

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

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

TABLE C.9. Quality Control Summary for Analysis of Phenol and Substituted Phenol in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Phenols (ng/L)										
	Phenol	2-chloro-phenol	2-nitro-phenol	2,4-di-methyl-phenol	2,4-di-chloro-phenol	Para-chloro-meta-cresol	2,4,6-tri-chloro-phenol	2,4-di-nitro-phenol	4-nitro-phenol	4,6-dini-tro-o-cresol	Penta-chloro-phenol
Blanks											
Method Blank (a)	4186.6 U ^(b)	4186.6 U	4186.6 U	4186.6 U	4186.6 U	4186.6 U	4186.6 U	4186.6 U	4186.6 U	4186.6 U	4186.6 U
Procedural Blank (c)	388.5 J ^(d)	1381.2 U	1381.2 U	4.9 J	3.9 J	10.2 J	1381.2 U	1381.2 U	21.8 J	1381.2 U	25.5 J
Matrix Spike											
PC-1 Replicate 1	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U
PC-1 Replicate 1 MS	13133.5	3671.3	7139.9	1076.0	59.8	68.2	66.3	8416.7	3839.4	7566.7	198.8
Concentration Recovered	13133.5	3671.3	7139.9	1076.0	59.8	68.2	66.3	8416.7	3839.4	7566.7	198.8
Amount Spiked	7142.9	7142.9	7142.9	7142.9	7142.9	7142.9	7361.5	7292.9	7142.9	7142.9	7142.9
Percent Recovery	184% (e)	51%	100%	15% (e)	1% (e)	1% (e)	1% (e)	115%	54%	106%	3% (e)
Analytical Replicates											
PC-1 Replicate 1	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U	1308.9 U
PC-1 Replicate 2	1366.1 U	1366.1 U	8.3 J	12.3 J	1366.1 U	1366.1 U	1366.1 U	1366.1 U	1366.1 U	1366.1 U	11.2 J
PC-1 Replicate 3	1366.1 U ^(f)	1366.1 U	10.5 J	8.0 J	1366.1 U	1366.1 U	1366.1 U	1366.1 U	1366.1 U	1366.1 U	7.3 J
RSD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing the average volume size of the water samples. The sediment and water samples were extracted together.

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

(c) Procedural blank was processed and analyzed following the same procedures as the water samples.

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

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

(f) NA Not applicable.

TABLE C.10. Phthalate Ester Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>Phthalate Esters (ng/L)</u>					
	<u>Dimethyl phthalate</u>	<u>Diethyl phthalate</u>	<u>Di-n-butyl phthalate</u>	<u>Butyl benzyl phthalate</u>	<u>bis (2-ethyl-hexyl) phthalate</u>	<u>Di-n-octyl phthalate</u>
Target DL ^(a)	200	200	200	200	200	200
Achieved DL High	290.70	290.70	290.70	290.70	290.70	290.70
Achieved DL Low	261.78	261.78	261.78	261.78	261.78	261.78
PC-1 Replicate 1	74.56 J ^(b)	99.49 JB ^(c)	97.14 J	31.84 J	206.38 JB	9.45 J
PC-1 Replicate 2	93.38 J	161.40 JB	100.58 J	71.93 J	253.27 JB	16.42 J
PC-1 Replicate 3	188.42 J	144.10 JB	83.52 J	33.22 J	195.65 JB	11.28 J
PC-1A	87.75 J	146.71 JB	135.47 J	65.09 J	288.72 JB	16.68 J
PC-2	95.22 J	185.42 JB	124.65 J	74.66 J	222.60 JB ^(d)	23.79 J
PC-4	90.60 J	155.80 JB	120.32 J	57.13 J	336.23 B ^(d)	14.52 J
PC-5	102.11 J	181.01 JB	93.47 J	81.32 J	377.17 B	39.66 J
Reference	104.70 J	174.98 JB	71.21 J	27.25 J	166.66 JB	22.86 J

(a) DL Detection limit.

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

(c) JB Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL), and found in the procedural blank; results presented are not corrected for the amount in the blank.

(d) B Analyte was found in the procedural blank; results presented are not corrected for the amount in the blank.

TABLE C.11. Quality Control Summary for Analysis of Phthalate Ester in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>Phthalate Esters (ng/L)</u>					
	<u>Dimethyl phthalate</u>	<u>Diethyl phthalate</u>	<u>Di-n-butyl phthalate</u>	<u>Butyl benzyl phthalate</u>	<u>Bis (2-ethyl-hexyl) phthalate</u>	<u>Di-n-octyl phthalate</u>
<u>Blanks</u>						
Method Blank ^(a)	837.31 U ^(b)	188.47 J ^(c)	12.34 J	18.20 J	59.29 J	2.74 J
Procedural Blank ^(d)	137.96 J	291.88 B ^(e)	253.21 J	172.65 J	2448.25 B	37.85 J
<u>Matrix Spike</u>						
PC-1 Replicate 1	74.56 J	99.49 JB ^(f)	97.14 J	31.84 J	206.38 JB	9.45 J
PC-1 Replicate 1 MS	7280.79	7645.61	4188.67	7407.85	6968.62	3290.36
Concentration Recovered	7206.23	7546.12	4091.53	7376.01	6762.24	3280.91
Amount Spiked	7142.87	7325.70	7142.87	7142.87	7142.87	7142.87
Percent Recovery	101%	103%	57%	103%	95%	46%
<u>Analytical Replicates</u>						
PC-1 Replicate 1	74.56 J	99.49 JB	97.14 J	31.84 J	206.38 JB	9.45 J
PC-1 Replicate 2	93.38 J	161.40 JB	100.58 J	71.93 J	253.27 JB	16.42 J
PC-1 Replicate 3	188.42 J	144.10 JB	83.52 J	33.22 J	195.65 JB	11.28 J
RSD	51% ^(g)	24%	10%	50% ^(g)	14%	29%

- (a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water samples. The sediment and water samples were extracted together.
- (b) U Analyte was not present above the associated value.
- (c) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
- (d) Procedural blank was processed and analyzed following the same procedures as the water samples.
- (e) B Analyte was found in the procedural blank; results presented are not corrected for the amount in the blank.
- (f) JB Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL), and found in the procedural blank; results presented are not corrected for the amount in the blank.
- (g) Value exceeds relative precision goal of $\leq 30\%$.

TABLE C.12. Surrogate Recoveries and Quality Control Data for Analysis of Polynuclear Aromatic Hydrocarbons (PAH) and Phenols in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>Surrogate Percent Recovery</u>			
	<u>2-fluoro-phenol</u>	<u>Naptha-lene d8</u>	<u>Acenaph-thene d10</u>	<u>Benzo[a]pyrene d12</u>
PC-1 Replicate 1	0 ^(a)	81	82	21 ^(a)
PC-1 Replicate 2	0 ^(a)	85	84	18 ^(a)
PC-1 Replicate 3	0 ^(a)	87	85	68
PC-1A	0 ^(a)	66	67	0 ^(a)
PC-2	0 ^(a)	74	77	0 ^(a)
PC-4	0 ^(a)	80	81	0 ^(a)
PC-5	0 ^(a)	78	67	0 ^(a)
Reference	0 ^(a)	83	81	0 ^(a)
<u>Quality Control Data</u>				
<u>Blanks</u>				
Method Blank ^(b)	27 ^(a)	40	37 ^(a)	25 ^(a)
Procedural Blank ^(c)	29 ^(a)	76	87	90
<u>Matrix Spike</u>				
PC-1 Replicate 1	0 ^(a)	81	82	21 ^(a)
PC-1 Replicate 1 MS	0 ^(a)	88	85	19 ^(a)
<u>Analytical Replicates</u>				
PC-1 Replicate 1	0 ^(a)	81	82	21 ^(a)
PC-1 Replicate 2	0 ^(a)	85	84	18 ^(a)
PC-1 Replicate 3	0 ^(a)	87	85	68
RSD	NA ^(d)	4%	2%	79%

- (a) Value outside of quality control range (40% - 120%); Matrix interferences resulting in poor recovery of 2-fluorophenol and benzo[a]pyrene-d12.
- (b) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water samples. The sediment and water samples were extracted together.
- (c) Procedural blank was processed and analyzed following the same procedures as the water samples.
- (d) NA Not applicable.

TABLE C.13. Chlorinated Pesticides (alphabetical, Aldrin - 4,4'-DDT) Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Pesticides (ng/L)								
	Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta-BHC	Dieldrin	4,4'-DDD	4,4'-DDE	4,4'-DDT
Target DL (a)	5	5	5	5	5	5	5	5	5
Achieved DL High	4.651	4.651	4.651	29.070	4.651	4.651	4.651	4.651	4.651
Achieved DL Low	4.188	4.188	4.188	26.178	4.188	4.188	4.188	4.188	4.188
PC-1 Replicate 1	4.188 U (b)	0.975 J (c)	4.188 U	26.178 U	4.188 U	4.188 U	2.239 J	1.052 J	4.188 U
PC-1 Replicate 2	4.372 U	1.104 J	4.372 U	27.322 U	4.372 U	4.372 U	2.053 J	0.445 J	4.372 U
PC-1 Replicate 3	4.372 U	0.819 J	4.372 U	27.322 U	4.372 U	4.372 U	0.964 J	4.372 U	4.372 U
PC-1A	4.651 U	0.585 J	4.651 U	29.070 U	4.651 U	4.651 U	0.780 J	1.061 J	1.230 J
PC-2	4.624 U	1.249 J	4.624 U	28.902 U	4.624 U	4.624 U	1.538 J	4.624 U	4.624 U
PC-4	4.507 U	1.086 J	4.507 U	28.169 U	4.507 U	4.507 U	1.219 J	0.762 J	4.507 U
PC-5	4.545 U	0.787 J	4.545 U	28.409 U	4.545 U	4.545 U	3.020 J	1.031 J	4.545 U
Reference	4.571 U	1.231 J	4.571 U	28.571 U	4.571 U	4.571 U	5.981	1.015 J	4.571 U

(a) DL Detection limit.

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

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

TABLE C.14. Chlorinated Pesticide (alphabetical, Endosulfan I - Toxaphene) Analysis f Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Pesticides (ng/L)									
	Endo-sulfan I	Endo-sulfan II	Endo-sulfan sulfate	Endrin	Endrin Aldehyde	Hepta-chlor	Hepta-chlor-epoxide	Lindane	Methoxy-chlor	Toxaphene
Target DL (a)	5	5	5	5	5	5	5	5	5	50
Achieved DL High	4.651	4.651	4.651	4.651	4.651	4.651	4.651	4.651	29.070	29.070
Achieved DL Low	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	26.178	26.178
PC-1 Replicate 1	4.188 U ^(b)	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	26.178 U	26.178 U
PC-1 Replicate 2	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	27.322 U	27.322 U
PC-1 Replicate 3	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	27.322 U	27.322 U
PC-1A	4.651 U	4.651 U	4.651 U	4.651 U	4.651 U	4.651 U	4.651 U	4.651 U	29.070 U	29.070 U
PC-2	4.624 U	4.624 U	4.624 U	4.624 U	4.624 U	4.624 U	4.624 U	4.624 U	28.902 U	28.902 U
PC-4	4.507 U	4.507 U	4.507 U	4.507 U	4.507 U	4.507 U	4.507 U	4.507 U	28.169 U	28.169 U
PC-5	4.545 U	4.545 U	4.545 U	4.545 U	4.545 U	4.545 U	4.545 U	4.545 U	28.409 U	28.409 U
Reference	4.571 U	4.571 U	4.571 U	4.571 U	4.571 U	4.571 U	4.571 U	4.571 U	28.571 U	28.571 U

(a) DL Detection limit.

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

TABLE C.15. Quality Control Summary for Analysis of Chlorinated Pesticides (alphabetical, Aldrin - 4,4'-DDT) in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Pesticides (ng/L)						
	Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta-BHC	Dieldrin	4,4'-DDD 4,4'-DDE 4,4'-DDT
Blanks							
Method Blank (a)	8.988 U ^(b)	4.294 U	4.294 U	431.788 U	4.294 U	8.616 U	12.627 U 5.497 U 13.463 U
Procedural Blank (c)	4.420 U	4.420 U	4.420 U	27.624 U	4.420 U	4.420 U	4.420 U 4.420 U 4.420 U
Matrix Spike							
PC-1 Replicate 1	4.188 U	0.975 J ^(d)	4.188 U	26.178 U	4.188 U	4.188 U	2.239 J 1.052 J 4.188 U
PC-1 Replicate 1 MS	89.503	85.443	93.539	NA ^(e)	89.654	73.382	125.816 83.854 126.533
Concentration Recovered	89.503	84.468	93.539	NA	89.654	73.382	123.577 82.802 126.533
Amount Spiked	85.714	90.217	85.714	NS ^(f)	85.714	85.714	85.714 85.714 85.760
Percent Recovery	104%	94%	109%	NA	105%	86%	144% ^(g) 97% 148% ^(g)
Analytical Replicates							
PC-1 Replicate 1	4.188 U	0.975 J	4.188 U	26.178 U	4.188 U	4.188 U	2.239 J 1.052 J 4.188 U
PC-1 Replicate 2	4.372 U	1.104 J	4.372 U	27.322 U	4.372 U	4.372 U	2.053 J 0.445 J 4.372 U
PC-1 Replicate 3	4.372 U	0.819 J	4.372 U	27.322 U	4.372 U	4.372 U	0.964 J ^(h) 4.372 U 4.372 U
RSD	NA	15%	NA	NA	NA	NA	39% ^(h) NA NA

(a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water samples. The sediment and water samples were extracted together.

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

(c) Procedural blank was processed and analyzed following the same procedures as the water samples.

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

(e) NA Not applicable

(f) NS Not spiked.

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

(h) Value exceeds relative precision range of $\leq 30\%$.

TABLE C.16.

Quality Control Summary for Analysis of Chlorinated Pesticides (alphabetical, Endosulfan I - Toxaphene) in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Pesticides (ng/L)									
	Endo-sulfan I	Endo-sulfan II	Endo-sulfan sulfate	Endrin	Endrin Aldehyde	Hepta-chlor	Hepta-chlor-epoxide	Lindane	Methoxy-chlor	Toxaphene
Blanks										
Method Blank (a)	43.179 U ^(b)	43.179 U	43.179 U	24.569 U	43.179 U	11.691 U	9.938 U	4.294 U	43.179 U	43.179 U
Procedural Blank (c)	4.420 U	4.420 U	4.420 U	4.420 U	4.420 U	4.420 U	4.420 U	4.420 U	27.624 U	27.624 U
Matrix Spike										
PC-1 Replicate 1	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	26.178 U	26.178 U ^(d)
PC-1 Replicate 1 MS	96.430	95.217	102.407	87.859	44.992	104.003	97.930	92.864	95.831	NA
Concentration Recovered	96.430	95.217	102.407	87.859	44.992	104.003	97.930	92.864	95.831	NA
Amount Spiked	85.714	85.714	85.714	87.731	85.674	85.714	85.760	85.714	85.714	NA ^(e)
Percent Recovery	113%	111%	119%	100%	53%	121% ^(f)	114%	108%	112%	NA
Analytical Replicates										
PC-1 Replicate 1	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	4.188 U	26.178 U	26.178 U
PC-1 Replicate 2	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	27.322 U	27.322 U
PC-1 Replicate 3	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	4.372 U	27.322 U	27.322 U
RSD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water samples. The sediment and water samples were extracted together.

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

(c) Procedural blank was processed and analyzed following the same procedures as the water samples.

(d) NA Not applicable

(e) NS Not spiked.

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

TABLE C.17. Polychlorinated Biphenyls (PCB) Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>PCBs (ng/L)</u>					
	<u>Aroclor 1221</u>	<u>Aroclor 1232</u>	<u>Aroclor 1242/1015</u>	<u>Aroclor 1248</u>	<u>Aroclor 1254</u>	<u>Aroclor 1260</u>
Target DL ^(a)	50	50	50	50	50	50
Achieved DL High	29.070	29.070	29.070	29.070	29.070	29.070
Achieved DL Low	26.178	26.178	26.178	26.178	26.178	26.178
PC-1 Replicate 1	26.178 U ^(b)	26.178 U	26.178 U	26.178 U	26.178 U	26.178 U
PC-1 Replicate 2	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U
PC-1 Replicate 3	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U
PC-1A	29.070 U	29.070 U	29.070 U	29.070 U	29.070 U	29.070 U
PC-2	28.902 U	28.902 U	28.902 U	28.902 U	28.902 U	28.902 U
PC-4	28.169 U	28.169 U	28.169 U	28.169 U	28.169 U	28.169 U
PC-5	28.409 U	28.409 U	28.409 U	28.409 U	28.409 U	28.409 U
Reference	28.571 U	28.571 U	28.571 U	28.571 U	28.571 U	28.571 U

(a) DL Detection limit.

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

TABLE C.18. Quality Control Summary for Analysis of Polychlorinated Biphenyls (PCB) in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>PCBs (ng/L)</u>					
	<u>Aroclor 1221</u>	<u>Aroclor 1232</u>	<u>Aroclor 1242/1016</u>	<u>Aroclor 1248</u>	<u>Aroclor 1254</u>	<u>Aroclor 1260</u>
<u>Blanks</u>						
Method Blank ^(a)	431.788 U ^(b)	431.788 U	431.788 U	431.788 U	431.788 U	431.788 U
Procedural Blank ^(c)	27.624 U	27.624 U	27.624 U	27.624 U	27.624 U	27.624 U
<u>Matrix Spike</u>						
PC-1 Replicate 1	26.178 U	26.178 U	26.178 U	26.178 U	26.178 U	26.178 U
PC-1 Replicate 1 MS	NA ^(d)	NA	NA	NA	1348.750	NA
Concentration Recovered	NA	NA	NA	NA	1348.750	NA
Amount Spiked	NS ^(e)	NS	NS	NS	1250.017	NS
Percent Recovery	NA	NA	NA	NA	108%	NA
<u>Analytical Replicates</u>						
PC-1 Replicate 1	26.178 U	26.178 U	26.178 U	26.178 U	26.178 U	26.178 U
PC-1 Replicate 2	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U
PC-1 Replicate 3	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U	27.322 U
RSD	NA	NA	NA	NA	NA	NA

(a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing the average volume size of the water samples. The sediment and water samples were extracted together.

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

(c) Procedural blank was processed and analyzed following the same procedures as the water sample.

(d) NA Not applicable.

(e) NS Not spiked.

TABLE C.19. Surrogate Recoveries and Quality Control Summary for Analysis of Chlorinated Pesticides and Polychlorinated Biphenyls (PCB) in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

<u>Water Treatment</u>	<u>Surrogate Percent Recoveries</u>	
	<u>DBOFB</u>	<u>CL5(112)</u>
PC-1 Replicate 1	102	90
PC-1 Replicate 2	106	91
PC-1 Replicate 3	105	90
PC-1A	91	79
PC-2	115	91
PC-4	99	84
PC-5	94	77
Reference	116	83
<u>Quality Control Data</u>		
<u>Blanks</u>		
Method Blank ^(a)	35 ^(b)	38 ^(b)
Procedural Blank ^(c)	102	95
<u>Matrix Spike</u>		
PC-1 Replicate 1	102	90
PC-1 Replicate 1 MS	34 ^(b)	42
<u>Analytical Replicates</u>		
PC-1 Replicate 1	102	90
PC-1 Replicate 2	106	91
PC-1 Replicate 3	105	90
RSD	2%	1%

- (a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water samples. The sediment and water samples were extracted together.
- (b) Recovery outside of quality control range (40% - 120%).
- (c) Procedural blank was processed and analyzed following the same procedure as the water samples.

TABLE C.20. Metals Analysis of Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Metals (µg/L)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Target DL (a)	0.01	1.0	0.1	1.0	0.1	0.001	0.1	0.1	2.0	2.0
Achieved High DL	0.002	0.03	0.031	0.128	0.03	0.00005	0.025	0.06	2.6	0.39
Achieved Low DL	0.001	0.03	0.015	0.128	0.03	0.00005	0.012	0.03	2.6	0.39
PC-1	0.001 U ^(b)	8.24	0.015 U	0.719	0.24	0.00076	0.93	0.323	2.6 U	2.14
PC-1A	0.006	7.98	0.015 U	0.745	0.30	0.00238	1.07	0.593	2.6 U	1.69
PC-2 Replicate 1	0.003	18.1	0.031 U	0.848	0.41	0.00174	1.47	0.841	2.6 U	1.92
PC-2 Replicate 2	0.004	17.3	0.031 U	0.925	0.31	0.00184	1.04	0.819	2.6 U	1.69
PC-2 Replicate 3	0.003	17.9	0.031 U	0.848	0.36	0.00211	1.43	0.819	2.6 U	1.69
PC-4	0.005	7.23	0.015 U	0.694	0.33	0.00304	1.10	0.690	2.6 U	1.58
PC-5	0.004	7.04	0.018	0.848	0.39	0.00158	1.21	1.09	2.6 U	2.03
Reference	0.009	1.49	0.015 U	0.848	0.38	0.00260	2.11	0.604	2.6 U	0.39 U

(a) DL Detection limit.

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

TABLE C.21. Quality Control Summary for Analysis of Metals in Suspended-Particulate-Phase (SPP) Samples, Panama City Harbor Project

Water Treatment	Metals ($\mu\text{g/L}$)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Blanks										
Method Blank (a)	0.004	0.03 U ^(b)	0.036	0.128	0.03 U	0.00085	0.04	0.03 U	2.6 U	1.13
Procedural Blank (c)	0.007	1.14	0.022	0.257	0.57	0.00311	0.86	0.108	2.6 U	3.61
Matrix Spike										
PC-2 (d)	0.003	17.8	0.031 U	0.874	0.36	0.00190	1.31	0.83	2.6 U	1.77
PC-2 MS	0.050	22.1	0.474	2.54	1.97	0.00806	2.45	1.88	42.9	8.81
Concentration Recovered	0.047	4.3	0.474	1.67	1.61	0.00616	1.14	1.05	42.9	7.04
Amount Spiked	0.050	4.5	0.500	1.92	2.00	0.00582	1.00	1.00	42.9	8.91
Percent Recovery	94%	96%	95%	87%	81%	106%	114%	105%	100%	79%
Standard Reference Material										
Certified Value	NC ^(e)	1.01 ± 0.07	0.019 ± 0.004	0.121 ± 0.016	0.675 ± 0.039	NC	0.298 ± 0.036	0.019 ± 0.006	NC	1.97 ± 0.12
CASS-2	0.003	1.02	0.022	0.128	0.64	NA ^(f)	0.37	0.03 U	2.6 U	2.03
Certified Value	NC	NC	NC	NC	NC	1520 ± 40	NC	NC	NC	NC
1641b	NA	NA	NA	NA	NA	1400	NA	NA	NA	NA
Analytical Replicates										
PC-2 Replicate 1	0.003	18.1	0.031 U	0.848	0.41	0.00174	1.47	0.841	2.6 U	1.92
PC-2 Replicate 2	0.004	17.3	0.031 U	0.925	0.31	0.00184	1.04	0.819	2.6 U	1.69
PC-2 Replicate 3	0.003	17.9	0.031 U	0.848	0.36	0.00211	1.43	0.819	2.6 U	1.69
RSD	17%	2%	NA	5%	14%	10%	18%	2%	NA	8%

(a) Method water blank concentrations were determined by using the sediment method blank values in (ng) and dividing by the average volume size of the water sample. The sediment and water samples were extracted together.

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

(c) Procedural blank was processed and analyzed following same procedures as the water samples.

(d) Mean of replicate concentrations.

(e) NC Not certified.

(f) NA Not applicable.

APPENDIX D

10-DAY SOLID-PHASE TEST
96-HOUR REFERENCE TOXICANT TEST
WITH *A. ABDITA*

Table D.1. Results for All Replicates in 10-Day *A. abdita* Solid-Phase Test, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>A. abdita</i></u>		<u>Proportion Surviving</u>	<u>Mean Percent Surviving</u>
		<u>Live</u>	<u>Dead or Missing</u>		
PC-1	1	16	4	0.80	84.0
PC-1	2	19	1	0.95	
PC-1	3	13	7	0.65	
PC-1	4	18	2	0.90	
PC-1	5	18	2	0.90	
PC-1A	1	18	2	0.90	84.0
PC-1A	2	17	3	0.85	
PC-1A	3	15	5	0.75	
PC-1A	4	14	6	0.70	
PC-1A	5	20	0	1.00	
PC-2	1	18	2	0.90	90.0
PC-2	2	19	1	0.95	
PC-2	3	18	2	0.90	
PC-2	4	17	3	0.85	
PC-2	5	18	2	0.90	
PC-4	1	16	4	0.80	88.0
PC-4	2	17	3	0.85	
PC-4	3	20	0	1.00	
PC-4	4	18	2	0.90	
PC-4	5	17	3	0.85	
PC-5	1	18	2	0.90	87.0
PC-5	2	18	2	0.90	
PC-5	3	18	2	0.90	
PC-5	4	16	4	0.80	
PC-5	5	17	3	0.85	
Reference	1	20	0	1.00	88.0
Reference	2	16	4	0.80	
Reference	3	19	1	0.95	
Reference	4	16	4	0.80	
Reference	5	17	3	0.85	
<i>A. abdita</i> Control	1	18	2	0.90	85.0
<i>A. abdita</i> Control	2	19	1	0.95	
<i>A. abdita</i> Control	3	17	3	0.85	
<i>A. abdita</i> Control	4	13	7	0.65	
<i>A. abdita</i> Control	5	18	2	0.90	

TABLE D.2. Water Quality Summary for 10-Day *A. abdita* Solid-Phase Test, Panama City Harbor Project

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	18.0	22.0	7.30	8.30	≥6.0		28.0	32.0
PC-1	18.2	20.7	7.46	8.08	6.3	7.5	30.5	32.0
PC-1A	18.1	20.5	7.64	8.07	6.1	7.4	30.5	32.0
PC-2	18.2	20.6	7.65	8.07	6.1	7.4	30.5	32.0
PC-4	18.2	20.9	7.64	8.07	6.1	7.5	30.0	32.0
PC-5	18.2	20.6	7.70	8.09	6.2	7.4	31.0	32.0
Reference	18.2	21.2	7.60	8.12	6.0	7.4	31.0	32.0
<i>A. abdita</i> Control	18.2	21.2	7.59	8.07	6.0	7.4	30.5	32.0

TABLE D.3. Results for All Replicates in 96-Hour *A. abdita* Reference Toxicant Test, Panama City Harbor Project

Cadmium Concentration (mg/L)	Replicate	<i>A. abdita</i>			Mean Percent Surviving
		Live	Dead or Missing	Proportion Surviving	
0.0	1	19	1	0.95	90.0
0.0	2	19	1	0.95	
0.0	3	16	4	0.80	
0.5	1	18	2	0.90	91.7
0.5	2	18	2	0.90	
0.5	3	19	1	0.95	
1.0	1	15	5	0.75	70.0
1.0	2	15	5	0.75	
1.0	3	12	8	0.60	
2.0	1	5	15	0.25	20.0
2.0	2	1	19	0.05	
2.0	3	6	14	0.30	
4.0	1	0	20	0.00	0.0
4.0	2	0	20	0.00	
4.0	3	0	20	0.00	

TABLE D.4. Water Quality Summary for 96-Hour *A. abdita* Reference Toxicant Test, Panama City Harbor Project

Cadmium Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	18.0	22.0	7.30	8.30	≥6.0		28.0	32.0
0.0	18.4	19.5	8.01	8.35 ^(a)	6.8	7.5	31.0	32.0
0.25	18.4	19.5	8.01	8.35 ^(a)	7.2	7.5	30.5	32.0
0.5	18.3	19.6	8.00	8.33 ^(a)	7.1	7.4	31.0	32.0
1.0	18.4	19.7	8.00	8.33 ^(a)	7.0	7.6	31.0	32.0
2.0	18.4	19.5	7.98	8.28	7.2	7.4	31.0	32.0

(a) Value outside of acceptable range.

APENDIX E

10-DAY SOLID-PHASE TEST
96-HOUR REFERENCE TOXICANT TEST
WITH *R. ABRONIUS*

Table E.1. Results for All Replicates in 10-Day *R. abronius*
Solid-Phase Test, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>R. abronius</i></u>			<u>Mean Percent Surviving</u>
		<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
PC-1	1	20	0	1.00	93.0
PC-1	2	16	4	0.80	
PC-1	3	19	1	0.95	
PC-1	4	18	2	0.90	
PC-1	5	20	0	1.00	
PC-1A	1	18	2	0.90	95.0
PC-1A	2	20	0	1.00	
PC-1A	3	19	1	0.95	
PC-1A	4	18	2	0.90	
PC-1A	5	20	0	1.00	
PC-2	1	9	11	0.45	61.0
PC-2	2	14	6	0.70	
PC-2	3	10	10	0.50	
PC-2	4	18	2	0.90	
PC-2	5	10	10	0.50	
PC-4	1	20	0	1.00	98.0
PC-4	2	18	2	0.90	
PC-4	3	20	0	1.00	
PC-4	4	20	0	1.00	
PC-4	5	20	0	1.00	
PC-5	1	19	1	0.95	91.0
PC-5	2	17	3	0.85	
PC-5	3	20	0	1.00	
PC-5	4	19	1	0.95	
PC-5	5	16	4	0.80	
Reference	1	19	1	0.95	92.0
Reference	2	19	1	0.95	
Reference	3	20	0	1.00	
Reference	4	15	5	0.75	
Reference	5	19	1	0.95	
<i>R. abronius</i> Control	1	20	0	1.00	100.0
<i>R. abronius</i> Control	2	20	0	1.00	
<i>R. abronius</i> Control	3	20	0	1.00	
<i>R. abronius</i> Control	4	20	0	1.00	
<i>R. abronius</i> Control	5	20	0	1.00	

TABLE E.2. Water Quality Summary for *R. abronius* 10-Day Solid-Phase Test, Panama City Harbor Project

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	13.0	17.0	7.30	8.30	≥6.0		28.0	32.0
PC-1	14.4	15.7	7.86	8.18	7.2	8.1	31.5	32.0
PC-1A	14.6	15.7	8.05	8.25	7.3	8.1	30.5	32.0
PC-2	14.6	15.9	8.02	8.22	7.3	8.3	31.0	32.0
PC-4	14.5	15.8	8.00	8.23	7.4	8.0	31.5	32.0
PC-5	14.4	15.7	8.04	8.23	7.0	8.1	31.0	32.5 ^(a)
Reference	14.5	15.7	7.92	8.27	6.8	8.2	31.5	32.0
<i>R. abronius</i> control	14.5	15.6	7.79	8.18	7.5	8.3	31.5	32.0

(a) Value outside of acceptable range.

TABLE E.3. Results for All Replicates in 96-Hour *R. abronius* Reference Toxicant Test, Panama City Harbor Project

Cadmium Concentration (mg/L)	Replicate	<u><i>R. abronius</i></u>			Mean Percent Surviving
		<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
0.0	1	18	2	0.90	95.0
0.0	2	20	0	1.00	
0.0	3	19	1	0.95	
0.5	1	18	2	0.90	91.7
0.5	2	18	2	0.90	
0.5	3	19	1	0.95	
1.0	1	13	7	0.65	65.0
1.0	2	12	8	0.60	
1.0	3	14	6	0.70	
2.0	1	9	11	0.45	40.0
2.0	2	7	13	0.35	
2.0	3	8	12	0.40	
4.0	1	0	20	0.00	6.7
4.0	2	3	17	0.15	
4.0	3	1	19	0.05	

TABLE E.4. Water Quality Summary for *R. abronius* 96-Hour Reference Toxicant Test, Panama City Harbor Project

Cadmium Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	13.0	17.0	7.30	8.30	≥6.0		28.0	32.0
0.0	14.4	14.8	8.02	8.28	7.7	8.2	31.5	32.0
0.5	14.3	14.7	8.07	8.28	7.8	8.2	32.0	32.0
1.0	14.5	14.7	7.90	8.28	7.7	8.1	32.0	32.0
2.0	14.4	14.7	7.91	8.21	7.9	8.4	31.5	32.0
4.0	14.4	14.7	7.87	8.14	7.5	8.5	32.0	32.0

APPENDIX F

10-DAY SOLID-PHASE TEST
WITH *N. VIRENS*

TABLE F.1. Results for All Replicates in 10-Day *N. virens* Solid-Phase Test, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>N. virens</i></u>			<u>Mean Percent Surviving</u>
		<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
PC-1	1	19	1	0.95	96.0
PC-1	2	20	0	1.00	
PC-1	3	20	0	1.00	
PC-1	4	19	1	0.95	
PC-1	5	18	2	0.90	
PC-1A	1	20	0	1.00	99.0
PC-1A	2	19	1	0.95	
PC-1A	3	20	0	1.00	
PC-1A	4	20	0	1.00	
PC-1A	5	20	0	1.00	
PC-2	1	20	0	1.00	97.0
PC-2	2	19	1	0.95	
PC-2	3	20	0	1.00	
PC-2	4	20	0	1.00	
PC-2	5	18	2	0.90	
PC-4	1	20	0	1.00	98.0
PC-4	2	20	0	1.00	
PC-4	3	20	0	1.00	
PC-4	4	19	1	0.95	
PC-4	5	19	1	0.95	
PC-5	1	19	1	0.95	99.0
PC-5	2	20	0	1.00	
PC-5	3	20	0	1.00	
PC-5	4	20	0	1.00	
PC-5	5	20	0	1.00	
Reference	1	20	0	1.00	96.0
Reference	2	17	3	0.85	
Reference	3	20	0	1.00	
Reference	4	20	0	1.00	
Reference	5	19	1	0.95	
<i>N. virens</i> Control	1	19	1	0.95	96.0
<i>N. virens</i> Control	2	20	0	1.00	
<i>N. virens</i> Control	3	20	0	1.00	
<i>N. virens</i> Control	4	18	2	0.90	
<i>N. virens</i> Control	5	19	1	0.95	

TABLE F.2. Water Quality Summary for *N. virens* 10-Day Solid-Phase Test, Panama City Harbor Project

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	≥6.0		28.0	32.0
PC-1	14.8	15.8	7.77	8.04	7.0	8.1	31.0	32.0
PC-1A	14.7	16.1	7.71	8.02	6.7	7.9	30.5	32.0
PC-2	14.8	16.0	7.73	7.95	7.0	7.8	31.0	32.5
PC-4	14.9	16.1	7.73	8.01	7.0	7.7	30.5	32.0
PC-5	14.8	15.9	7.71	7.99	7.1	7.9	30.5	32.0
Reference	14.9	16.0	7.74	7.96	6.2	7.8	30.5	32.0
<i>N. virens</i> Control	14.8	15.9	7.69	7.92	7.1	7.7	31.0	32.0

APPENDIX G

28-DAY SOLID-PHASE TEST
WITH *N. VIRENS*

TABLE G.1. Results for All Replicates in 23-Day *M. virens* Solid-Phase Test, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>N. virens</i></u>			<u>Mean Percent Surviving</u>
		<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
PC-1	1	19	1	0.95	96.0
PC-1	2	20	0	1.00	
PC-1	3	19	1	0.95	
PC-1	4	18	2	0.90	
PC-1	5	20	0	1.00	
PC-1A	1	19	1	0.95	96.0
PC-1A	2	20	0	1.00	
PC-1A	3	20	0	1.00	
PC-1A	4	17	3	0.85	
PC-1A	5	20	0	1.00	
PC-2	1	19	1	0.95	88.0
PC-2	2	18	2	0.90	
PC-2	3	19	1	0.95	
PC-2	4	19	1	0.95	
PC-2	5	13	7	0.65	
PC-4	1	20	0	1.00	98.0
PC-4	2	20	0	1.00	
PC-4	3	19	1	0.95	
PC-4	4	19	1	0.95	
PC-4	5	20	0	1.00	
PC-5	1	20	0	1.00	97.0
PC-5	2	19	1	0.95	
PC-5	3	19	1	0.95	
PC-5	4	20	0	1.00	
PC-5	5	19	1	0.95	
Reference	1	20	0	1.00	98.0
Reference	2	20	0	1.00	
Reference	3	19	1	0.95	
Reference	4	19	1	0.95	
Reference	5	20	0	1.00	
<i>N. virens</i> Control	1	19	1	0.95	92.0
<i>N. virens</i> Control	2	19	1	0.95	
<i>N. virens</i> Control	3	17	3	0.85	
<i>N. virens</i> Control	4	19	1	0.95	
<i>N. virens</i> Control	5	18	2	0.90	

TABLE G.2. Water Quality Summary for *N. virens* 28-Day Solid-Phase Test, Panama City Harbor Project

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.30	8.30	≥6.0		28.0	32.0
PC-1	14.8	16.5	7.73	7.99	7.0	8.1	31.0	32.0
PC-1A	14.8	16.5	7.73	7.96	7.0	8.0	30.5	32.0
PC-2	14.7	16.4	7.61	7.99	6.6	8.1	30.0	32.0
PC-4	14.8	16.4	7.60	7.99	7.0	8.1	30.5	32.0
PC-5	14.8	16.6	7.60	8.00	7.0	8.2	31.0	32.0
Reference	14.8	16.2	7.53	7.98	6.7	8.0	31.0	32.0
<i>N. virens</i> Control	14.8	16.3	7.61	7.94	7.0	8.1	30.5	32.0

APPENDIX H

28-DAY SOLID-PHASE TEST
WITH M. NASUTA

TABLE H.1. Results for All Replicates in 28-Day *M. nasuta* Solid-Phase Test, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u><i>M. nasuta</i></u>			<u>Mean Percent Surviving</u>
		<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
PC-1	1	25	0	1.00	100.0
PC-1	2	25	0	1.00	
PC-1	3	25	0	1.00	
PC-1	4	25	0	1.00	
PC-1	5	25	0	1.00	
PC-1A	1	25	0	1.00	100.0
PC-1A	2	25	0	1.00	
PC-1A	3	25	0	1.00	
PC-1A	4	25	0	1.00	
PC-1A	5	25	0	1.00	
PC-2	1	25	0	1.00	100.0
PC-2	2	25	0	1.00	
PC-2	3	25	0	1.00	
PC-2	4	25	0	1.00	
PC-2	5	25	0	1.00	
PC-4	1	25	0	1.00	99.2
PC-4	2	25	0	1.00	
PC-4	3	24	1	0.96	
PC-4	4	25	0	1.00	
PC-4	5	25	0	1.00	
PC-5	1	25	0	1.00	96.8
PC-5	2	24	1	0.96	
PC-5	3	23	2	0.92	
PC-5	4	24	1	0.96	
PC-5	5	25	0	1.00	
Reference	1	24	1	0.96	95.2
Reference	2	24	1	0.96	
Reference	3	24	1	0.96	
Reference	4	23	2	0.92	
Reference	5	24	1	0.96	
<i>M. nasuta</i> Control	1	23	2	0.92	96.0
<i>M. nasuta</i> Control	2	24	1	0.96	
<i>M. nasuta</i> Control	3	25	0	1.00	
<i>M. nasuta</i> Control	4	23	2	0.92	
<i>M. nasuta</i> Control	5	25	0	1.00	

TABLE H.2. Water Quality Summary for *M. nasuta* 28-Day Solid-Phase Test, Panama City Harbor Project

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	13.0	17.0	7.30	8.30	≥6.0		28.0	32.0
PC-1	14.8	16.4	7.75	8.00	7.1	8.3	30.5	32.0
PC-1A	14.8	16.3	7.73	8.00	7.1	8.1	31.0	32.0
PC-2	14.8	16.2	7.73	7.96	7.1	8.1	30.5	32.0
PC-4	14.8	16.2	7.73	8.10	7.1	8.1	30.5	32.0
PC-5	14.9	16.4	7.76	7.98	7.1	8.1	30.5	32.0
Reference	14.8	16.5	7.71	8.00	7.0	8.1	30.5	32.0
<i>M. nasuta</i> Control	14.9	16.9	7.69	7.98	6.9	8.3	30.5	32.0

APPENDIX I

96-HOUR SUSPENDED-PARTICULATE-PHASE TEST
96-HOUR REFERENCE TOXICANT TEST
WITH M. BAHIA

TABLE I.1. Results for All Replicates in 96-Hour *M. bahia* Suspended-Particulate-Phase Test, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Concentration Percent SPP</u>	<u>Replicate</u>	<u><i>M. bahia</i></u>			<u>Mean Percent Surviving</u>
			<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
PC-1	0	1	10	0	1.00	100.0
PC-1	0	2	10	0	1.00	
PC-1	0	3	10	0	1.00	
PC-1	0	4	10	0	1.00	
PC-1	0	5	10	0	1.00	
PC-1	10	1	10	0	1.00	96.0
PC-1	10	2	10	0	1.00	
PC-1	10	3	9	1	0.90	
PC-1	10	4	10	0	1.00	
PC-1	10	5	9	1	0.90	
PC-1	50	1	10	0	1.00	100.0
PC-1	50	2	10	0	1.00	
PC-1	50	3	10	0	1.00	
PC-1	50	4	10	0	1.00	
PC-1	50	5	10	0	1.00	
PC-1	100	1	9	1	0.90	94.0
PC-1	100	2	10	0	1.00	
PC-1	100	3	9	1	0.90	
PC-1	100	4	9	1	0.90	
PC-1	100	5	10	0	1.00	
PC-1A	0	1	10	0	1.00	98.0
PC-1A	0	2	9	1	0.90	
PC-1A	0	3	10	0	1.00	
PC-1A	0	4	10	0	1.00	
PC-1A	0	5	10	0	1.00	
PC-1A	10	1	10	0	1.00	98.0
PC-1A	10	2	9	1	0.90	
PC-1A	10	3	10	0	1.00	
PC-1A	10	4	10	0	1.00	
PC-1A	10	5	10	0	1.00	
PC-1A	50	1	10	0	1.00	98.0
PC-1A	50	2	10	0	1.00	
PC-1A	50	3	10	0	1.00	
PC-1A	50	4	10	0	1.00	
PC-1A	50	5	9	1	0.90	

TABLE I.1. (contd)

<u>Sediment Treatment</u>	<u>Concentration Percent SPP</u>	<u>Replicate</u>	<u>M. bahia</u>			<u>Mean Percent Surviving</u>
			<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
PC-1A	100	1	10	0	1.00	96.0
PC-1A	100	2	9	1	0.90	
PC-1A	100	3	10	0	1.00	
PC-1A	100	4	10	0	1.00	
PC-1A	100	5	9	1	0.90	
PC-2	0	1	10	0	1.00	98.0
PC-2	0	2	10	0	1.00	
PC-2	0	3	10	0	1.00	
PC-2	0	4	10	0	1.00	
PC-2	0	5	9	1	0.90	
PC-2	10	1	10	0	1.00	96.0
PC-2	10	2	9	1	0.90	
PC-2	10	3	9	1	0.90	
PC-2	10	4	10	0	1.00	
PC-2	10	5	10	0	1.00	
PC-2	50	1	10	0	1.00	98.0
PC-2	50	2	10	0	1.00	
PC-2	50	3	10	0	1.00	
PC-2	50	4	10	0	1.00	
PC-2	50	5	9	1	0.90	
PC-2	100	1	10	0	1.00	100.0
PC-2	100	2	10	0	1.00	
PC-2	100	3	10	0	1.00	
PC-2	100	4	10	0	1.00	
PC-2	100	5	10	0	1.00	
PC-4	0	1	10	0	1.00	98.0
PC-4	0	2	10	0	1.00	
PC-4	0	3	10	0	1.00	
PC-4	0	4	9	1	0.90	
PC-4	0	5	10	0	1.00	
PC-4	10	1	10	0	1.00	100.0
PC-4	10	2	10	0	1.00	
PC-4	10	3	10	0	1.00	
PC-4	10	4	10	0	1.00	
PC-4	10	5	10	0	1.00	

TABLE I.1. (contd)

Sediment Treatment	Concentration Percent SPP	Replicate	<i>M. bahia</i>			Mean Percent Surviving
			Live	Dead or Missing	Proportion Surviving	
PC-4	50	1	10	0	1.00	100.0
PC-4	50	2	10	0	1.00	
PC-4	50	3	10	0	1.00	
PC-4	50	4	10	0	1.00	
PC-4	50	5	10	0	1.00	
PC-4	100	1	10	0	1.00	100.0
PC-4	100	2	10	0	1.00	
PC-4	100	3	10	0	1.00	
PC-4	100	4	10	0	1.00	
PC-4	100	5	10	0	1.00	
PC-5	0	1	10	0	1.00	100.0
PC-5	0	2	10	0	1.00	
PC-5	0	3	10	0	1.00	
PC-5	0	4	10	0	1.00	
PC-5	0	5	10	0	1.00	
PC-5	10	1	9	1	0.90	98.0
PC-5	10	2	10	0	1.00	
PC-5	10	3	10	0	1.00	
PC-5	10	4	10	0	1.00	
PC-5	10	5	10	0	1.00	
PC-5	50	1	10	0	1.00	100.0
PC-5	50	2	10	0	1.00	
PC-5	50	3	10	0	1.00	
PC-5	50	4	10	0	1.00	
PC-5	50	5	10	0	1.00	
PC-5	100	1	10	0	1.00	100.0
PC-5	100	2	10	0	1.00	
PC-5	100	3	10	0	1.00	
PC-5	100	4	10	0	1.00	
PC-5	100	5	10	0	1.00	
Reference	0	1	10	0	1.00	100.0
Reference	0	2	10	0	1.00	
Reference	0	3	10	0	1.00	
Reference	0	4	10	0	1.00	
Reference	0	5	10	0	1.00	

TABLE I.1. (contd)

<u>Sediment Treatment</u>	<u>Concentration Percent SPP</u>	<u>Replicate</u>	<u>M. bahia</u>			<u>Mean Percent Surviving</u>
			<u>Live</u>	<u>Dead or Missing</u>	<u>Proportion Surviving</u>	
Reference	10	1	10	0	1.00	98.0
Reference	10	2	10	0	1.00	
Reference	10	3	9	1	0.90	
Reference	10	4	10	0	1.00	
Reference	10	5	10	0	1.00	
Reference	50	1	10	0	1.00	100.0
Reference	50	2	10	0	1.00	
Reference	50	3	10	0	1.00	
Reference	50	4	10	0	1.00	
Reference	50	5	10	0	1.00	
Reference	100	1	10	0	1.00	98.0
Reference	100	2	10	0	1.00	
Reference	100	3	10	0	1.00	
Reference	100	4	10	0	1.00	
Reference	100	5	9	1	0.90	

TABLE I.2. Water Quality Summary for 96-Hour *M. bahia* Suspended-Particulate-Phase Test, Panama City Harbor Project

Sediment Treatment	Concentration Percent SPP	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range		18.0	22.0	7.30	8.30	≥4.0		28.0	32.0
PC-1	0	19.2	20.3	7.88	8.35 ^(a)	6.8	7.8	28.0	30.5
PC-1	10	19.3	20.2	8.06	8.35 ^(a)	6.7	7.8	27.0 ^(a)	31.0
PC-1	50	19.2	20.1	8.01	8.28	6.7	7.9	28.0	30.5
PC-1	100	19.3	20.4	7.96	8.25	6.7	8.0	28.0	40.0 ^(a)
PC-1A	0	19.1	20.2	7.69	8.27	6.3	8.1	30.0	31.5
PC-1A	10	19.3	20.1	7.95	8.26	6.7	8.0	30.0	32.0
PC-1A	50	19.2	20.4	7.89	8.27	6.5	7.9	29.0	31.5
PC-1A	100	19.4	20.1	8.01	8.27	6.7	7.7	28.0	30.5
PC-2	0	19.1	20.3	7.87	8.36 ^(a)	6.7	7.9	28.0	30.0
PC-2	10	19.1	20.5	7.92	8.36	6.6	8.1	28.5	33.0 ^(a)
PC-2	50	19.1	20.4	8.05	8.27	6.6	8.0	29.0	31.5
PC-2	100	19.3	20.4	7.99	8.30	6.6	7.7	28.0	30.0
PC-4	0	19.2	20.2	7.82	8.23	6.3	8.0	28.0	30.5
PC-4	10	19.3	20.1	7.81	8.29	6.5	7.8	28.0	32.0
PC-4	50	19.2	20.2	7.92	8.26	6.4	7.6	28.0	33.5 ^(a)
PC-4	100	19.2	20.3	7.77	8.19	6.3	7.5	28.0	32.0
PC-5	0	18.8	20.3	7.95	8.17 ^(a)	6.5	7.9	30.0	30.5
PC-5	10	19.0	20.3	7.87	8.34 ^(a)	6.3	7.7	29.0	30.0
PC-5	50	18.9	20.4	7.75	8.28	6.0	7.6	28.0	31.5
PC-5	100	19.2	20.2	8.03	8.22	6.4	7.5	29.0	32.0
Reference	0	19.4	20.0	7.98	8.36 ^(a)	6.4	7.7	29.0	30.5
Reference	10	19.3	20.1	7.95	8.32 ^(a)	6.4	7.7	29.0	32.5 ^(a)
Reference	50	19.2	20.3	7.86	8.19	6.4	7.5	29.0	31.0
Reference	100	19.1	20.5	7.87	8.19	6.2	7.3	29.0	45.0 ^(a)

(a) Value outside of acceptable range.

TABLE I.3. Results for All Replicates in 96-Hour *M. bahia* Reference
Toxicant Test, Panama City Harbor Project

Copper Concentration ($\mu\text{g/L}$)	Replicate	<i>M. bahia</i>			Mean Percent Surviving
		Live	Dead or Missing	Proportion Surviving	
0	1	10	0	1.00	100.0
0	2	10	0	1.00	
0	3	10	0	1.00	
32	1	10	0	1.00	100.0
32	2	10	0	1.00	
32	3	10	0	1.00	
80	1	10	0	1.00	96.7
80	2	10	0	1.00	
80	3	9	1	0.90	
200	1	7	3	0.70	86.7
200	2	9	1	0.90	
200	3	10	0	1.00	
500	1	2	8	0.20	23.3
500	2	3	7	0.30	
500	3	2	8	0.20	

TABLE I.4. Water Quality Summary for 96-Hour *M. bahia* Reference Toxicant Test, Panama City Harbor Project

Copper Concentration ($\mu\text{g/L}$)	Temperature ($^{\circ}\text{C}$)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	18.0	22.0	7.30	8.30	≥ 4.0		28.0	32.0
0	19.7	20.1	7.78	8.27	6.3	7.5	31.0	34.0 ^(a)
32	19.7	20.2	7.78	8.27	6.3	7.5	31.0	33.5 ^(a)
80	19.6	20.2	7.79	8.26	6.4	7.3	31.0	33.5 ^(a)
200	19.4	20.2	7.77	8.26	6.4	7.3	31.0	33.0 ^(a)
500	19.5	20.3	7.76	8.26	6.3	7.2	31.0	34.0 ^(a)

(a) Value outside of acceptable range.

APPENDIX J

96-HOUR SUSPENDED-PARTICULATE-PHASE TEST
96-HOUR REFERENCE TOXICANT TEST
WITH *M. BERYLLINA*

TABLE J.1. Results for All Replicates in 96-Hour *M. beryllina* Suspended-Particulate-Phase Test, Panama City Harbor Project

Sediment Treatment	Concentration Percent SPP	Replicate	<i>M. beryllina</i>			Mean Percent Surviving
			Live	Dead or Missing	Proportion Surviving	
PC-1	0	1	10	0	1.00	98.0
PC-1	0	2	10	0	1.00	
PC-1	0	3	9	1	0.90	
PC-1	0	4	10	0	1.00	
PC-1	0	5	10	0	1.00	
PC-1	10	1	10	0	1.00	100.0
PC-1	10	2	10	0	1.00	
PC-1	10	3	10	0	1.00	
PC-1	10	4	10	0	1.00	
PC-1	10	5	10	0	1.00	
PC-1	50	1	10	0	1.00	98.0
PC-1	50	2	10	0	1.00	
PC-1	50	3	10	0	1.00	
PC-1	50	4	9	1	0.90	
PC-1	50	5	10	0	1.00	
PC-1	100	1	10	0	1.00	100.0
PC-1	100	2	10	0	1.00	
PC-1	100	3	10	0	1.00	
PC-1	100	4	10	0	1.00	
PC-1	100	5	10	0	1.00	
PC-1A	0	1	10	0	1.00	98.0
PC-1A	0	2	10	0	1.00	
PC-1A	0	3	9	1	0.90	
PC-1A	0	4	10	0	1.00	
PC-1A	0	5	10	0	1.00	
PC-1A	10	1	9	1	0.90	98.0
PC-1A	10	2	10	0	1.00	
PC-1A	10	3	10	0	1.00	
PC-1A	10	4	10	0	1.00	
PC-1A	10	5	10	0	1.00	
PC-1A	50	1	10	0	1.00	100.0
PC-1A	50	2	10	0	1.00	
PC-1A	50	3	10	0	1.00	
PC-1A	50	4	10	0	1.00	
PC-1A	50	5	10	0	1.00	

TABLE J.1. (contd)

Sediment Treatment	Concentration Percent SPP	Replicate	<i>M. beryllina</i>			Mean Percent Surviving
			Live	Dead or Missing	Proportion Surviving	
PC-1A	100	1	10	0	1.00	100.0
PC-1A	100	2	10	0	1.00	
PC-1A	100	3	10	0	1.00	
PC-1A	100	4	10	0	1.00	
PC-1A	100	5	10	0	1.00	
PC-2	0	1	10	0	1.00	100.0
PC-2	0	2	10	0	1.00	
PC-2	0	3	10	0	1.00	
PC-2	0	4	10	0	1.00	
PC-2	0	5	10	0	1.00	
PC-2	10	1	10	0	1.00	98.0
PC-2	10	2	10	0	1.00	
PC-2	10	3	10	0	1.00	
PC-2	10	4	9	1	0.90	
PC-2	10	5	10	0	1.00	
PC-2	50	1	9	1	0.90	98.0
PC-2	50	2	10	0	1.00	
PC-2	50	3	10	0	1.00	
PC-2	50	4	10	0	1.00	
PC-2	50	5	10	0	1.00	
PC-2	100	1	10	0	1.00	100.0
PC-2	100	2	10	0	1.00	
PC-2	100	3	10	0	1.00	
PC-2	100	4	10	0	1.00	
PC-2	100	5	10	0	1.00	
PC-4	0	1	10	0	1.00	100.0
PC-4	0	2	10	0	1.00	
PC-4	0	3	10	0	1.00	
PC-4	0	4	10	0	1.00	
PC-4	0	5	10	0	1.00	
PC-4	10	1	10	0	1.00	98.0
PC-4	10	2	10	0	1.00	
PC-4	10	3	10	0	1.00	
PC-4	10	4	10	0	1.00	
PC-4	10	5	9	1	0.90	

TABLE J.1. (contd)

Sediment Treatment	Concentration Percent SPP	Replicate	<i>M. beryllina</i>			Mean Percent Surviving
			Live	Dead or Missing	Proportion Surviving	
PC-4	50	1	10	0	1.00	98.0
PC-4	50	2	10	0	1.00	
PC-4	50	3	10	0	1.00	
PC-4	50	4	9	1	0.90	
PC-4	50	5	10	0	1.00	
PC-4	100	1	10	0	1.00	98.0
PC-4	100	2	10	0	1.00	
PC-4	100	3	10	0	1.00	
PC-4	100	4	10	0	1.00	
PC-4	100	5	9	1	0.90	
PC-5	0	1	10	0	1.00	98.0
PC-5	0	2	9	1	0.90	
PC-5	0	3	10	0	1.00	
PC-5	0	4	10	0	1.00	
PC-5	0	5	10	0	1.00	
PC-5	10	1	10	0	1.00	100.0
PC-5	10	2	10	0	1.00	
PC-5	10	3	10	0	1.00	
PC-5	10	4	10	0	1.00	
PC-5	10	5	10	0	1.00	
PC-5	50	1	10	0	1.00	98.0
PC-5	50	2	9	1	0.90	
PC-5	50	3	10	0	1.00	
PC-5	50	4	10	0	1.00	
PC-5	50	5	10	0	1.00	
PC-5	100	1	9	1	0.90	96.0
PC-5	100	2	9	1	0.90	
PC-5	100	3	10	0	1.00	
PC-5	100	4	10	0	1.00	
PC-5	100	5	10	0	1.00	
Reference	0	1	10	0	1.00	98.0
Reference	0	2	10	0	1.00	
Reference	0	3	10	0	1.00	
Reference	0	4	10	0	1.00	
Reference	0	5	9	1	0.90	

TABLE J.1. (contd)

Sediment Treatment	Concentration Percent SPP	Replicate	<u>M. beryllina</u>			Mean Percent Surviving
			Live	Dead or Missing	Proportion Surviving	
Reference	10	1	10	0	1.00	
Reference	10	2	10	0	1.00	
Reference	10	3	10	0	1.00	
Reference	10	4	10	0	1.00	
Reference	10	5	9	1	0.90	98.0
Reference	50	1	9	1	0.90	
Reference	50	2	9	1	0.90	
Reference	50	3	10	0	1.00	
Reference	50	4	10	0	1.00	
Reference	50	5	10	0	1.00	96.0
Reference	100	1	10	0	1.00	
Reference	100	2	10	0	1.00	
Reference	100	3	9	1	0.90	
Reference	100	4	10	0	1.00	
Reference	100	5	10	0	1.00	98.0

TABLE J.2. Water Quality Summary for 96-Hour *M. beryllina* Suspended-Particulate-Phase Test, Panama City Harbor Project

Sediment Treatment	Concentration Percent SPP	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range		18.0	22.0	7.30	8.30	≥4.0		28.0	32.0
PC-1	0	19.3	20.8	7.93	8.21	6.5	8.1	30.0	31.5
PC-1	10	19.7	20.8	8.00	8.18	6.6	8.2	29.5	31.5
PC-1	50	19.9	20.7	7.89	8.17	6.5	7.7	30.0	32.0
PC-1	100	19.7	20.8	7.84	8.19	6.2	7.5	30.0	32.0
PC-1A	0	19.9	20.9	7.70	8.17	6.0	7.7	30.5	32.0
PC-1A	10	19.7	20.9	7.87	8.16	6.3	7.8	30.5	32.0
PC-1A	50	20.0	21.0	7.84	8.17	6.5	7.7	30.5	33.0 ^(a)
PC-1A	100	19.9	20.8	7.88	8.17	6.4	7.5	30.5	32.0
PC-2	0	19.7	20.8	7.92	8.17	6.3	8.3	28.0	29.5
PC-2	10	19.7	20.8	7.49	8.18	4.5	8.2	28.5	30.5
PC-2	50	20.0	20.8	7.95	8.16	6.4	7.7	30.0	31.5
PC-2	100	19.7	20.8	7.92	8.22	6.3	7.5	30.5	32.0
PC-4	0	19.5	20.8	7.73	8.18	5.6	7.9	30.5	32.0
PC-4	10	19.5	20.8	7.91	8.17	6.1	7.6	30.5	32.0
PC-4	50	19.6	20.8	7.89	8.26	6.3	7.6	30.5	32.0
PC-4	100	19.6	20.8	7.98	8.19	6.3	7.6	30.0	32.0
PC-5	0	19.4	20.8	7.77	8.17	6.0	7.6	29.5	31.5
PC-5	10	19.4	20.8	7.61	8.17	4.5	7.6	30.5	31.5
PC-5	50	19.5	20.8	7.99	8.16	6.2	7.5	30.5	32.0
PC-5	100	19.4	20.8	7.46	8.16	4.7	7.2	30.5	32.0
Reference	0	19.2	20.8	7.97	8.18	6.1	7.9	30.5	32.0
Reference	10	19.1	20.8	7.96	8.17	6.4	7.7	30.5	32.0
Reference	50	19.2	20.8	7.58	8.08	5.9	7.1	30.5	32.0
Reference	100	19.2	20.9	7.54	8.16	4.7	7.2	30.5	32.0

(a) Value outside of acceptable range.

TABLE J.3. Results for All Replicates in 96-Hour *M. beryllina* Reference Toxicant Test, Panama City Harbor Project

Copper Concentration ($\mu\text{g/L}$)	Replicate	<i>M. beryllina</i>			Mean Percent Surviving
		Live	Dead or Missing	Proportion Surviving	
0	1	10	0	1.00	100.0
0	2	10	0	1.00	
0	3	10	0	1.00	
16	1	10	0	1.00	96.7
16	2	10	0	1.00	
16	3	9	1	0.90	
64	1	10	0	1.00	96.7
64	2	9	0	0.90	
64	3	10	0	1.00	
160	1	1	9	0.10	10.0
160	2	1	9	0.10	
160	3	1	9	0.10	
400	1	0	10	0.00	0.0
400	2	0	10	0.00	
400	3	0	10	0.00	

TABLE J.4. Water Quality Summary for 96-Hour *M. beryllina* Reference Toxicant Test, Panama City Harbor Project

Copper Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable range	18.0	22.0	7.30	8.30	≥6.0		28.0	32.0
0	18.1	19.5	7.73	8.16	6.5	7.5	32.0	32.5 ^(a)
16	18.1	19.4	7.75	8.15	6.8	7.6	32.0	32.5 ^(a)
64	18.2	19.5	7.75	8.09	6.8	7.5	32.0	32.0
160	18.1	19.6	7.75	8.25	7.0	7.4	32.0	32.0
640	18.1	19.5	7.74	8.23	6.9	7.5	32.0	32.0

(a) Value outside of acceptable range.

APPENDIX K

72-HOUR SUSPENDED-PARTICULATE-PHASE TEST
72-HOUR REFERENCE TOXICANT TEST
WITH *M. EDULIS*

TABLE K.1. Results for All Replicates in 72-Hour *M. edulis* Suspended-Particulate-Phase Test, Panama City Harbor Project

Sediment Treatment	Concentration Percent SPP	Replicate	Normal D-Shaped Shell	Abnormal with Shell	Other	Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
PC-1	0	1	199	11	6	79.92		86.75	
PC-1	0	2	185	26	13	74.30		89.96	
PC-1	0	3	222	23	6	89.16		100.00 ^(b)	
PC-1	0	4	219	1	11	87.95		92.77	
PC-1	0	5	195	12	6	78.31	81.93	85.54	91.00
PC-1	10	1	162	2	1	65.06		66.27	
PC-1	10	2	190	2	19	76.31		84.74	
PC-1	10	3	216	1	10	86.75		91.16	
PC-1	10	4	164	2	22	65.86		75.50	
PC-1	10	5	263	3	2	100.00 ^(b)	78.80	100.00 ^(h)	83.53
PC-1	50	1	190	1	9	76.31		80.32	
PC-1	50	2	180	3	4	72.29		75.10	
PC-1	50	3	181	3	14	72.69		79.52	
PC-1	50	4	156	11	12	62.65		71.89	
PC-1	50	5	152	7	11	61.04	69.00	68.27	75.02
PC-1	100	1	234	5	9	93.98		99.60	
PC-1	100	2	174	8	7	69.88		75.90	
PC-1	100	3	209	9	10	83.94		91.57	
PC-1	100	4	221	5	0	88.76		90.76	
PC-1	100	5	234	9	4	93.98	86.10	99.20	91.41
PC-1A	0	1	230	14	7	92.37		100.00 ^(b)	
PC-1A	0	2	174	30	2	69.88		82.73	
PC-1A	0	3	193	10	16	77.51		87.95	
PC-1A	0	4	180	7	8	72.29		78.31	
PC-1A	0	5	240	4	5	96.39	81.69	100.00	89.80
PC-1A	10	1	180	6	17	72.29		81.53	
PC-1A	10	2	197	4	11	79.12		85.14	
PC-1A	10	3	179	6	25	71.89		84.34	
PC-1A	10	4	210	10	13	84.34		93.57	
PC-1A	10	5	213	2	13	85.54	78.63	91.57	87.23
PC-1A	50	1	217	1	11	87.15		91.97	
PC-1A	50	2	205	10	1	82.33		86.75	
PC-1A	50	3	240	2	16	96.39		100.00 ^(b)	
PC-1A	50	4	166	5	5	66.67		70.68	
PC-1A	50	5	194	6	14	77.91	82.09	85.94	87.07
PC-1A	100	1	196	1	23	78.71		88.35	
PC-1A	100	2	192	22	15	77.11		91.97	
PC-1A	100	3	227	2	6	91.16		94.38	
PC-1A	100	4	173	6	10	69.48		75.90	
PC-1A	100	5	191	5	11	76.71	78.63	83.13	86.75
PC-2	0	1	215	15	16	86.35		98.80	
PC-2	0	2	211	21	6	84.74		95.58	
PC-2	0	3	204	6	1	81.93		84.74	
PC-2	0	4	184	12	5	73.90		80.72	
PC-2	0	5	181	6	16	72.69	79.92	81.53	88.27

TABLE K.1. (contd)

Sediment Treatment	Concentration Percent SPP	Replicate	Normal D-Shaped Shell	Abnormal with Shell	Other	Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
PC-2	10	1	206	6	15	82.73		91.16	
PC-2	10	2	207	7	7	83.13		88.76	
PC-2	10	3	189	3	4	75.90		78.71	
PC-2	10	4	218	0	11	87.55		91.97	
PC-2	10	5	215	14	5	86.35	83.13	93.98	88.92
PC-2	50	1	205	11	10	82.33		90.76	
PC-2	50	2	128	0	9	51.41		55.02	
PC-2	50	3	221	3	2	88.76		90.76	
PC-2	50	4	218	0	11	87.55		91.97	
PC-2	50	5	106	1	5	42.57	70.52	44.98	74.70
PC-2	100	1	206	3	8	82.73		87.15	
PC-2	100	2	214	10	2	85.94		90.76	
PC-2	100	3	195	2	11	78.31		83.53	
PC-2	100	4	190	11	2	76.31		81.53	
PC-2	100	5	232	2	10	93.17	83.29	97.99	88.19
PC-4	0	1	178	24	5	71.49		83.13	
PC-4	0	2	158	13	3	63.45		69.88	
PC-4	0	3	194	4	10	77.91		83.53	
PC-4	0	4	226	3	6	90.76		94.38	
PC-4	0	5	158	0	3	63.45	73.41	64.66	79.12
PC-4	10	1	168	8	19	67.47		78.31	
PC-4	10	2	182	1	12	73.09		78.31	
PC-4	10	3	207	17	16	83.13		96.39	
PC-4	10	4	139	6	1	55.82		58.63	
PC-4	10	5	195	9	12	78.31	71.57	86.75	79.68
PC-4	50	1	115	6	14	46.18		54.22	
PC-4	50	2	220	4	17	88.35		96.79	
PC-4	50	3	209	11	7	83.94		91.16	
PC-4	50	4	165	8	13	66.27		74.70	
PC-4	50	5	169	10	3	67.87	70.52	73.09	77.99
PC-4	100	1	202	4	8	81.12		85.94	
PC-4	100	2	216	8	3	86.75		91.16	
PC-4	100	3	223	11	3	89.56		95.18	
PC-4	100	4	148	3	0	59.44		60.64	
PC-4	100	5	191	4	6	76.71	78.71	80.72	82.73
PC-5	0	1	177	8	9	71.08		77.91	
PC-5	0	2	165	7	2	66.27		69.88	
PC-5	0	3	175	12	13	70.28		80.32	
PC-5	0	4	216	4	13	86.75		93.57	
PC-5	0	5	144	21	7	57.83	70.44	69.08	78.15
PC-5	10	1	178	8	6	71.49		77.11	
PC-5	10	2	192	4	6	77.11		81.12	
PC-5	10	3	ND ^(c)	ND	ND	ND		ND	
PC-5	10	4	190	21	7	76.31		87.55	
PC-5	10	5	196	8	9	78.71	75.91	85.54	82.83
PC-5	50	1	197	6	17	79.12		88.35	
PC-5	50	2	223	13	9	89.56		98.39	
PC-5	50	3	201	0	13	80.72		85.94	
PC-5	50	4	205	6	13	82.33		89.96	
PC-5	50	5	188	10	13	75.50	81.45	84.74	89.48

PANAMA CITY HARBOR

K.2

TABLE K.1. (contd)

Sediment Treatment	Concentration Percent SPP	Replicate	Normal D-Shaped Shell	Abnormal with Shell	Other	Percent Normal ^(a)	Mean Percent Normal	Percent Survival ^(a)	Mean Percent Survival
PC-5	100	1	195	15	3	78.31		85.54	
PC-5	100	2	192	2	9	77.11		81.53	
PC-5	100	3	160	6	7	64.26		69.48	
PC-5	100	4	183	16	0	73.49		79.92	
PC-5	100	5	210	1	21	84.34	75.50	93.17	81.93
Reference	0	1	184	10	1	73.90		78.31	
Reference	0	2	222	13	5	89.16		96.39	
Reference	0	3	237	13	0	95.18		100.00 ^(b)	
Reference	0	4	205	7	6	82.33		87.55	
Reference	0	5	198	8	4	79.52	84.02	84.34	89.32
Reference	10	1	241	3	27	96.79		100.00 ^(b)	
Reference	10	2	288	1	17	100.00 ^(b)		100.00 ^(b)	
Reference	10	3	205	4	19	82.33		91.57	
Reference	10	4	224	3	12	89.96		95.98	
Reference	10	5	162	6	2	65.06	86.83	68.27	91.16
Reference	50	1	189	1	26	75.90		86.75	
Reference	50	2	ND	ND	ND	ND		ND	
Reference	50	3	180	4	7	72.29		76.71	
Reference	50	4	173	10	13	69.48		78.71	
Reference	50	5	194	1	11	77.91	73.90	82.73	81.23
Reference	100	1	238	1	6	95.58		98.39	
Reference	100	2	201	3	8	80.72		85.14	
Reference	100	3	200	0	11	80.32		84.74	
Reference	100	4	190	7	7	76.31		81.93	
Reference	100	5	227	1	6	91.16	84.82	93.98	88.84
Brine Control		1	214	2	10	85.94		90.76	
Brine Control		2	150	0	12	60.24		65.06	
Brine Control		3	204	7	10	81.93		88.76	
Brine Control		4	146	0	18	58.63		65.86	
Brine Control		5	194	9	18	77.91	72.93	88.76	79.84

(a) Percent normal and percent survival based on stocking density (average of multicell larvae) of 249 larvae per 10 mL.

(b) A percent survival of 100.00 was used when the number surviving was greater than the stocking density.

(c) ND No data.

TABLE K.2. Water Quality Summary for *M. edulis* 72-Hour Suspended-Particulate-Phase Test, Panama City Harbor Project

Sediment Treatment	Concentration Percent SPP	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range		14.0	18.0	7.30	8.30	≥4.0		28.0	32.0
PC-1	0	15.0	15.4	8.11	8.27	7.4	8.4	30.0	31.5
PC-1	10	15.0	15.5	8.09	8.26	7.5	8.2	30.0	31.5
PC-1	50	15.0	15.7	8.13	8.24	7.4	8.4	30.0	32.0
PC-1	100	15.0	15.7	8.09	8.24	7.5	8.4	30.0	32.0
PC-1A	0	15.0	15.5	8.16	8.25	7.3	8.3	29.5	32.0
PC-1A	10	15.0	15.4	8.16	8.27	7.4	8.1	30.0	32.0
PC-1A	50	15.1	15.6	8.15	8.24	7.4	8.2	30.0	31.0
PC-1A	100	15.0	15.4	8.15	8.25	7.4	8.5	30.0	32.0
PC-2	0	15.0	15.4	8.13	8.27	7.1	8.5	30.0	32.0
PC-2	10	15.1	15.6	8.16	8.26	7.4	8.1	30.0	31.0
PC-2	50	15.0	15.5	8.13	8.24	7.4	8.3	30.0	32.0
PC-2	100	15.0	15.4	8.14	8.27	7.4	8.4	30.0	31.0
PC-4	0	15.1	15.5	8.11	8.27	7.4	8.4	30.0	32.0
PC-4	10	15.0	15.4	8.16	8.25	7.4	8.1	30.0	31.0
PC-4	50	15.0	15.6	8.14	8.25	7.4	8.3	30.0	31.5
PC-4	100	15.0	15.4	8.12	8.26	7.3	8.4	30.0	31.0
PC-5	0	15.0	15.5	8.15	8.27	7.4	8.4	30.0	32.0
PC-5	10	15.0	15.5	8.16	8.26	7.3	8.2	30.0	32.0
PC-5	50	15.1	15.7	8.15	8.26	7.3	8.3	30.0	31.0
PC-5	100	15.0	15.4	8.15	8.29	7.4	8.3	30.0	32.0
Reference	0	15.0	15.4	8.15	8.26	7.4	8.2	30.0	32.0
Reference	10	15.1	15.4	8.14	8.25	7.5	8.1	30.0	32.0
Reference	50	15.1	15.6	8.14	8.24	7.4	8.3	30.0	32.0
Reference	100	15.1	15.9	8.09	8.22	7.5	8.5	30.0	32.0

TABLE K.3. Results for All Replicates in 72-Hour *M. edulis* Reference Toxicant Test, Panama City Harbor Project

Copper Concentration	Replicate	Normal D-Shaped Shell	Abnormal with Shell	Other	Percent Normal (a)	Mean Percent Normal	Percent Survival (a)	Mean Percent Survival
0	1	133	0	8	54.29		57.55	
0	2	262	0	28	100.00 ^(b)		100.00 ^(b)	
0	3	255	1	24	100.00 ^(b)	84.76	100.00 ^(b)	85.85
2.9	1	263	0	17	100.00 ^(b)		100.00 ^(b)	
2.9	2	233	1	13	95.10		100.00 ^(b)	
2.9	3	209	0	19	85.31	93.47	93.06	97.69
9.0	1	237	5	29	96.73		100.00 ^(b)	
9.0	2	194	1	33	79.18		93.06	
9.0	3	210	2	54	85.71	87.21	100.00 ^(b)	97.69
30.0	1	4	0	2	1.63		2.45	
30.0	2	0	0	5	0.00		2.04	
30.0	3	0	0	4	0.00	0.54	1.63	2.04
100.0	1	0	0	0	0.00		0.00	
100.0	2	0	0	0	0.00		0.00	
100.0	3	1	0	5	0.41	0.14	2.45	0.82

(a) Percent normal and percent survival based on stocking density (average of multicell larvae) of 245 larvae per 10 mL.

(b) A percent survival of 100.00 was used when the number surviving was greater than the stocking density.

TABLE K.4. Water Quality Summary for 72-Hour *M. edulis* Reference Toxicant Test, Panama City Harbor Project

Copper Concentration ($\mu\text{g/L}$)	Temperature ($^{\circ}\text{C}$)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	14.0	18.0	7.30	8.30	≥ 4.0		28.0	32.0
0.0	15.0	15.3	8.11	8.23	7.5	8.3	30.0	31.0
2.9	15.0	15.3	8.14	8.17	7.6	8.3	30.0	31.0
9.0	15.1	15.3	8.14	8.22	7.6	8.2	30.0	31.0
30.0	15.0	15.3	8.08	8.19	7.2	8.0	30.0	31.0
100.0	15.0	15.2	8.14	8.20	7.6	8.3	30.0	31.0

APPENDIX L

M. NASUTA TISSUE CHEMISTRY
AND QUALITY CONTROL DATA

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs)
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: *M. nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
EPA Method 8270 (1986a)	40-120%	≤30%	≤30%	30 µg/kg

HOLDING TIMES All samples were stored frozen (-20°C) in sealed containers until ready for extraction. The tissue samples were extracted within 2 months of receipt at the laboratory and were analyzed within the 40-day holding period.

DETECTION LIMITS The achieved detection limits for PAHs were all well below the target detection limits.

METHOD BLANKS The four method blanks analyzed with the samples were contaminated in at least one of the blanks, by all but one of the low-molecular-weight PAHs and all but three of the high-molecular-weight PAHs. The data associated with these blanks were flagged with a "B" if the amount in the blank was > 1/5 the target detection limit.

MATRIX SPIKES The recovery of target PAHs in the matrix spikes ranged from 43% to 151%. Seven of the 29 low-molecular-weight PAH matrix spike recoveries ranged from 121% to 125%. One of the matrix spike recoveries of naphthalene could not be calculated due to the elevated concentration of naphthalene in the sample. Twenty-eight of the 50 high-molecular-weight PAH matrix spike recoveries ranged from 121% to 151%. The matrix spike recoveries of PC-1 COMP MS and MSD sample were all outside the 40% to 120% acceptable range, but precision between the matrix spike recoveries (RPD) was ≤10%.

SRMs The standard reference material NIST 1974 was analyzed with the PAH samples. The percent differences of certified PAHs in the tissue SRMs were acceptable in 22 of the 32 reported SRM values.

REPLICATES

Precision was measured by relative standard deviation (RSD) between triplicates. All but three of the low-molecular-weight PAH calculable RSD values exceeded the 30% goal. These elevated RSD values ranged from 50% to 164%, generally due to one of the replicates being suspect or associated with contamination from the blank sample. Seven of the 25 high-molecular-weight PAH calculable RSD values exceeded the 30% goal and ranged from 34% to 109%. These elevated RSD values were generally due to one of the replicates being suspect or several of the replicates being detected below the target detection limit.

SURROGATES

Three surrogate compounds were analyzed with the samples: naphthalene-d₈, acenaphthene-d₁₀, and benzo(a)pyrene-d₁₂. The recoveries of the surrogate internal standard (SIS) compound for 32 of the 144 tissue samples were outside the 40% to 120% acceptable range.

ADDITIONAL INFORMATION

The individual replicate tissue samples analyzed for PAHs, PCBs, and chlorinated pesticides in the *M. nasuta* tissues were contaminated in the analytical laboratory during analysis. Existing leftover uncontaminated tissue samples were combined into a single composite for each sediment treatment and reanalyzed. The composite and original data are presented in Appendix L.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Phenols, Substituted Phenols, and Phthalate Esters
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: *M. nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Phenols	EPA Method 8270(1986a)	40-120%	NA	≤30%	330 µg/kg
Phthalate Esters	EPA Method 8270	40-120%	NA	≤30%	100 µg/kg

HOLDING TIMES All samples were stored frozen (-20°C) in sealed containers until ready for extraction. The tissue samples were extracted within 2 months of receipt at the laboratory and were analyzed within the 40-day holding period.

DETECTION LIMITS The samples analyzed for phenols and phthalate esters were slightly elevated above the target detection limits. These elevations do not present a problem, due to all but two samples having concentrations of phenols or phthalate esters either undetected or detected below the method detection limit.

METHOD BLANKS The method blanks analyzed with the samples had concentrations of phenols and phthalate esters either undetected or detected below the method detection limit; therefore, no corrective action was taken.

MATRIX SPIKES Matrix spike recovery criteria for phenols and phthalate esters in tissues have not been established by the EPA. This may be due to the difficulty involved with recovering phenols both from the extraction procedures as well as from the gas chromatograph. Fifteen of the 43 matrix spike recoveries ranged from 121% to 1133%, exceeding the target range of 40% to 120% and were generally due to relatively high concentrations of phenols and phthalate esters that were spiked into the samples.

SRMs NA

REPLICATES Precision was measured by relative standard deviation (RSDs) between triplicates. The concentrations of phenols and phthalate esters were either undetected or detected below the MDL; thus the RSDs could not be calculated.

SURROGATES

The surrogate compound 2-fluorophenol was analyzed with the samples. The recovery of 7 of the 48 surrogate internal standard (SIS) compounds 2-fluorophenol ranged from 124% to 148% and from 2% to 8%, exceeding the target range of 40% to 120%.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs)
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: *M. nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
EPA Method 8080 (1986a)	40-120%	NA	≤30%	10-30 µg/kg

HOLDING TIMES All samples were stored frozen (-20°C) in sealed containers until ready for extraction. The tissue samples were extracted within 2 months of receipt at the laboratory and were analyzed within 40 days.

DETECTION LIMITS The achieved detection limits for pesticides and PCBs were all well below the target detection limits.

METHOD BLANKS The method blanks analyzed with the composite samples and Batches 3 and 4 of the individual replicate samples were free of contamination. The method blank analyzed with the Batch 5 samples was slightly contaminated with dieldrin, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT. The amount of 4,4'-DDD and 4,4'-DDT in the method blank was >1/5 the target detection limit; therefore, the data associated with this batch were flagged with a "B."

MATRIX SPIKES Recoveries of 17 of the 54 matrix spikes were outside of the 40% to 120% acceptable range. These 17 matrix spike recoveries ranged from 121% to 246% and from 4% to 9%, most due to concentrations of pesticides and PCBs in the samples that were either undetected or detected below the target detection limit.

SRMs NA

REPLICATES Precision was measured by relative standard deviation (RSDs) between triplicates. Four of the calculable 19 RSD values exceeded the relative precision goal of 30%, ranging from 35% to 64% and generally due to concentrations of pesticides and PCBs detected below the target detection limit.

SURROGATES Three surrogate compounds were analyzed with the samples: DBOFB, Cl₅(103), and Cl₅(112). The recovery of the surrogate internal standard (SIS) compounds was acceptable, with the exception of 12 of the 120 tissue samples.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *M. nasuta* Tissues

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Antimony	ICP/MS (EPA 1990b)	75-125	≤30%	≤20%	0.1 mg/kg
Arsenic	XRF (PNL SOP)	75-125	≤30%	≤20%	0.1 mg/kg
Beryllium	ICP/MS	75-125	≤30%	≤20%	0.2 mg/kg
Cadmium	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Chromium	ICP/MS	75-125	≤30%	≤20%	0.6 mg/kg
Copper	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Lead	GFAA (EPA 1986a)	75-125	≤30%	≤20%	0.1 mg/kg
Mercury	CVAA (Bloom/Crecelius 1984)	75-125	≤30%	≤20%	0.01 mg/kg
Nickel	ICP/MS	75-125	≤30%	≤20%	1.0 mg/kg
Selenium	XRF	75-125	≤30%	≤20%	0.3 mg/kg
Silver	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Thallium	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Zinc	XRF	75-125	≤30%	≤20%	0.3 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 were held frozen and then freeze-dried and stored in sealed containers until ready for analysis.

DETECTION LIMITS Achieved detection limits based on dry weight concentrations were lower than the target detection limits for all metals except As, Hg, Se, and Zn. These four metals were detected in all the tissue samples at concentrations above the target detection limits. Sample concentrations of these four metals were well above the achieved detection limits; therefore, no corrective action was taken.

METHOD BLANKS The method blank analyzed for metals had low levels of Ag, Cd, Cr, Cu, Hg, Pb, and Sb. The data associated with these blanks were corrected for the amount in the method blank.

MATRIX SPIKES Recovery of 12 of the 50 calculable matrix spikes were outside the 75% to 125% range, ranging from 126% to 182%, with one matrix spike recovery at 68%. Nine of these 12 exceedences were matrix spikes of Be and Tl.

SRMs The oyster tissue standard reference material (SRM) 1566a was analyzed for all the metals. The values were all within the acceptable limit of 30%.

REPLICATES

Precision between triplicates was measured by Relative Standard Deviation (RSDs). Two of the calculable 42 RSD values were 35% and 52%, exceeding the target limit of 20%.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *M. nasuta* Tissues

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Tributyltin	Unger et al. 1986	40-120	NA	≤30%	10 µg/kg
Dibutyltin	Unger et al. 1986	40-120	NA	≤30%	10 µg/kg
Monobutyltin	Unger et al. 1986	40-120	NA	≤30%	10 µg/kg

HOLDING TIMES Samples were extracted within the 14-day holding period and analyzed within 40 days after extraction.

DETECTION LIMITS The detection limit of 10µg/kg was met for all samples.

METHOD BLANKS The method blanks analyzed with the samples were free of contamination.

MATRIX SPIKES Two of the four tributyltin matrix spike percent recovery values were slightly above (124% and 147%) the target range of 40% to 120%. The matrix spike recoveries for monobutyltin ranged from 24% to 31% and were all below the target QC range. Low recoveries for monobutyltin are standard due to the inefficiency of the method used to extract this compound.

SRMs NA

REPLICATES Precision between triplicates was measured by Relative Standard Deviation (RSDs). There was at least one replicate that was undetected; therefore, no RSDs could be calculated.

SURROGATES The surrogate internal standard (SIS) compound triphenyltin was analyzed with the samples. Two of the 42 percent recovery values were 39% and 126%, and these values were outside the target range of 40% to 120%.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Dioxins
LABORATORY: Battelle Columbus Operations, Columbus, Ohio
MATRIX: *M. nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
EPA Method 8290 (1990a)	40-120%	NA	≤30%	1.0 ng/kg

HOLDING TIMES All samples were extracted and analyzed within 30 days of sample receipt at the laboratory. Samples were stored frozen (-20°C) until ready for analysis.

DETECTION LIMITS The target detection limit of 1.0 ng/kg wet weight for dioxin analysis was met for all samples except one compound, OCDD, with an achieved detection limit of 2.27 ng/g wet weight. The concentration found in the samples was detected above the target detection limit; therefore, no corrective action was taken.

METHOD BLANKS The method blank analyzed with the samples was undetected for all the dioxin congeners except for OCDD and OCDF, detected at 2.27 ng/kg and 0.24 ng/kg, respectively. The concentrations of OCDD in the samples were all well above the achieved detection limit, and the concentrations of OCDF in the samples were all below the target detection limit; therefore, no corrective action was taken.

MATRIX SPIKES Matrix spike recoveries for the dioxin analysis ranged from 41% to 114%, within the 40% to 120% acceptable range as set in the QA/QC plan.

SRMs NA

REPLICATES Precision was measured by Relative Percent Difference (RPD) and I-STAT measurement between the percent recoveries of the matrix spike and matrix spike duplicate samples. All RPD values ranged from 0% to 26%, which were well within the acceptable 30% limit.

SURROGATES Fifteen labeled compounds and one clean-up standard were spiked into the *M. nasuta* tissue samples to assess the surrogate percent recovery of the compounds. One of the 96 surrogate percent recoveries had a value of 35%, which is outside the targeted 40% to 120% range.

**ADDITIONAL
INFORMATION**

The hepta- and octa- dioxin and furan compounds are determined to be ubiquitous in the analytical laboratory; therefore, their presence in the *M. nasuta* tissues should not be a concern.

NA Not applicable.

TABLE L.1. Total Polynuclear Aromatic Hydrocarbon (PAH) Results, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
PC-1 COMP			19	11	30
PC-1	1	5	4	13	17
PC-1	2	5	7	15	22
PC-1	3	5	74	11	85
PC-1	4	4	4	10	14
PC-1	5	3	77	14	91
PC-1A COMP			9	11	20
PC-1A	1	5	4	10	14
PC-1A	2	4	47	14	61
PC-1A Rep 1	3	4	9	15	24
PC-1A Rep 2	3	4	11	14	25
PC-1A Rep 3	3	4	118	15	133
PC-1A	4	4	96	13	109
PC-1A	5	5	4	12	16
PC-2 COMP			8	8	16
PC-2	1	4	5	9	14
PC-2	2	4	95	12	107
PC-2	3	4	81	11	92
PC-2	4	4	5	10	15
PC-2	5	4	102	11	113
PC-4 COMP			3	7	10
PC-4	1	4	53	9	62
PC-4	2	5	5	10	15
PC-4	3	3	219	11	230
PC-4	4	3	82	10	92
PC-4	5	4	230	14	244
PC-5 COMP			4	91	95
PC-5	1	5	7	101	108
PC-5	2	4	173	67	240
PC-5	3	5	9	88	97
PC-5	4	4	64	94	158
PC-5	5	3	283	102	385
Reference COMP			10	5	15
Reference	1	4	38	7	45
Reference	2	4	85	8	93
Reference Rep 1	3	5	293	25	318
Reference Rep 2	3	5	6	12	18
Reference Rep 3	3	5	4	11	15
Reference	4	3	155	11	166
Reference	5	3	147	11	158

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L.1

TABLE L.1. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
<i>M. nasuta</i> Background Rep 1	1	5	6	17	23
<i>M. nasuta</i> Background Rep 2	2	5	18	17	35
<i>M. nasuta</i> Background Rep 3	3	5	7	17	24
<i>M. nasuta</i> Control COMP			11	13	24
<i>M. nasuta</i> Control	1	3	98	24	122
<i>M. nasuta</i> Control	2	3	157	15	172
<i>M. nasuta</i> Control	3	5	7	17	24
<i>M. nasuta</i> Control	4	5	5	16	21
<i>M. nasuta</i> Control	5	5	4	12	16

TABLE L.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbon (LPAH) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)									
				Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene		
Target DL (a)				30	30	30	30	30	30	30	30		
Achieved DL High				3.12	1.59	1.64	2.88	1.09	1.84	2.04	1.57		
Achieved DL Low				0.98	0.50	0.52	0.91	0.34	0.58	0.64	0.49		
PC-1 COMP			13.424	13.07	0.78 J(b)	0.42 J	1.66 U(c)	0.63 U	0.26 J	4.46	0.90 U		
PC-1	1	5	14.978	1.16	0.75 (d)	0.33 J	1.00 U	0.38 U	0.21 J	0.87	0.26 J		
PC-1	2	5	14.257	1.73	2.74 (d)	0.77 (d)	0.99 U	0.37 U	0.35 J	1.31	0.25 J		
PC-1	3	5	11.647	47.91	12.86 (d)	5.89 (d)	0.29 J	0.75	0.28 J	6.19	0.29 J		
PC-1	4	4	10.453	1.61 B(e)	0.51 UB	0.29 JB(d)	0.13 J	0.05 J	0.26 J	0.90 B	0.27 J		
PC-1	5	3	12.981	61.40 B	0.89 UB	4.14 B(d)	0.54 J	1.12	1.03 U	9.33 B	0.40 J		
PC-1A COMP			14.505	5.35	0.52	0.30 J	0.81 U	0.31 U	0.21 J	2.33	0.22 J		
PC-1A	1	5	13.331	1.42	0.86	0.28 J(d)	0.98 U	0.37 U	0.15 J	0.76	0.17 J		
PC-1A	2	4	14.133	37.50 B(d)	0.50 UB	2.89 B(d)	0.32 J	0.34 U	0.58 U	5.09 B	0.83 (d)		
PC-1A Rep 1	3	4	12.944	5.32 B	1.35 UB	1.00 JB(d)	0.30 J	0.93 U	1.56 U	1.55 JB	0.54 J		
PC-1A Rep 2	3	4	12.944	6.42 B(d)	1.59 UB	1.17 JB(d)	0.36 J	0.39 J	0.59 J	1.55 JB	0.60 J		
PC-1A Rep 3	3	4	12.944	96.12 B(d)	1.41 UB	7.01 JB(d)	0.82 J	1.28	0.61 J	11.48 B	0.52 J		
PC-1A	4	4	12.779	53.43 B(d)	0.59 UB	34.24 B(d)	0.46 J	0.43	0.38 J	6.90 B	0.50 J		
PC-1A	5	5	12.122	1.46	0.84	0.37 J	1.20 U	0.46 U	0.22 J	0.95	0.29 J		
PC-2 COMP			14.158	4.91	0.51	0.27 J	0.83 U	0.31 U	0.27 J	2.02	0.45 U		
PC-2	1	4	12.313	3.51 B	0.73 UB	0.75 UB	1.32 U	0.50 U(d)	0.37 J	1.26 B(d)	0.35 J		
PC-2	2	4	12.488	78.22 B(d)	0.59 UB	5.52 B(d)	0.56 J	1.05 (d)	0.43 J	9.00 B(d)	0.47 J		
PC-2	3	4	14.708	65.74 B(d)	0.78 UB	4.93 B(d)	0.46 J	0.85	0.35 J	7.93 B(d)	0.46 J		
PC-2	4	4	14.903	2.17 B	0.78 UB	0.80 UB	0.16 J	0.53 U(d)	0.28 J	1.58 B(d)	0.51 J		
PC-2	5	4	14.869	82.10 B(d)	1.15 UB	6.26 B(d)	0.66 J	1.33 (d)	0.37 J	10.19 B(d)	0.70 J		
PC-4 COMP			14.542	0.67 J(d)	0.43 J	0.23 J(d)	0.83 U	0.31 U	0.24 J	0.86	0.13 J		
PC-4	1	4	12.851	42.76 B	0.68 UB	3.21 B(d)	0.39 J	0.54	0.79 U	5.18 B(d)	0.44 J(d)		
PC-4	2	5	14.206	1.64	0.96	0.48 J(d)	1.24 U	0.47 U(d)	0.30 J	1.06	0.20 J		
PC-4	3	3	12.937	161.55 B(d)	20.41 B(d)	11.55 B(d)	1.17 J	2.51 (d)	0.96 U	20.69 B(d)	0.66 J(d)		
PC-4	4	3	12.755	61.02 B(d)	7.05 B(d)	4.15 B(d)	0.44 J	0.56 U(d)	0.34 J	9.14 B(d)	0.35 J(d)		
PC-4	5	4	12.989	194.34 B(d)	0.67 UB	13.64 B(d)	0.87 J	2.06 (d)	0.78 U	18.79 B(d)	0.64 J(d)		
PC-5 COMP			14.684	0.54 J	0.36 J(d)	0.22 J	0.16 J	0.12 J	0.30 J	1.28	1.08		
PC-5	1	5	12.806	1.58	1.76 (d)	0.56 J	0.43 J(d)	0.44 U(d)	0.30 J	1.34	1.26		
PC-5	2	4	14.186	141.60 B(d)	1.55 UB	10.25 JB(d)	1.71 J(d)	1.53 (d)	0.66 J	15.03 B(d)	2.08		
PC-5	3	5	14.039	1.89 (B)	3.20 (d)	0.57 J	0.20 J(d)	0.40 U(d)	0.26 J	1.38	1.27		
PC-5	4	4	13.276	48.23 B(d)	0.63 UB	3.81 JB(d)	1.45 (d)	0.85 (d)	0.54 J	7.02 B(d)	2.38		
PC-5	5	3	13.892	208.22 B(d)	23.82 B(d)	15.34 JB(d)	2.41 (d)	4.02 (d)	1.04 U	26.01 B(d)	3.62		

TABLE L.2. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasua</i> LPAHs ($\mu\text{g/kg}$ wet weight)							
				Naphtha-lene	2-methyl-naphtha-lene	1-methyl-naphtha-lene	Acenaph-thylene	Acenaph-thene	Fluorene	Phenan-threne	Anthra-cene
Reference COMP											
Reference	1		13.976	6.62	0.46	0.30 J(d)	0.83 U	0.31 U	0.21 J	2.86	0.45 U
Reference	2	4	12.696	23.47 B(d)	8.86 B(d)	2.81 B(d)	2.33 U	0.88 U	1.49 U	2.56 B	1.27 U
Reference Rep 1	3	4	14.103	70.92 B(d)	1.07 U	5.40 B(d)	0.41 J	0.78 U	1.24 U	7.46 B	0.24 J
Reference Rep 2	3	5	12.986	192.80 B(d)	45.37(d)	27.06 B(d)	2.43 U	2.17(d)	1.55 U	25.01 B	0.67 J
Reference Rep 3	3	5	12.986	2.39 J	1.04 J	0.40 J	2.47 U	0.94 U	1.58 U	1.69 J	0.19 J
Reference	3	5	12.986	1.96 U	0.96 J(d)	0.59 J(d)	1.81 U	0.68 U	0.43 J	1.47	0.24 J
Reference	4	3	12.212	114.69 B(d)	12.26 B(d)	7.65 B(d)	0.64 J	1.92(d)	0.50 J	16.56 B(d)	0.61 J
Reference	5	3	13.839	108.24 B(d)	12.08 B(d)	7.26 B(d)	0.71 J	1.62(d)	0.52 J	16.48 B(d)	0.42 J
<i>M. nasua</i> Background	Rep 1	5	16.303	1.85 J	0.99 J	0.40 J	1.92 U	0.73 U	0.43 J	2.23	0.25 J
<i>M. nasua</i> Background	Rep 2	5	16.303	4.40	7.34	1.23 J	2.40 U	0.91 U	0.49 J	2.40	2.56
<i>M. nasua</i> Background	Rep 3	5	16.303	2.11	1.27	0.39 J	1.54 U	0.59 U	0.35 J	2.30	0.20 J
<i>M. nasua</i> Control COMP											
<i>M. nasua</i> Control	1	3	14.815	6.92	0.47	0.30 J	0.82 U	0.15 J	0.22 J	3.14	0.18 J
<i>M. nasua</i> Control	2	3	15.651	71.40 B(d)	7.60 B(d)	4.91 B(d)	0.47 J	1.38(d)	1.03 U	11.63 B(d)	0.47 J
<i>M. nasua</i> Control	3	3	14.229	114.69 B(d)	13.93 B(d)	8.01 B(d)	0.75 J	1.45(d)	0.53 J	17.44 B(d)	0.45 J
<i>M. nasua</i> Control	3	5	13.711	2.55	1.54(d)	0.74 J	1.91 U	0.72 U	0.36 J	1.34 J	0.28 J
<i>M. nasua</i> Control	4	5	14.994	1.47	1.00	0.58 J	1.04 U	0.39 U	0.31 J	1.14	0.21 J
<i>M. nasua</i> Control	5	5	12.86	1.31	0.80	0.41 J	0.93 U	0.35 U	0.28 J	0.90	0.21 J

(a) DL Detection limit.

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

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

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

(e) B Procedural blank amount was detected at >1/5 of the target detection limit.

TABLE L.3. High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	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- c,d]- pyrene	Dibenzo- [a,h]- anthra- cene	Benzo- [g,h,i] perylene
Target DL (a)				30	30	30	30	30	30	30	30	30	30
Achieved DL High				2.72	1.95	2.48	2.84	2.80	1.31	1.04	2.28	2.06	1.92
Achieved DL Low				0.86	0.62	0.78	0.89	0.88	0.41	0.33	0.72	0.65	0.61
PC-1 COMP			13.424	2.20	2.20	1.09 J(b)	1.28 J	1.60 J	1.02	0.72	0.32 J	1.18 U(c)	0.73 J
PC-1	1	5	14.978	2.07	2.36	1.15	1.38	2.27	1.23	0.88	0.55 J	0.19 J	0.61 J
PC-1	2	5	14.257	3.12	3.70	1.28	1.60	2.19	1.19	0.97	0.42 J	0.71 U	0.73
PC-1	3	5	11.647	2.10	2.29	1.06	1.27	1.63	0.95	0.69	0.54 J	0.67 U	0.91
PC-1	4	4	10.453	1.93 B(d)	2.60	0.92	1.03	1.67	0.50	0.65	0.30 J	0.07 J	0.28 J
PC-1	5	3	12.981	3.03	3.34	1.14 J	1.46 J	2.19	0.64 J	0.82	0.61 J	0.17 J	0.68 J
PC-1A COMP			14.505	1.78	1.26	1.01	1.31	1.95	1.34	0.93	0.46 J	0.58 U	0.78
PC-1A	1	5	13.331	1.63	1.03	1.03	1.20	2.19	1.10	0.94	0.51 J	0.15 J	0.64 J
PC-1A	2	4	14.133	2.73 B	2.08	1.28	1.91	2.92	0.61	1.12	0.44 J	0.65 U	0.49 J
PC-1A Rep 1	3	4	12.944	2.59 B	2.47	1.34 J	1.81 J	3.07	1.02 J	1.39	0.48 J	1.75 U	0.52 J
PC-1A Rep 2	3	4	12.944	2.52 JB	2.17	1.52 J	1.76 J	2.92	0.91 J	1.24	0.42 J	2.06 U	0.49 J
PC-1A Rep 3	3	4	12.944	3.37 B	2.82	1.37 J	1.72 J	2.72	0.86 J	1.20	0.62 J	1.83 U	0.71 J
PC-1A	4	4	12.779	2.77 B	2.21	1.21	1.82	2.30	0.83	1.04	0.51 J	0.11 J	0.56 J
PC-1A	5	5	12.122	1.77	1.07	1.42	1.72	2.77	1.34	1.10	0.60 J	0.86 U	0.67 J
PC-2 COMP			14.158	1.48	1.19	0.66 J	0.85	1.55	0.60	0.56	0.26 J	0.59 U	0.38 J
PC-2	1	4	12.313	1.83 B	1.54	0.80 J	1.01 J	1.69	0.54 J	0.63	0.25 J	0.94 U	0.30 J
PC-2	2	4	12.488	2.26 B	2.08	1.07	1.58	2.22	0.48 J	0.85	0.64 J	0.16 J	0.73
PC-2	3	4	14.708	2.18 B	2.02	0.95 J	1.40	2.36	0.62 J	0.51 J	0.53 J	1.02 U	0.57 J
PC-2	4	4	14.903	1.87 B	1.58	1.01 J	1.35 J	1.95	0.69	0.80	0.33 J	1.01 U	0.30 J
PC-2	5	4	14.869	2.33 B	1.91	1.14 J	1.40 J	2.24	0.53 J	0.51 J	0.42 J	1.49 U	0.51 J
PC-4 COMP			14.542	1.58	1.02	0.59 J	0.82	1.43	0.62	0.37	0.66 U	0.59 U	0.29 J
PC-4	1	4	12.851	2.21 B	1.55	0.67 J	1.17 J	1.48	0.55 J	0.50	0.29 J	0.89 U	0.39 J
PC-4	2	5	14.206	2.03	1.20	0.83 J	1.33	2.14	0.98	0.59	0.43 J	0.89 U	0.52 J
PC-4	3	3	12.937	1.43 U	3.04	0.88 J	1.65	2.09	0.82	0.47 J	0.78 J	0.23 J	1.19(e)
PC-4	4	3	12.755	1.90	1.58	0.73 J	0.92 J	1.79	0.50 J	0.57	0.69 J	0.19 J	0.79 J
PC-4	5	4	12.989	3.20 B	2.98	0.91 J	1.65	2.19	0.61	0.79	0.86 J	0.16 J	1.05

TABLE L.3. (c ntd)

<i>M. nasuta</i> HPAHs (<i>μg/kg</i> wet weight)														
Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs (<i>μg/kg</i> wet weight)										
				Fluor-anthene	Pyrene	Benzo[a]Anthracene	Chrysene	Fluor-anthene	Benzo[b]Fluor-anthene	Benzo[k]Fluor-anthene	Benzo[a]pyrene	Indeno[1,2,3-c,d]pyrene	Dibenzo[a,h]-anthracene	Benzo[g,h,i]perylene
PC-5 COMP														
PC-5	1	5	14.684	8.80	14.99	7.11	6.55	22.23	14.57	12.00	2.09	0.58 J	2.23	
PC-5	2	4	12.806	7.98	12.17	8.36	8.93	25.98	17.28	12.37	3.67	0.96 J	3.07	
PC-5	3	4	14.186	9.35 B	13.98	5.30	5.70	18.78	4.67	7.15	1.16 J	0.28 J	1.06 J	
PC-5	2	5	14.039	9.59	15.93	6.79	6.23	20.69	13.30	10.45	2.15	0.48 J	2.02	
PC-5	4	4	13.276	10.91 B	21.33	8.12	7.54	27.01	6.23	9.19	1.67	0.40 J	1.26	
PC-5	5	3	13.892	11.71	17.48	8.42	8.60	26.02	10.85	10.78	3.88	0.81 J	3.29	
Reference COMP														
Reference	1	4	13.976	1.94	1.06	0.28 J	0.80 J	0.62 J	0.24 J	0.18 J	0.66 U	0.59 U	0.30 J	
Reference	2	4	12.696	2.32 B	1.50 J	0.44 J	1.32 J	0.75 J	0.41 J	0.85 U	1.85 U	1.67 U	1.56 U	
Reference	3	4	14.103	2.13 B	1.41	0.48 J	1.08 J	0.98 J	0.27 J	0.24 J	0.46 J	1.39 U	0.53 U	
Reference Rep 1	3	5	12.986	7.22	5.18 (e)	1.27 J	2.52	2.46	1.17 (e)	0.99 (e)	1.93 U	0.52 J	3.25 (e)	
Reference Rep 2	3	5	12.986	4.56	3.06	0.65 J	1.28 J	0.80 J	0.53 J	0.33 J	1.96 U	1.77 U	0.61 J	
Reference Rep 3	3	5	12.986	4.29	2.92	0.63 J	1.27 J	0.68 J	0.41 J	0.36 J	1.43 U	1.29 U	0.46 J	
Reference	4	3	12.212	2.86	2.05	0.53 J	1.23 J	1.11 J	0.44 J	0.43 J	0.65 J	0.16 J	1.10 (e)	
Reference	5	3	13.839	2.72	1.83	0.68 J	1.52 J	1.24 J	0.48 J	0.48 J	0.90 J	0.21 J	1.01 J (e)	
<i>M. nasuta</i> Background Rep 1	1	5	16.303	6.86	4.13	0.80 J	2.34	1.38 J	0.51 J	0.36 J	1.53 U	1.38 U	0.58 J	
<i>M. nasuta</i> Background Rep 2	2	5	16.303	6.66	3.80	0.86 J	2.33 J	1.17 J	0.50 J	0.36 J	0.38 J	1.72 U	0.61 J	
<i>M. nasuta</i> Background Rep 3	3	5	16.303	6.56	3.76	0.83 J	2.56	1.30 J	0.52 J	0.42 J	0.34 J	1.10 U	0.50 J	
<i>M. nasuta</i> Control COMP														
<i>M. nasuta</i> Control	1	3	14.815	3.99	2.68	0.64 J	1.40	1.46	0.96	0.48	0.44 J	0.58 U	0.91	
<i>M. nasuta</i> Control	2	3	15.651	7.63	5.66	1.21 J	2.59	3.25	0.70 J	0.88	1.05 J	0.19 J	1.21	
<i>M. nasuta</i> Control	2	3	14.229	4.71	2.79	0.79 J	1.91	2.08	0.57 J	0.50 J	0.79 J	0.21 J	1.00 J	
<i>M. nasuta</i> Control	3	5	13.711	5.69	4.04	0.91 J	1.92	1.61 J	1.15	0.62 J	0.59 J	1.36 U	0.92 J	
<i>M. nasuta</i> Control	4	5	14.994	5.16	3.12	0.85 J	1.88	2.01	1.08	0.46	0.62 J	0.74 U	0.82	
<i>M. nasuta</i> Control	5	5	12.86	3.53	2.56	0.62 J	1.23	1.66	0.50	0.29 J	0.54 J	0.66 U	0.58 J	

(a) DL Detection limit.

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

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

(d) B Procedural blank amount was detected at >1/5 of the target detection limit.

(e) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE L.4. Total Polynuclear Aromatic Hydrocarbon (PAH) Results, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
PC-1 COMP			141	83	224
PC-1	1	5	24	85	109
PC-1	2	5	50	107	157
PC-1	3	5	639	98	737
PC-1	4	4	34	95	129
PC-1	5	3	593	108	701
PC-1A COMP			62	75	136
PC-1A	1	5	27	78	105
PC-1A	2	4	330	96	426
PC-1A Rep 1	3	4	67	113	180
PC-1A Rep 2	3	4	86	108	194
PC-1A Rep 3	3	4	910	119	1029
PC-1A	4	4	754	105	859
PC-1A	5	5	34	103	137
PC-2 COMP			56	53	109
PC-2	1	4	45	70	115
PC-2	2	4	763	97	860
PC-2	3	4	549	76	625
PC-2	4	4	32	66	98
PC-2	5	4	683	74	757
PC-4 COMP			18	46	64
PC-4	1	4	409	69	478
PC-4	2	5	33	71	104
PC-4	3	3	1689	86	1775
PC-4	4	3	647	76	723
PC-4	5	4	1773	111	1884
PC-5 COMP			28	621	649
PC-5	1	5	56	787	843
PC-5	2	4	1219	475	1694
PC-5	3	5	62	624	686
PC-5	4	4	484	705	1189
PC-5	5	3	2040	733	2773
Reference COMP			75	39	114
Reference	1	4	297	53	350
Reference	2	4	604	54	658
Reference Rep 1	3	5	2257	189	2446
Reference Rep 2	3	5	44	105	149
Reference Rep 3	3	5	28	85	113
Reference	4	3	1268	86	1354
Reference	5	3	1065	80	1145

TABLE L.4. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
<i>M. nasuta</i> Background Rep 1	1	5	38	104	142
<i>M. nasuta</i> Background Rep 2	2	5	113	102	215
<i>M. nasuta</i> Background Rep 3	3	5	41	103	144
<i>M. nasuta</i> Control COMP			77	88	165
<i>M. nasuta</i> Control	1	3	625	156	781
<i>M. nasuta</i> Control	2	3	1105	108	1213
<i>M. nasuta</i> Control	3	5	50	127	177
<i>M. nasuta</i> Control	4	5	31	107	138
<i>M. nasuta</i> Control	5	5	30	90	120

TABLE L.5. Low Molecular Weight Polynuclear Aromatic Hydrocarbon (LPAH) Analysis Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs (µg/kg dry weight)							
				Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
PC-1 COMP											
PC-1	1	5	13.424	97.36	5.82 J(a)	3.09 J	12.33 U(b)	4.67 U	1.93 J	33.26	6.71 U
PC-1	2	5	14.978	7.74	5.01 (c)	2.20 J	6.68 U	2.54 U	1.40 J	5.81	1.74 J
PC-1	3	5	14.257	12.13	19.22 (c)	5.40 (c)	6.94 U	2.60 U	2.45 J	9.19	1.75 J
PC-1	4	4	11.647	411.35	110.41 (c)	50.57 (c)	2.49 J	6.44	2.40 J	53.15	2.49 J
PC-1	5	3	10.453	15.40 B	4.88 UB	2.77 JB	1.24 J	0.48 J	2.49 J	8.61 B	2.58 J
PC-1	5	3	12.981	473.00 B	6.86 UB	31.89 B(c)	4.16 J	8.63	7.93 U	71.87 B	3.08 J
PC-1A COMP											
PC-1A	1	5	14.505	36.87	3.60	2.10 J	5.56 U	2.11 U	1.48 J	16.04	1.48 J
PC-1A	2	4	13.331	10.65	6.45	2.10 J	7.35 U	2.78 U	1.13 J	5.70	1.28 J
PC-1A Rep 1	3	4	14.133	265.34 B(c)	3.54 UB	20.45 B(c)	2.26 J	2.41 U	4.10 U	36.02 B	5.87 (c)
PC-1A Rep 2	3	4	12.944	41.10 B	10.43 UB	7.73 JB(c)	2.32 J	7.18 U	12.05 U	11.97 JB	4.17 J
PC-1A Rep 3	3	4	12.944	49.60 B(c)	12.28 UB	9.04 JB(c)	2.78 J	3.01 J	4.56 J	11.97 JB	4.64 J
PC-1A	4	4	12.944	742.58 B(c)	10.89 UB	54.16 JB(c)	6.33 J	9.89	4.71 J	88.69 B	4.02 J
PC-1A	4	4	12.779	418.11 B(c)	4.62 UB	267.94 B(c)	3.60 J	3.36	2.97 J	53.99 B	3.91 J
PC-1A	5	5	12.122	12.04	6.93	3.05 J	9.90 U	3.79 U	1.81 J	7.84	2.39 J
PC-2 COMP											
PC-2	1	4	14.158	34.70	3.59	1.89 J	5.85 U	2.22 U	1.93 J	14.25	3.18 U
PC-2	2	4	12.313	28.51 B	5.93 UB	6.09 UB	10.72 U	4.06 U	3.00 J	10.23 B(c)	2.84 J
PC-2	3	4	12.488	626.36 B(c)	4.72 UB	44.20 B(c)	4.48 J	8.41 (c)	3.44 J	72.07 B(c)	3.76 J
PC-2	4	4	14.708	446.97 B(c)	5.30 UB	33.52 B(c)	3.13 J	5.78	2.38 J	53.92 B(c)	3.13 J
PC-2	4	4	14.903	14.56 B(c)	5.23 UB	5.37 UB	1.07 J	3.56 U	1.88 J	10.60 B	3.42 J
PC-2	5	4	14.869	552.16 B(c)	7.73 UB	42.10 B(c)	4.44 J	8.94 (c)	2.49 J	68.53 B(c)	4.71 J
PC-4 COMP											
PC-4	1	4	14.542	4.63 J	2.95 J	1.57 J(c)	5.70 U	2.16 U	1.65 J	5.93	0.86 J(c)
PC-4	2	5	12.851	332.74 B(c)	5.29 UB	24.98 B(c)	3.03 J	4.20	6.15 U	40.31 B(c)	3.42 J(c)
PC-4	3	3	14.206	11.54	6.76	3.38 J(c)	8.73 U	3.31 U	2.11 J	7.46	1.41 J
PC-4	4	3	12.937	1248.74 B(c)	157.76 B(c)	89.28 B(c)	9.04 J	19.40 (c)	7.42 U	159.93 B(c)	5.10 J(c)
PC-4	4	3	12.755	478.40 B(c)	55.27 B(c)	32.54 B(c)	3.45 J	4.39 U	2.67 J	71.66 B(c)	2.74 J
PC-4	5	4	12.989	1496.19 B(c)	5.16 UB	105.01 B(c)	6.70 J	15.86 (c)	6.01 U	144.66 B(c)	4.93 J(c)
PC-5 COMP											
PC-5	1	5	14.684	3.65 J	2.44 J	1.49 J	1.12 J	0.82 J	2.06 J	8.74	7.39
PC-5	2	4	12.806	12.34	13.74 (c)	4.37 J	3.36 J	3.44 U	2.34 J	10.46	9.84
PC-5	3	5	14.186	998.17 B(c)	10.93 UB	72.25 JB(c)	12.05 J(c)	10.79 (c)	4.65 J	105.95 B(c)	14.66
PC-5	4	4	14.039	13.46 (c)	22.79 (c)	4.06 J	1.42 J	2.85 U	1.85 J	9.83	9.05
PC-5	4	4	13.276	363.29 B(c)	4.75 UB	28.70 JB	10.92 (c)	6.40 (c)	4.07 J	52.88 B(c)	17.93
PC-5	5	3	13.892	1498.85 B(c)	171.47 B(c)	110.42 JB(c)	17.35 (c)	28.94 (c)	7.49 U	187.23 B(c)	26.06

TABLE L.5. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> LPAHs ($\mu\text{g}/\text{kg}$ dry weight)							
				Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Reference COMP	1	4	13.976	47.35	3.32	2.17 J	5.94 U	2.25 U	1.52 J	20.47	3.23 U
	2	4	12.696	184.86 B	69.79 B	22.13 B	18.35 U	6.93 U	11.74 U	20.16 B	10.00 U
	3	5	14.103	502.87 B	7.59 B	38.29 B	2.91 J	5.53	8.79 U	52.90 B	1.70 J
	3	5	12.986	1484.68	349.38	208.38	18.71 U	16.71	11.94 U	192.59	5.16 J
	3	5	12.986	18.40 J	8.01 J	3.08 J	19.02 U	7.24 U	12.17 U	13.01 J	1.46 J
	3	5	12.986	15.09 U	7.39 J	4.54 J	13.94 U	5.24 U	3.31 J	11.32	1.85 J
	4	3	12.212	939.16 B	100.39 B	62.64 B	5.24 J	15.72	4.09 J	135.60 B	5.00 J
	5	3	13.839	782.14 B	87.29 B	52.46 B	5.13 J	11.71	3.76 J	119.08 B	3.03 J
	1	5	16.303	11.35 J	6.07 J	2.45 J	11.78 U	4.48 U	2.64 J	13.68	1.53 J
	2	5	16.303	26.99	45.02	7.54 J	14.72 U	5.58 U	3.01 J	14.72	15.70
<i>M. nasuta</i> Background Rep 3	3	5	16.303	12.94	7.79	2.39 J	9.45 U	3.62 U	2.15 J	14.11	1.23 J
<i>M. nasuta</i> Control COMP	1	3	14.815	46.73	3.18	2.00 J	5.51 U	1.02 J	1.50 J	21.19	1.18 J
	2	3	15.651	456.20 B	48.56 B	31.37 B	3.00 J	8.82	6.58 U	74.31 B	3.00 J
	3	3	14.229	806.03 B	97.90 B	56.29 B	5.27 J	10.19	3.72 J	122.57 B	3.16 J
	3	5	13.711	18.60	11.23	5.40 J	13.93 U	5.25 U	2.63 J	9.77 J	2.04 J
	4	5	14.994	9.80	6.67	3.87 J	6.94 U	2.60 U	2.07 J	7.60	1.40 J
	5	5	12.86	10.19	6.22	3.19 J	7.23 U	2.72 U	2.18 J	7.00	1.63 J
	5	5									

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

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

(c) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

(d) B Procedural blank amount was detected at $>1/5$ of the target detection limit.

TABLE L.6. High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ dry weight)									
				Fluor- anthene	Pyrene	Benzo[a] Anthra- cene	Chrysene	Fluor- anthene	Benzo[b] Fluor- anthene	Benzo[k] Fluor- anthene	Benzo- [a]- pyrene	Indeno [1,2,3- c,d]- pyrene	Dibenzo- [a,h]- anthra- cene
PC-1 COMP													
PC-1	1	5	13.424	16.42	16.38	8.12 J ^(a)	9.57 J	11.89 J	7.61	5.36	2.35 J	8.82 U ^(b)	5.41 J
PC-1	2	5	14.978	13.82	15.76	7.68	9.21	15.16	8.21	5.88	3.67 J	1.27 J	4.07 J
PC-1	3	5	14.257	21.88	25.95	8.98	11.22	15.36	8.35	6.80	2.95 J	4.98 U	5.12
PC-1	4	5	11.647	18.03	19.66	9.10	10.90	14.00	8.16	5.92	4.64 J	5.75 U	7.81
PC-1	4	4	10.453	18.46 B	24.87	8.80	9.85	15.98	4.78	6.22	2.87 J	0.67 J	2.68 J
PC-1	5	3	12.981	23.34	25.73	8.78 J	11.25 J	16.87	4.93 J	6.32	4.70 J	1.31 J	5.24 J
PC-1A COMP													
PC-1A	1	5	14.505	12.27	8.68	6.93	9.00	13.43	9.26	6.45	3.16 J	3.98 U	5.35
PC-1A	2	4	13.331	12.23	7.73	7.73	9.00	16.43	8.25	7.05	3.83 J	1.13 J	4.80 J
PC-1A Rep 1	3	4	14.133	19.32 B	14.72	9.06	13.51	20.66	4.32	7.92	3.11 J	4.60 U	3.47 J
PC-1A Rep 2	3	4	12.944	20.01 B	19.08	10.35 J	13.98 J	23.72	7.88 J	10.74	3.71 J	13.52 U	4.02 J
PC-1A Rep 3	3	4	12.944	19.47 JB	16.76	11.74 J	13.60 J	22.56	7.03 J	9.58	3.24 J	15.91 U	3.79 J
PC-1A	4	4	12.944	26.04 B	21.79	10.58 J	13.29 J	21.01	6.64 J	9.27	4.79 J	14.14 U	5.49 J
PC-1A	4	4	12.779	21.68 B	17.29	9.47	14.24	18.00	6.50	8.14	3.99 J	0.86 J	4.38 J
PC-1A	5	5	12.122	14.60	8.83	11.71	14.19	22.85	11.05	9.07	4.95 J	7.09 U	5.53 J
PC-2 COMP													
PC-2	1	4	14.158	10.42	8.37	4.67 J	6.00	10.94	4.24	3.94	1.85 J	4.18 U	2.71 J
PC-2	2	4	12.313	14.86 B	12.51	6.50 J	8.20 J	13.73	4.39 J	5.12	2.03 J	7.63 U	2.44 J
PC-2	3	4	12.488	18.10 B	16.66	8.57	12.65	17.78	3.84 J	6.81	5.12 J	1.28 J	5.85
PC-2	4	4	14.708	14.82 B	13.73	6.46 J	9.52	16.05	4.22 J	3.47 J	3.60 J	6.94 U	3.88 J
PC-2	4	4	14.903	12.55 B	10.60	6.78 J	9.06 J	13.08	4.63	5.37	2.21 J	6.78 U	2.01 J
PC-2	5	4	14.869	15.67 B	12.85	7.67 J	9.42 J	15.06	3.56 J	3.43 J	2.82 J	10.02 U	3.43 J
PC-4 COMP													
PC-4	1	4	14.542	10.85	7.01	4.03 J	5.63	9.86	4.24	2.53	4.52 U	4.07 U	1.96 J
PC-4	2	4	12.851	17.20 B	12.06	5.21 J	9.10 J	11.52	4.28 J	3.89	2.26 J	6.93 U	3.03 J
PC-4	3	5	14.206	14.29	8.45	5.84 J	9.36	15.06	6.90	4.15	3.03 J	6.26 U	3.66 J
PC-4	3	3	12.937	11.05 U ^(d)	23.50	6.80 J	12.75	16.16	6.34	3.63 J	6.03 J	1.78 J	9.20 J
PC-4	4	3	12.755	14.90	12.39	5.72 J	7.21 J	14.03	3.92 J	4.47	5.41 J	1.49 J	6.19 J
PC-4	5	4	12.989	24.64 B	22.94	7.01 J	12.70	16.86	4.70	6.08	6.62 J	1.23 J	8.08 J
PC-5 COMP													
PC-5	1	5	14.684	59.94	102.06	48.41	44.61	151.39	99.20	81.69	14.20	3.96 J	15.21
PC-5	2	4	12.806	62.31	95.03	65.28	69.73	202.87	134.94	96.60	28.66	7.50 J	23.97
PC-5	3	4	14.186	65.91 B	98.55	37.36	40.18	132.38	32.92	50.40	8.18 J	1.97 J	7.47 J
PC-5	4	5	14.039	68.31	113.47	48.37	44.38	147.38	94.74	74.44	15.31	3.42 J	14.39
PC-5	4	4	13.276	82.18 B	160.67	61.16	56.79	203.45	46.93	69.22	12.58	3.01 J	9.49
PC-5	5	3	13.892	84.29	125.83	60.61	61.91	187.30	78.10	77.60	27.93	5.83 J	23.68

TABLE L.6. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ dry weight)									
				Fluor- anthene	Pyrene	Benzo[a]- Anthra- cene	Chrysene	Fluor- anthene	Benzo[b]- Fluor- anthene	Benzo[k]- Fluor- anthene	Benzo- [a]- pyrene	Indeno [1,2,3- c,d]- pyrene	Dibenzo- [a,h]- anthra- cene
Reference COMP			13.976	13.87	7.61	2.02 J	5.72 J	4.43 J	1.69 J	1.29 J	4.71 U	4.25 U	2.16 J
Reference	1	4	12.696	18.27 B	11.81 J	3.47 J	10.40 J	5.91 J	3.23 J	6.70 U	14.57 U	13.15 U	12.29 U
Reference	2	4	14.103	15.10 B	10.00	3.40 J	7.66 J	6.95 J	1.91 J	1.70 J	3.26 J	9.86 U	3.76 J
Reference Rep 1	3	5	12.986	55.60	39.89 (d)	9.78 J	19.41	18.94	9.01 (d)	7.62 (d)	14.86 U	4.00 J	25.03 (d)
Reference Rep 2	3	5	12.986	35.11	23.56	5.01 J	9.86 J	6.16 J	4.08 J	2.54 J	15.09 U	13.63	4.70 J
Reference Rep 3	3	5	12.986	33.04	22.49	4.85 J	9.78 J	5.24 J	3.16 J	2.77 J	11.01 U	9.93 U	3.54 (d)
Reference	4	3	12.212	23.42	16.79	4.34 J	10.07 J	9.09 J	3.60 J	3.52 J	5.32 J	1.31 J	9.01 (d)
Reference	5	3	13.839	19.65	13.22	4.91 J	10.98 J	8.96 J	3.47 J	3.47 J	6.50 J	1.52 J	7.30 J (d)
<i>M. nasuta</i> Background Rep 1	1	5	16.303	42.08	25.33	4.91 J	14.35	8.46 J	3.13 J	2.21 J	9.38 U	8.46 U	3.56 J
<i>M. nasuta</i> Background Rep 2	2	5	16.303	40.85	23.31	5.28 J	14.29 J	7.18 J	3.07 J	2.21 J	2.33 J	10.55 U	3.74 J
<i>M. nasuta</i> Background Rep 3	3	5	16.303	40.24	23.06	5.09 J	15.70	7.97 J	3.19 J	2.58 J	2.09 J	6.75 U	3.07 J
<i>M. nasuta</i> Control COMP			14.815	26.92	18.09	4.34 J	9.42	9.88	6.49	3.26	3.00 J	3.94 U	6.16
<i>M. nasuta</i> Control	1	3	15.651	48.75	36.16	7.73 J	16.55	20.77	4.47 J	5.62	6.71 J	1.21 J	7.73
<i>M. nasuta</i> Control	2	3	14.229	33.10	19.61	5.55 J	13.42	14.62	4.01 J	3.51 J	5.55 J	1.48 J	7.03 J
<i>M. nasuta</i> Control	3	5	13.711	41.50	29.47	6.64 J	14.00	11.74 J	8.39	4.52 J	4.30 J	9.92 U	6.71 J
<i>M. nasuta</i> Control	4	5	14.994	34.41	20.81	5.67 J	12.54	13.41	7.20	3.07	4.13 J	4.94 U	5.47
<i>M. nasuta</i> Control	5	5	12.860	27.45	19.91	4.82 J	9.56	12.91	3.89	2.26 J	4.20 J	5.13 U	4.51 J

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

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

(c) B Procedural blank amount was detected at >1/5 of the target detection limit.

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE L.7. Quality Control Data for Low Molecular Weight Polynuclear Aromatic Hydrocarbon (LPAH) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)							
			Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Method Blanks										
COMP Blank			0.26 J(a)	0.16 J	0.10 J	0.89 U(b)	0.34 U	0.57 U	0.09 J	0.05 J
Blank	3		219.78 B(c)	33.01 B	16.99 B	1.18 J	4.10 B	1.05 U	25.36 B	0.73 J
Blank	4		237.38 B	31.18 B	16.11 B	1.45 J	3.97 B	1.92 B	30.51 B	2.16 B
Blank	5		2.01 B	0.72 U	0.74 U	1.30 U	0.49 U	0.83 U	0.86 J	0.18 J
Matrix Spikes										
PC-1 COMP			13.07	0.78 J(d)	0.42 J	1.66 U	0.63 U	0.26 J	4.46	0.90 U
PC-1 COMP MS			104.62	NA	NA	98.57	95.46	96.25	100.2	96.78
Concentration Recovered			91.55	NA(e)	NA	98.57	95.46	95.99	95.78	96.78
Amount Spiked			79.77	NS	NS	79.77	79.77	79.77	79.77	79.77
Percent Recovery			115%	NA	NA	124%(f)	120%	120%	120%	121%(f)
PC-1 COMP			13.07	0.78 J	0.42 J	1.66 U	0.63 U	0.26 J	4.46	0.90 U
PC-1 COMP MSD			106.51	NA	NA	99.62	96.96	99.08	103.8	100.2
Concentration Recovered			93.44	NA	NA	99.62	96.96	98.82	99.42	100.2
Amount Spiked			80.28	NS	NS	80.28	80.28	80.28	80.28	80.28
Percent Recovery			116%	NA	NA	124%(f)	121%(f)	123%(f)	124%(f)	125%(f)
RPD			1%	NA	NA	0%	1%	2%	3%	3%
I-Stat			0.01	NA	NA	0.00	0.00	0.01	0.02	0.02
PC-5			141.60 B(g)	1.55 UB	10.25 JB(g)	1.71 J(g)	1.53(g)	0.66 J	15.03 B(g)	2.08
PC-5 MS	2	4	44.94	NA	NA	39.72	43.28	42.98	46.28	40.51
Concentration Recovered			NA	NA	NA	38.01	41.75	42.32	31.25	38.43
Amount Spiked			38.37	NS	NS	38.37	38.37	38.37	38.37	38.37
Percent Recovery			NA	NA	NA	99%	109%	110%	81%	100%
Reference	1	4	23.47 B(g)	8.86 B(g)	2.81 B(g)	2.33 U	0.88 U	1.49 U	2.56 B	1.27 U
Reference MS	1	4	36.94	NA	NA	32.13	34.88	34.71	37.32	30.57
Concentration Recovered			13.47	NA	NA	32.13	34.88	34.71	34.76	30.57
Amount Spiked			31.11	NS	NS	31.11	31.11	31.11	31.11	31.11
Percent Recovery			43%	NA	NA	103%	112%	112%	112%	98%

TABLE L.7. (contd)

Sediment Treatment	Replicate	Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g}/\text{kg}$ wet weight)							
			Naphtha- lene	2-methyl- naphtha- lene	1-methyl- naphtha- lene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
<i>M. nasuta</i> Control	3	5	2.55	1.54(g)	0.74 J	1.91 U	0.72 U	0.36 J	1.34 J	0.28 J
<i>M. nasuta</i> Control MS	3	5	69.75	NA	NA	60.55	66.61	72.13	74.19	58.36
Concentration Recovered			67.20	NA	NA	60.55	66.61	71.77	72.85	58.08
Amount Spiked			63.88	NS	NS	63.88	63.88	63.88	63.88	63.88
Percent Recovery			105%	NA	NA	95%	104%	112%	114%	91%
Standard Reference Material										
Certified Value			NC(h)	NC	NC	NC	NC	NC	5.6 ± 1.4	0.75 ± 0.21
NIST 1974 COMP										
NIST 1974		3	NA	NA	NA	NA	NA	NA	7(i) 37.23	0.82(j) 4.14(i)
NIST 1974		4	NA	NA	NA	NA	NA	NA	5.19	2.37(i)
NIST 1974		5	NA	NA	NA	NA	NA	NA	14.98(i)	1.29(i)
Analytical Replicates										
PC-1A Rep 1	3	4	5.32 B	1.35 UB	1.00 J(g)	0.30 J	0.93 U	1.56 U	1.55 JB	0.54 J
PC-1A Rep 2	3	4	6.42 B(g)	1.59 UB	1.17 J(g)	0.36 J	0.39 J	0.59 J	1.55 JB	0.60 J
PC-1A Rep 3	3	4	96.12 B(g)	1.41 UB	7.01(g)	0.82 J	1.28	0.61 J	11.48 B(j)	0.52 J
RSD			145%(j)	NA	112%(j)	58%(j)	NA	NA	118%(j)	8%
Reference Rep 1	3	5	192.80(g)	45.37(g)	27.06(g)	2.43 U	2.17(g)	1.55 U	25.01(g)	0.67 J
Reference Rep 2	3	5	2.39 J	1.04 J	0.40 J	2.47 U	0.94 U	1.58 U	1.69 J	0.19 J
Reference Rep 3	3	5	1.96 U	0.96 J	0.59 J	1.81 U	0.68 U	0.43 J	1.47	0.24 J
RSD			NA	162%(j)	164%(j)	NA	NA	NA	144%(j)	72%(j)

TABLE L.7. (contd)

Sediment Treatment	Replicate	Batch	<i>M. nasuta</i> LPAHs ($\mu\text{g/kg}$ wet weight)							
			Naphtha- lene	2-methyl- naphtha- lene	1-methyl- naphtha- lene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
<i>M. nasuta</i> Background Rep 1	1	5	1.85 J	0.99 J	0.40 J	1.92 U	0.73 U	0.43 J	2.23	0.25 J
<i>M. nasuta</i> Background Rep 2	2	5	4.40	7.34	1.23 J	2.40 U	0.91 U	0.49 J	2.40	2.56
<i>M. nasuta</i> Background Rep 3	3	5	2.11	1.27	0.39 J	1.54 U	0.59 U	0.35 J	2.30	0.20 J
RSD			50% (j)	112% (j)	72% (j)	NA	NA	17%	4%	134% (j)

- (a) J Analyte detected below method detection limit (MDL), but above the instrument detection limit (IDL).
 (b) U Analyte was not present above the associated value.
 (c) B Procedural blank amount was detected at $>1/5$ of the target detection limit.
 (d) NA Not applicable.
 (e) NS Not spiked.
 (f) Recovery outside of quality control range (40%-120%).
 (g) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.
 (h) NC Not certified.
 (i) Value exceeds SRM goal of $\leq 30\%$.
 (j) Value exceeds precision goal of $\leq 30\%$.

TABLE L.8. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<i>M. nasuta</i> HPAHs ($\mu\text{g/kg}$ wet weight)												
Sediment Treatment	Replicate	Batch	Fluor-anthene	Pyrene	Benzo[a]-Anthracene	Chrysene	Benzo[b] Fluor-anthene	Benzo[k] Fluor-anthene	Benzo[a] pyrene	Indeno [1,2,3-c,d]-pyrene	Dibenzo-[a,h]-anthracene	Benzo-[g,h,i] perylene
Method Blanks												
COMP Blank			0.10 J ^(a)	0.16 J	0.76 U ^(b)	0.06 J	0.86 U	0.40 U	0.32 U	0.70 U	0.63 U	0.59 U
Blank	3		2.78 B ^(c)	2.68 B	0.77 J	1.20 J	1.04 J	0.34 J	0.36 J	0.48 J	0.18 J	0.78 J
Blank	4		8.09 B	5.98 B	1.54 B	2.03 B	1.74 B	0.71 B	0.89 B	0.73 J	0.17 J	0.89 J
Blank	5		1.08 J	1.61 B	0.60 J	0.85 J	0.73 J	0.51 J	0.46 J	1.03 U	0.93 U	0.71 J
Matrix Spikes												
PC-1 COMP			2.20	2.20	1.09 J	1.28 J	1.60 J	1.02	0.72	0.32 J	1.18 U	0.73 J
PC-1 COMP MS			99.81	98.44	101.77	98.66	104.86	106.28	104.95	99.37	110.7	107.10
Concentration Recovered			97.61	96.24	100.68	97.38	103.26	105.26	104.23	99.05	110.7	106.37
Amount Spiked			79.77	79.77	79.77	79.77	79.77	79.77	79.77	79.77	79.77	79.77
Percent Recovery			122%(d)	121%(d)	126%(d)	122%(d)	129%(d)	132%(d)	131%(d)	124%(d)	139%(d)	133%(d)
PC-1 COMP			2.20	2.20	1.09 J	1.28 J	1.60 J	1.02	0.72	0.32 J	1.18 U	0.73 J
PC-1 COMP MSD			104.16	102.47	109.57	105.97	110.31	110.53	108.08	110.2	121.2	117.45
Concentration Recovered			101.96	100.27	108.48	104.69	108.71	109.51	107.36	109.88	121.2	116.72
Amount Spiked			80.28	80.28	80.28	80.28	80.28	80.28	80.28	80.28	80.28	80.28
Percent Recovery			127%(d)	125%(d)	135%(d)	130%(d)	135%(d)	136%(d)	134%(d)	137%(d)	151%(d)	145%(d)
RPD			4%	3%	7%	7%	5%	3%	2%	10%	8%	9%
I-Stat			0.02	0.02	0.03	0.03	0.02	0.02	0.01	0.05	0.04	0.04
PC-5	2	4	9.35 B	13.98	5.30	5.70	18.78	4.67	7.15	1.16 J	0.28 J	1.06 J
PC-5 MS	2	4	56.28	62.29	49.56	50.04	66.14	52.46	47.22	35.33	27.61	30.56
Concentration Recovered			46.93	48.31	44.26	44.34	47.36	47.79	40.07	34.17	27.33	29.50
Amount Spiked			38.37	38.37	38.37	38.37	38.37	38.37	38.37	38.37	38.37	38.37
Percent Recovery			122%(d)	126%(d)	115%	116%	123%(d)	125%(d)	104%	89%	71%	77%
Reference	1	4	2.32 B	1.50 J	0.44 J	1.32 J	0.75 J	0.41 J	0.85 U	1.85 U	1.67 U	1.56 U
Reference MS	1	4	41.29	40	33.11	34.9	35.54	33.07	28.88	23.88	18.37	19.99
Concentration Recovered			38.97	38.50	32.67	33.58	34.79	32.66	28.88	23.88	18.37	19.99
Amount Spiked			31.11	31.11	31.11	31.11	31.11	31.11	31.11	31.11	31.11	31.11
Percent Recovery			125%(d)	124%(d)	105%	108%	112%	105%	93%	77%	59%	64%

TABLE L.8. (contd)

Sediment Treatment	Replicate	Batch	<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-c,d]-pyrene	Dibenzo-[a,h]-anthracene	Benzo-[g,h,i] perylene
<i>M. nasuta</i> Control	3	5	5.69	4.04	0.91 J	1.92	1.61 J	1.15	0.62 J	0.59 J	1.36 U	0.92 J
<i>M. nasuta</i> Control MS	3	5	76.45	81.73	72.3	82.8	58.85	66.19	61.04	58.37	63.79	47.81
Concentration Recovered			70.76	77.69	71.39	80.88	57.24	65.04	60.42	57.78	63.79	46.89
Amount Spiked			63.88	63.88	63.88	63.88	63.88	63.88	63.88	63.88	63.88	63.88
Percent Recovery			111%	122%(d)	112%	127%(d)	90%	102%	95%	90%	100%	73%
<u>Standard Reference Material</u>												
Certified Value			33.6 ±5.8	34.1 ±3.7	NC(e)	NC	6.5 ±1.2	NC	2.29 ±.47	1.8 ±.33	NC	2.47 ±.28
NIST 1974 COMP												
NIST 1974	3		33.15	31.29	NA(f)	NA	6.05	NA	1.61	1.75	NA	3.17(g)
NIST 1974	4		36.03	35.36	NA	NA	8.18	NA	2.35	2.08	NA	4.29(g)
NIST 1974	5		37.53	37.08	NA	NA	7.99	NA	1.49(g)	1.29(j)	NA	2.62(g)
NIST 1974	5		39.81	38.6	NA	NA	8.85(g)	NA	2.01	2.77(g)	NA	4.90(g)
<u>Analytical Replicates</u>												
PC-1A Rep 1	3	4	2.59 B	2.47	1.34 J	1.81 J	3.07	1.02 J	1.39	0.48 J	1.75 U	0.52 J
PC-1A Rep 2	3	4	2.52 JB	2.17	1.52 J	1.76 J	2.92	0.91 J	1.24	0.42 J	2.06 U	0.49 J
PC-1A Rep 3	3	4	3.37 B	2.82	1.37 J	1.72 J	2.72	0.86 J	1.20	0.62 J	1.83 U	0.71 J
RSD			17%	13%	7%	3%	6%	9%	8%	20%	NA	21%
Reference Rep 1	3	5	7.22	5.18(h)	1.27 J(h)	2.52	2.46	1.17(h)	0.99(h)	1.93 U	0.52 J	3.25(h)
Reference Rep 2	3	5	4.56	3.06	0.65 J	1.28 J	0.80 J	0.53 J	0.33 J	1.96 U	1.77 U	0.61 J
Reference Rep 3	3	5	4.29	2.92	0.63 J(i)	1.27 J(i)	0.68 J(i)	0.41 J(i)	0.36 J(i)	1.43 U	1.29 U	0.46 J(i)
RSD			30%	34%(i)	43%	43%	76%(i)	58%(i)	67%(i)	NA	NA	109%(i)

TABLE L.8. (contd)

Sediment Treatment	Replicate	Batch	<i>M. nasuta</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)									
			Fluor- anthene	Pyrene	Benzo[a]- Anthra- cene	Chrysene	Benzo[b] Fluor- anthene	Benzo[k] Fluor- anthene	Benzo[a] pyrene	Indeno [1,2,3- c,d]- pyrene	Dibenzo- [a,h]- anthra- cene	Benzo- [g,h,i] perylene
<i>M. nasuta</i> Background Rep 1	1	5	6.86	4.13	0.80 J	2.34	1.38 J	0.51 J	0.36 J	1.53 U	1.38 U	0.58 J
<i>M. nasuta</i> Background Rep 2	2	5	6.66	3.80	0.86 J	2.33 J	1.17 J	0.50 J	0.36 J	0.38 J	1.72 U	0.61 J
<i>M. nasuta</i> Background Rep 3	3	5	6.56	3.76	0.83 J	2.56	1.30 J	0.52 J	0.42 J	0.34 J	1.10 U	0.50 J
RSD			2%	5%	4%	5%	8%	2%	9%	NA	NA	10%

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

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

(c) B Procedural blank amount was detected at $>1/5$ of the target detection limit.

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

(e) NC Not certified.

(f) NA Not applicable.

(g) Value exceeds SRM goal of $\leq 30\%$.

(h) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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

TABLE L.9. Phenol and Substituted Phenol Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phenol and Substituted Phenols (µg/kg wet weight)				
				Phenol	2,4-di- methyl- phenol	2,4,6- tri- chloro- phenol	Para- chloro- meta- cresol	2-chloro- phenol
Target DL (a)				330	330	330	330	330
Achieved DL High				1155.00	1155.00	1155.00	1155.00	1155.00
Achieved DL Low				364.19	364.19	364.19	364.19	364.19
PC-1	1	5	14.978	36.30 J ^(b)	400.88 U ^(c)	400.88 U	400.88 U	400.88 U
PC-1	2	5	14.257	396.79 U	396.79 U	396.79 U	396.79 U	396.79 U
PC-1	3	5	11.647	23.20 J	377.00 U	377.00 U	377.00 U	377.00 U
PC-1	4	4	10.453	41.24 J	373.73 U	373.73 U	373.73 U	373.73 U
PC-1	5	3	12.981	142.96 J	650.28 U	650.28 U	650.28 U	650.28 U
PC-1A	1	5	13.331	391.68 U	391.68 U	391.68 U	391.68 U	391.68 U
PC-1A	2	4	14.133	89.69 J	364.19 U	364.19 U	364.19 U	364.19 U
PC-1A Rep 1	3	4	12.944	72.42 J	979.62 U	979.62 U	979.62 U	979.62 U
PC-1A Rep 2	3	4	12.944	125.58 J	1155.00 U	1155.00 U	1155.00 U	1155.00 U
PC-1A Rep 3	3	4	12.944	70.06 J	1027.85 U	1027.85 U	1027.85 U	1027.85 U
PC-1A	4	4	12.779	75.05 J	426.06 U	426.06 U	426.06 U	0.49 J
PC-1A	5	5	12.122	482.49 U	482.49 U	482.49 U	482.49 U	482.49 U
PC-2	1	4	12.313	146.35 J	529.30 U	529.30 U	529.30 U	529.30 U
PC-2	2	4	12.488	103.24 J	426.42 U	426.42 U	426.42 U	426.42 U
PC-2	3	4	14.708	112.29 J	569.67 U	569.67 U	569.67 U	569.67 U
PC-2	4	4	14.903	167.44 J	564.49 U	564.49 U	564.49 U	564.49 U
PC-2	5	4	14.869	87.87 J	836.19 U	836.19 U	836.19 U	836.19 U
PC-4	1	4	12.851	58.27 J	497.44 U	497.44 U	497.44 U	497.44 U
PC-4	2	5	14.206	497.51 U	497.51 U	497.51 U	497.51 U	497.51 U
PC-4	3	3	12.937	161.75 J	606.24 U	606.24 U	606.24 U	606.24 U
PC-4	4	3	12.755	91.64 J	593.08 U	593.08 U	593.08 U	593.08 U
PC-4	5	4	12.989	51.07 J	487.66 U	487.66 U	487.66 U	487.66 U
PC-5	1	5	12.806	39.86 J	0.17 J	462.60 U	462.60 U	462.60 U
PC-5	2	4	14.186	215.72 J	1128.29 U	1128.29 U	1128.29 U	1128.29 U
PC-5	3	5	14.039	0.37 J	428.08 U	428.08 U	428.08 U	428.08 U
PC-5	4	4	13.276	110.81 J	456.64 U	456.64 U	456.64 U	456.64 U
PC-5	5	3	13.892	110.60 J	653.64 U	653.64 U	653.64 U	653.64 U
Reference	1	4	12.696	1108.86	936.50 U	936.50 U	936.50 U	936.50 U
Reference	2	4	14.103	230.18 J	778.03 U	778.03 U	778.03 U	778.03 U
Reference Rep 1	3	5	12.986	64.75 J	976.47 U	976.47 U	976.47 U	976.47 U
Reference Rep 2	3	5	12.986	58.77 J	991.57 U	991.57 U	991.57 U	991.57 U
Reference Rep 3	3	5	12.986	59.70 J	724.38 U	724.38 U	724.38 U	724.38 U
Reference	4	3	12.212	148.09 J	643.83 U	643.83 U	643.83 U	643.83 U
Reference	5	3	13.839	173.00 J	641.15 U	641.15 U	641.15 U	641.15 U
<i>M. nasuta</i> Background Rep 1	1	5	16.303	771.90 U	771.90 U	771.90 U	771.90 U	771.90 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	1.67 J	964.23 U	964.23 U	964.23 U	964.23 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	40.04 J	619.62 U	619.62 U	619.62 U	619.62 U

TABLE L.9. (contd)

<u>Sediment</u> <u>Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Percent</u> <u>Dry</u> <u>Weight</u>	<u>M. nasuta</u> <u>Phenol and Substituted Phenols (µg/kg wet weight)</u>				
				<u>Phenol</u>	<u>2,4-di-</u> <u>methyl-</u> <u>phenol</u>	<u>2,4,6-</u> <u>tri-</u> <u>chloro-</u> <u>phenol</u>	<u>Para-</u> <u>chloro-</u> <u>meta-</u> <u>cresol</u>	<u>2-chloro-</u> <u>phenol</u>
<i>M. nasuta</i> Control	1	3	15.651	86.91 J	644.50 U	644.50 U	644.50 U	644.50 U
<i>M. nasuta</i> Control	2	3	14.229	124.24 J	655.52 U	655.52 U	655.52 U	655.52 U
<i>M. nasuta</i> Control	3	5	13.711	50.28 J	764.64 U	764.64 U	764.64 U	764.64 U
<i>M. nasuta</i> Control	4	5	14.994	415.37 U	415.37 U	415.37 U	415.37 U	415.37 U
<i>M. nasuta</i> Control	5	5	12.880	31.13 J	372.01 U	372.01 U	372.01 U	372.01 U

(a) DL Detection limit.

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

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

TABLE L.10. Phenols and Substituted Phenol Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<i>M. nasuta</i> Phenol and Substituted Phenols (<i>µ</i> g/kg wet weight)									
Sediment Treatment	Percent Dry Weight	Replicate	Batch	2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
Target DL (a)									
Achieved DL High				330	330	330	330	330	330
Achieved DL Low				1155.00	1155.00	1155.00	1155.00	1155.00	1155.00
				364.19	364.19	364.19	364.19	364.19	364.19
PC-1	14.978	1	5	400.88 U (b)	400.88 U	400.88 U	400.88 U	400.88 U	400.88 U
PC-1	14.257	2	5	396.79 U	2.35 J (c)	396.79 U	396.79 U	396.79 U	396.79 U
PC-1	11.647	3	5	377.00 U	377.00 U	377.00 U	377.00 U	377.00 U	377.00 U
PC-1	10.453	4	4	373.73 U	373.73 U	373.73 U	373.73 U	373.73 U	373.73 U
PC-1	12.981	5	3	650.28 U	650.28 U	650.28 U	650.28 U	650.28 U	650.28 U
PC-1A	13.331	1	5	391.68 U	391.68 U	391.68 U	391.68 U	391.68 U	391.68 U
PC-1A	14.133	2	4	364.19 U	364.19 U	364.19 U	364.19 U	364.19 U	364.19 U
PC-1A Rep 1	12.944	3	4	979.62 U	979.62 U	979.62 U	979.62 U	979.62 U	979.62 U
PC-1A Rep 2	12.944	3	4	1155.00 U	1155.00 U	1155.00 U	1155.00 U	1155.00 U	1155.00 U
PC-1A Rep 3	12.944	3	4	1027.85 U	1027.85 U	1027.85 U	1027.85 U	1027.85 U	1027.85 U
PC-1A	12.779	4	4	426.06 U	426.06 U	426.06 U	426.06 U	426.06 U	426.06 U
PC-1A	12.122	5	5	482.49 U	482.49 U	482.49 U	482.49 U	482.49 U	482.49 U
PC-2	12.313	1	4	529.30 U	529.30 U	529.30 U	529.30 U	529.30 U	529.30 U
PC-2	12.488	2	4	426.42 U	426.42 U	426.42 U	426.42 U	426.42 U	426.42 U
PC-2	14.708	3	4	569.67 U	569.67 U	569.67 U	569.67 U	569.67 U	569.67 U
PC-2	14.903	4	4	564.49 U	564.49 U	564.49 U	564.49 U	564.49 U	564.49 U
PC-2	14.869	5	4	836.19 U	836.19 U	836.19 U	836.19 U	836.19 U	836.19 U
PC-4	12.851	1	4	497.44 U	497.44 U	497.44 U	497.44 U	497.44 U	497.44 U
PC-4	14.206	2	5	497.51 U	497.51 U	497.51 U	497.51 U	497.51 U	497.51 U
PC-4	12.937	3	3	606.24 U	606.24 U	606.24 U	606.24 U	606.24 U	606.24 U
PC-4	12.755	4	3	593.08 U	593.08 U	593.08 U	593.08 U	593.08 U	593.08 U
PC-4	12.989	5	4	487.66 U	487.66 U	487.66 U	487.66 U	487.66 U	487.66 U
PC-5	12.806	1	5	462.60 U	462.60 U	462.60 U	462.60 U	462.60 U	462.60 U
PC-5	14.186	2	4	1128.29 U	1128.29 U	1128.29 U	1128.29 U	1128.29 U	1128.29 U
PC-5	14.039	3	5	428.08 U	428.08 U	428.08 U	428.08 U	428.08 U	428.08 U
PC-5	13.276	4	4	456.64 U	456.64 U	456.64 U	456.64 U	456.64 U	456.64 U
PC-5	13.892	5	3	653.64 U	653.64 U	653.64 U	653.64 U	653.64 U	653.64 U

TABLE L.10. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phenol and Substituted Phenols (<i>µg</i> /kg wet weight)					
				2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
Reference	1	4	12.696	936.50 U	936.50 U	936.50 U	936.50 U	936.50 U	936.50 U
Reference	2	4	14.103	778.03 U	778.03 U	778.03 U	778.03 U	778.03 U	778.03 U
Reference Rep 1	3	5	12.986	976.47 U	976.47 U	976.47 U	976.47 U	976.47 U	976.47 U
Reference Rep 2	3	5	12.986	991.57 U	991.57 U	991.57 U	991.57 U	991.57 U	991.57 U
Reference Rep 3	3	5	12.986	724.38 U	724.38 U	724.38 U	724.38 U	724.38 U	724.38 U
Reference	4	3	12.212	643.83 U	643.83 U	643.83 U	643.83 U	643.83 U	643.83 U
Reference	5	3	13.839	641.15 U	641.15 U	641.15 U	641.15 U	641.15 U	641.15 U
<i>M. nasuta</i> Background Rep 1	1	5	16.303	771.90 U	771.90 U	771.90 U	771.90 U	771.90 U	771.90 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	964.23 U	964.23 U	964.23 U	964.23 U	964.23 U	964.23 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	619.62 U	619.62 U	619.62 U	619.62 U	619.62 U	619.62 U
<i>M. nasuta</i> Control	1	3	15.651	644.50 U	644.50 U	644.50 U	644.50 U	644.50 U	644.50 U
<i>M. nasuta</i> Control	2	3	14.229	655.52 U	655.52 U	655.52 U	655.52 U	655.52 U	655.52 U
<i>M. nasuta</i> Control	3	5	13.711	764.64 U	764.64 U	764.64 U	764.64 U	764.64 U	764.64 U
<i>M. nasuta</i> Control	4	5	14.994	415.37 U	2.37 J	415.37 U	415.37 U	415.37 U	415.37 U
<i>M. nasuta</i> Control	5	5	12.860	372.01 U	372.01 U	372.01 U	372.01 U	372.01 U	372.01 U

(a) DL Detection limit.

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

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

TABLE L.11. Phenol and Substituted Phenol Analysis, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phenol and Substituted Phenols (µg/kg dry weight)				
				Phenol	2,4-di- methyl- phenol	2,4,6- tri- chloro- phenol	Para- chloro- meta- cresol	2-chloro- phenol
PC-1	1	5	14.978	242.36 J ^(a)	2676.46 U ^(b)	2676.46 U	2676.46 U	2676.46 U
PC-1	2	5	14.257	2783.12 U	2783.12 U	2783.12 U	2783.12 U	2783.12 U
PC-1	3	5	11.847	199.19 J	3236.89 U	3236.89 U	3236.89 U	3236.89 U
PC-1	4	4	10.453	394.53 J	3575.34 U	3575.34 U	3575.34 U	3575.34 U
PC-1	5	3	12.981	1101.30 J	5009.48 U	5009.48 U	5009.48 U	5009.48 U
PC-1A	1	5	13.331	2938.11 U	2938.11 U	2938.11 U	2938.11 U	2938.11 U
PC-1A	2	4	14.133	634.61 J	2576.88 U	2576.88 U	2576.88 U	2576.88 U
PC-1A Rep 1	3	4	12.944	559.49 J	7568.14 U	7568.14 U	7568.14 U	7568.14 U
PC-1A Rep 2	3	4	12.944	970.18 J	8923.05 U	8923.05 U	8923.05 U	8923.05 U
PC-1A Rep 3	3	4	12.944	541.25 J	7940.74 U	7940.74 U	7940.74 U	7940.74 U
PC-1A	4	4	12.779	587.29 J	3334.06 U	3334.06 U	3334.06 U	3.83 J
PC-1A	5	5	12.122	3980.28 U	3980.28 U	3980.28 U	3980.28 U	3980.28 U
PC-2	1	4	12.313	1188.58 J	4298.71 U	4298.71 U	4298.71 U	4298.71 U
PC-2	2	4	12.488	828.71 J	3414.64 U	3414.64 U	3414.64 U	3414.64 U
PC-2	3	4	14.708	763.46 J	3873.20 U	3873.20 U	3873.20 U	3873.20 U
PC-2	4	4	14.903	1123.53 J	3787.76 U	3787.76 U	3787.76 U	3787.76 U
PC-2	5	4	14.889	590.96 J	5623.71 U	5623.71 U	5623.71 U	5623.71 U
PC-4	1	4	12.851	453.43 J	3870.83 U	3870.83 U	3870.83 U	3870.83 U
PC-4	2	5	14.206	3502.11 U	3502.11 U	3502.11 U	3502.11 U	3502.11 U
PC-4	3	3	12.937	1250.29 J	4686.09 U	4686.09 U	4686.09 U	4686.09 U
PC-4	4	3	12.755	718.46 J	4649.78 U	4649.78 U	4649.78 U	4649.78 U
PC-4	5	4	12.989	393.18 J	3754.41 U	3754.41 U	3754.41 U	3754.41 U
PC-5	1	5	12.806	311.26 J	1.33 J	3612.37 U	3612.37 U	3612.37 U
PC-5	2	4	14.186	1520.65 J	7953.55 U	7953.55 U	7953.55 U	7953.55 U
PC-5	3	5	14.039	2.64 J	3049.22 U	3049.22 U	3049.22 U	3049.22 U
PC-5	4	4	13.276	834.66 J	3439.59 U	3439.59 U	3439.59 U	3439.59 U
PC-5	5	3	13.892	796.14 J	4705.15 U	4705.15 U	4705.15 U	4705.15 U
Reference	1	4	12.696	8733.93	7376.34 U	7376.34 U	7376.34 U	7376.34 U
Reference	2	4	14.103	1632.14 J	5516.77 U	5516.77 U	5516.77 U	5516.77 U
Reference Rep 1	3	5	12.986	498.61 J	7519.41 U	7519.41 U	7519.41 U	7519.41 U
Reference Rep 2	3	5	12.986	452.56 J	7635.68 U	7635.68 U	7635.68 U	7635.68 U
Reference Rep 3	3	5	12.986	459.73 J	5578.16 U	5578.16 U	5578.16 U	5578.16 U
Reference	4	3	12.212	1212.66 J	5272.11 U	5272.11 U	5272.11 U	5272.11 U
Reference	5	3	13.839	1250.09 J	4632.92 U	4632.92 U	4632.92 U	4632.92 U
<i>M. nasuta</i> Background Rep 1	1	5	16.303	4734.71 U	4734.71 U	4734.71 U	4734.71 U	4734.71 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	10.24 J	5914.43 U	5914.43 U	5914.43 U	5914.43 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	245.60 J	3800.65 U	3800.65 U	3800.65 U	3800.65 U
<i>M. nasuta</i> Control	1	3	15.651	555.30 J	4117.95 U	4117.95 U	4117.95 U	4117.95 U
<i>M. nasuta</i> Control	2	3	14.229	873.15 J	4606.93 U	4606.93 U	4606.93 U	4606.93 U
<i>M. nasuta</i> Control	3	5	13.711	366.71 J	5576.84 U	5576.84 U	5576.84 U	5576.84 U
<i>M. nasuta</i> Control	4	5	14.994	2770.24 U	2770.24 U	2770.24 U	2770.24 U	2770.24 U
<i>M. nasuta</i> Control	5	5	12.86	242.07 J	2892.77 U	2892.77 U	2892.77 U	2892.77 U

(a) J Analyte detected below method detection limit (MDL), but above the instrument detection limit (IDL).
(b) U Analyte was not present above the associated value.

TABLE L.12. Phenol and Substituted Phenol Analysis, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phenol and Substituted Phenols (µg/kg dry weight)					
				2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
PC-1	1	5	14.978	2676.46 U (a) 2783.12 U 3236.89 U 3575.34 U 5009.48 U	2676.46 U 16.48 J (b) 3236.89 U 3575.34 U 5009.48 U	2676.46 U 2783.12 U 3236.89 U 3575.34 U 5009.48 U	2676.46 U 2783.12 U 3236.89 U 3575.34 U 5009.48 U	2676.46 U 2783.12 U 3236.89 U 3575.34 U 5009.48 U	
PC-1A	1	5	13.331	2938.11 U 2576.88 U 7568.14 U 8923.05 U 7940.74 U 3334.06 U 3980.28 U	2938.11 U 2576.88 U 7568.14 U 8923.05 U 7940.74 U 3334.06 U 3980.28 U	2938.11 U 2576.88 U 7568.14 U 8923.05 U 7940.74 U 3334.06 U 3980.28 U	2938.11 U 2576.88 U 7568.14 U 8923.05 U 7940.74 U 3334.06 U 3980.28 U	2938.11 U 2576.88 U 7568.14 U 8923.05 U 7940.74 U 3334.06 U 3980.28 U	
PC-2	1	4	12.313	4298.71 U 3414.64 U 3873.20 U 3787.76 U 5623.71 U	4298.71 U 3414.64 U 3873.20 U 3787.76 U 5623.71 U	4298.71 U 3414.64 U 3873.20 U 3787.76 U 5623.71 U	4298.71 U 3414.64 U 3873.20 U 3787.76 U 5623.71 U	4298.71 U 3414.64 U 3873.20 U 3787.76 U 5623.71 U	
PC-4	1	4	12.851	3870.83 U 3502.11 U 4686.09 U 4649.78 U 3754.41 U	3870.83 U 3502.11 U 4686.09 U 4649.78 U 3754.41 U	3870.83 U 3502.11 U 4686.09 U 4649.78 U 3754.41 U	3870.83 U 3502.11 U 4686.09 U 4649.78 U 3754.41 U	3870.83 U 3502.11 U 4686.09 U 4649.78 U 3754.41 U	
PC-5	1	5	12.806	3612.37 U 7953.55 U 3049.22 U 3439.59 U 4705.15 U	3612.37 U 7953.55 U 3049.22 U 3439.59 U 4705.15 U	3612.37 U 7953.55 U 3049.22 U 3439.59 U 4705.15 U	3612.37 U 7953.55 U 3049.22 U 3439.59 U 4705.15 U	3612.37 U 7953.55 U 3049.22 U 3439.59 U 4705.15 U	
Reference	1	4	12.696	7376.34 U 5516.77 U 7519.41 U 7635.68 U 5578.16 U 5272.11 U 4632.92 U	7376.34 U 5516.77 U 7519.41 U 7635.68 U 5578.16 U 5272.11 U 4632.92 U	7376.34 U 5516.77 U 7519.41 U 7635.68 U 5578.16 U 5272.11 U 4632.92 U	7376.34 U 5516.77 U 7519.41 U 7635.68 U 5578.16 U 5272.11 U 4632.92 U	7376.34 U 5516.77 U 7519.41 U 7635.68 U 5578.16 U 5272.11 U 4632.92 U	

TABLE L.12. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phenol and Substituted Phenols (<i>μ</i> g/kg dry weight)					
				2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
<i>M. nasuta</i> Background Rep 1	1	5	16.303	4734.71 U	4734.71 U	4734.71 U	4734.71 U	4734.71 U	4734.71 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	5914.43 U	5914.43 U	5914.43 U	5914.43 U	5914.43 U	5914.43 U
<i>M. nasuta</i> Background Rep 1	3	5	16.303	3800.65 U	3800.65 U	3800.65 U	3800.65 U	3800.65 U	3800.65 U
<i>M. nasuta</i> Control	1	3	15.651	4117.95 U	4117.95 U	4117.95 U	4117.95 U	4117.95 U	4117.95 U
<i>M. nasuta</i> Control	2	3	14.229	4606.93 U	4606.93 U	4606.93 U	4606.93 U	4606.93 U	4606.93 U
<i>M. nasuta</i> Control	3	5	13.711	5576.84 U	5576.84 U	5576.84 U	5576.84 U	5576.84 U	5576.84 U
<i>M. nasuta</i> Control	4	5	14.994	2770.24 U	15.81 J	2770.24 U	2770.24 U	2770.24 U	2770.24 U
<i>M. nasuta</i> Control	5	5	12.860	2892.77 U	2892.77 U	2892.77 U	2892.77 U	2892.77 U	2892.77 U

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

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

TABLE L.13. Quality Control Data for Phenol and Substituted Phenol Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<i>M. nasuta</i>							
Phenol and Substituted Phenols ($\mu\text{g/kg}$ wet weight)							
Sediment Treatment	Replicate	Batch	Phenol	2,4-di-methyl-phenol	2,4,6-tri-chloro-phenol	Para-chloro-meta-cresol	2-chloro-phenol
<u>Method Blanks</u>							
Blank		3	59.04 J ^(a)	659.89 U ^(b)	659.89 U	659.89 U	659.89 U
Blank		4	62.16 J	584.69 U	584.69 U	584.69 U	584.69 U
Blank		5	522.06 U	522.06 U	522.06 U	522.06 U	522.06 U
<u>Matrix Spikes</u>							
Reference	1	4	1108.86	936.50 U	936.50 U	936.50 U	936.50 U
Reference MS	1	4	3349.87	3219.17	8267.78	2865.57	3594.26
Concentration Recovered			2241.01	3219.17	8267.78	2865.57	3594.26
Amount Spiked			2837.23	2837.23	2923.84	2837.23	2837.23
Percent Recovery			79%	113%	283% ^(c)	101%	127% ^(c)
PC-5	2	4	215.72 J	1128.29 U	1128.29 U	1128.29 U	1128.29 U
PC-5 MS	2	4	3774.23	4161.16	5107.92	2882.35	4368.89
Concentration Recovered			3558.51	4161.16	5107.92	2882.35	4368.89
Amount Spiked			3499.34	3499.35	3606.17	3499.35	3499.35
Percent Recovery			102%	119%	142% ^(c)	82%	125% ^(c)
<i>M. nasuta</i> Control	3	5	50.28 J	764.64 U	764.64 U	764.64 U	764.64 U
<i>M. nasuta</i> Control	3	5	2963.81	3539.06	11075.88	2586.38	3350.10
Concentration Recovered			2913.53	3539.06	11075.88	2586.38	3350.10
Amount Spiked			3066.31	3066.31	3159.83	3066.31	3066.31
Percent Recovery			95%	115%	351% ^(c)	84%	109%
<u>Analytical Replicates</u>							
PC-1A Rep 1	3	4	72.42 J	979.62 U	979.62 U	979.62 U	979.62 U
PC-1A Rep 2	3	4	125.58 J	1155.00 U	1155.00 U	1155.00 U	1155.00 U
PC-1A Rep 3	3	4	70.06 J	1027.85 U	1027.85 U	1027.85 U	1027.85 U
RSD			35% ^(d)	NA ^(e)	NA	NA	NA
Reference Rep 1	3	5	64.75 J	976.47 U	976.47 U	976.47 U	976.47 U
Reference Rep 2	3	5	58.77 J	991.57 U	991.57 U	991.57 U	991.57 U
Reference Rep 3	3	5	59.70 J	724.38 U	724.38 U	724.38 U	724.38 U
RSD			5%	NA	NA	NA	NA
<i>M. nasuta</i> Background Rep 1	1	5	771.90 U	771.90 U	771.90 U	771.90 U	771.90 U
<i>M. nasuta</i> Background Rep 2	2	5	1.67 J	964.23 U	964.23 U	964.23 U	964.23 U
<i>M. nasuta</i> Background Rep 3	3	5	40.04 J	619.62 U	619.62 U	619.62 U	619.62 U
RSD			NA	NA	NA	NA	NA

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

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

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

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

(e) NA Not applicable.

TABLE L.14. Quality Control Data for Phenol and Substituted Phenol Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

			M. nasuta					
			Phenol and Substituted Phenols (µg/kg wet weight)					
Sediment Treatment	Replicate	Batch	2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
Method Blanks								
Blank		3	659.89 U ^(a)	659.89 U	659.89 U	659.89 U	659.89 U	659.89 U
Blank		4	584.69 U	584.69 U	584.69 U	584.69 U	584.69 U	584.69 U
Blank		5	522.06 U	522.06 U	522.06 U	522.06 U	522.06 U	522.06 U
Matrix Spikes								
Reference	1	4	936.50 U	936.50 U	936.50 U ^(b)	936.50 U	936.50 U	936.50 U
Reference MS	1	4	3672.33	2980.31	NA	2787.64	32156.90	NA
Concentration Recovered			3672.33	2980.31	NA	2787.64	32156.90	NA
Amount Spiked			2837.23	2837.23	2837.23	2896.78	2837.23	2837.23
Percent Recovery			129% ^(c)	105%	NA	96%	1133% ^(c)	NA
PC-5	2	4	1128.29 U	1128.29 U	1128.29 U	1128.29 U	1128.29 U	1128.29 U
PC-5 MS	2	4	3228.19	3836.87	NA	NA	27315.70	NA
Concentration Recovered			3228.19	3836.87	NA	NA	27315.70	NA
Amount Spiked			3499.35	3499.35	3499.35	3572.79	3499.35	3499.35
Percent Recovery			92%	110%	NA	NA	781% ^(c)	NA
M. nasuta Control	3	5	764.64 U	764.64 U	764.64 U	764.64 U	764.64 U	764.64 U
M. nasuta Control	3	5	4283.96	3330.58	NA	NA	3085.59	NA
Concentration Recovered			4283.96	3330.58	NA	NA	3085.59	NA
Amount Spiked			3066.31	3066.31	3066.31	3130.70	3066.31	3066.31
Percent Recovery			140% ^(c)	109%	NA	NA	101%	NA
Analytical Replicates								
PC-1A Rep 1	3	4	979.62 U	979.62 U	979.62 U	979.62 U	979.62 U	979.62 U
PC-1A Rep 2	3	4	1155.00 U	1155.00 U	1155.00 U	1155.00 U	1155.00 U	1155.00 U
PC-1A Rep 3	3	4	1027.85 U	1027.85 U	1027.85 U	1027.85 U	1027.85 U	1027.85 U
RSD			NA	NA	NA	NA	NA	NA
Reference Rep 1	3	5	976.47 U	976.47 U	976.47 U	976.47 U	976.47 U	976.47 U
Reference Rep 2	3	5	991.57 U	991.57 U	991.57 U	991.57 U	991.57 U	991.57 U
Reference Rep 3	3	5	724.38 U	724.38 U	724.38 U	724.38 U	724.38 U	724.38 U
RSD			NA	NA	NA	NA	NA	NA
M. nasuta Background Rep 1	1	5	771.90 U	771.90 U	771.90 U	771.90 U	771.90 U	771.90 U
M. nasuta Background Rep 2	2	5	964.23 U	964.23 U	964.23 U	964.23 U	964.23 U	964.23 U
M. nasuta Background Rep 3	3	5	619.62 U	619.62 U	619.62 U	619.62 U	619.62 U	619.62 U
RSD			NA	NA	NA	NA	NA	NA

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

(b) NA Not applicable.

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

TABLE L.15. Phthalate Ester Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phthalate Esters ($\mu\text{g/kg}$ wet weight)					
				Bis(2- ethyl hexyl) phthalate	Butyl benzyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Diethyl phthalate	Dimethyl phthalate
Target DL (a)				100	100	100	100	100	100
Achieved DL High				231.00	231.00	231.00	231.00	231.00	231.00
Achieved DL Low				72.84	72.84	72.84	72.84	72.84	72.84
PC-1	1	5	14.978	24.04 J(b)	80.18 U(c)	25.26 J	80.18 U	80.18 U	80.18 U
PC-1	2	5	14.257	15.74 J	79.36 U	2.48 J	79.36 U	79.36 U	79.36 U
PC-1	3	5	11.647	43.27 J	75.40 U	14.50 J	75.40 U	0.72 J	75.40 U
PC-1	4	4	10.453	35.32 J	74.75 U	3.53 J	74.75 U	1.31 J	0.63 J
PC-1	5	3	12.981	16.49 J	85.42 J	6.53 J	130.06 U	5.42 J	1.05 J
PC-1A	1	5	13.331	15.44 J	78.34 U	3.04 J	78.34 U	78.34 U	78.34 U
PC-1A	2	4	14.133	33.14 J	72.84 U	2.14 J	72.84 U	1.45 J	0.53 J
PC-1A Rep 1	3	4	12.944	91.39 J	195.92 U	6.80 J	195.92 U	3.60 J	1.41 J
PC-1A Rep 2	3	4	12.944	49.33 J	231.00 U	5.81 J	231.00 U	2.76 J	1.43 J
PC-1A Rep 3	3	4	12.944	23.52 J	205.57 U	4.61 J	205.57 U	2.32 J	0.63 J
PC-1A	4	4	12.779	4564.56(d)	85.21 U	0.88 J	0.85 J	2.14 J	1.12 J
PC-1A	5	5	12.122	20.22 J	96.50 U	2.92 J	96.50 U	0.97 J	96.50 U
PC-2	1	4	12.313	47.90 J	105.86 U	105.86 U	105.86 U	105.86 U	105.86 U
PC-2	2	4	12.488	29.67 J	85.28 U	1.68 J	85.28 U	85.28 U	85.28 U
PC-2	3	4	14.708	24.58 J	113.93 U	2.15 J	113.93 U	1.23 J	113.93 U
PC-2	4	4	14.903	19.02 J	112.90 U	2.39 J	112.90 U	1.98 J	0.73 J
PC-2	5	4	14.869	36.12 J	167.24 U	3.63 J	167.24 U	2.91 J	167.24 U
PC-4	1	4	12.851	45.81 J	99.49 U	2.02 J	99.49 U	1.65 J	99.49 U
PC-4	2	5	14.206	18.89 J	99.50 U	99.50 U	99.50 U	99.50 U	99.50 U
PC-4	3	3	12.937	18.73 J	69.73 J	121.25 U	6.56 J	5.08 J	121.25 U
PC-4	4	3	12.755	10.16 J	118.62 U	118.62 U	8.64 J	1.64 J	118.62 U
PC-4	5	4	12.989	31.27 J	97.53 U	4.11 J	97.53 U	97.53 U	97.53 U
PC-5	1	5	12.806	62.71 J	92.52 U	32.55 J	92.52 U	92.52 U	0.41 J
PC-5	2	4	14.186	34.86 J	225.66 U	5.13 J	5.86 J	225.66 U	225.66 U
PC-5	3	5	14.039	18.34 J	85.62 U	85.62 U	85.62 U	1.07 J	85.62 U
PC-5	4	4	13.276	33.49 J	91.33 U	2.30 J	91.33 U	1.30 J	91.33 U
PC-5	5	3	13.892	7.38 J	130.73 U	3.42 J	8.80 J	130.73 U	130.73 U

TABLE L.15. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phthalate Esters ($\mu\text{g}/\text{kg}$ wet weight)					
				Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Diethyl phthalate	Dimethyl phthalate
Reference	1	4	12.696	95.84 J	187.30 U	55.94 J	10.94 J	23.90 J	187.30 U
Reference	2	4	14.103	52.91 J	155.61 U	3.50 J	155.61 U	155.61 U	155.61 U
Reference Rep 1	3	5	12.986	85.87 J	195.29 U	79.16 J	195.29 U	1.29 J	195.29 U
Reference Rep 2	3	5	12.986	53.15 J	198.31 U	8.46 J	198.31 U	5.89 J	1.92 J
Reference Rep 3	3	5	12.986	38.57 J	144.88 U	5.47 J	144.88 U	144.88 U	144.88 U
Reference	4	3	12.212	11.75 J	128.77 U	3.65 J	6.49 J	0.90 J	128.77 U
Reference	5	3	13.839	13.64 J	128.23 U	5.68 J	10.34 J	0.86 J	0.76 J
<i>M. nasuta</i> Background Rep 1	1	5	16.303	60.05 J	154.38 U	10.84 J	154.38 U	154.38 U	154.38 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	174.11 J	192.85 U	3.02 J	192.85 U	1.36 J	192.85 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	108.59 J	123.92 U	3.86 J	123.92 U	123.92 U	0.73 J
<i>M. nasuta</i> Control	1	3	15.651	15.64 J	19.72 J	128.90 U	11.90 J	4.32 J	1.22 J
<i>M. nasuta</i> Control	2	3	14.229	7.09 J	131.10 U	4.17 J	7.30 J	0.96 J	131.10 U
<i>M. nasuta</i> Control	3	5	13.711	34.89 J	152.93 U	2.99 J	152.93 U	0.90 J	152.93 U
<i>M. nasuta</i> Control	4	5	14.994	19.87 J	83.07 U	83.07 U	83.07 U	83.07 U	83.07 U
<i>M. nasuta</i> Control	5	5	12.860	38.56 J	74.40 U	20.25 J	74.40 U	0.85 J	0.24 J

(a) DL Detection limit.

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

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

(d) Value was confirmed to be detected at this level. Bis(2-ethylhexyl) phthalate is a common laboratory contaminant introduced from materials such as plastics.

TABLE L.16. Phthalate Ester Analysis, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phthalate Esters ($\mu\text{g/kg}$ dry weight)						
				Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Diethyl phthalate	Dimethyl phthalate	
PC-1	1	5	14.978	160.50 J ^(a)	535.32 U ^(b)	168.65 J	535.32 U	535.32 U	535.32 U	
PC-1	2	5	14.257	110.40 J	556.64 U	17.39 J	556.64 U	556.64 U	556.64 U	
PC-1	3	5	11.647	371.51 J	647.38 U	124.50 J	647.38 U	6.18 J	647.38 U	
PC-1	4	4	10.453	337.89 J	715.11 U	33.77 J	715.11 U	12.53 J	6.03 J	
PC-1	5	3	12.981	127.03 J	658.04 J	50.30 J	1001.93 U	41.75 J	8.09 J	
PC-1A	1	5	13.331	115.82 J	587.65 U	22.80 J	587.65 U	587.65 U	587.65 U	
PC-1A	2	4	14.133	234.49 J	515.39 U	15.14 J	515.39 U	10.26 J	3.75 J	
PC-1A Rep 1	3	4	12.944	706.04 J	1513.60 U	52.53 J	1513.60 U	27.81 J	10.89 J	
PC-1A Rep 2	3	4	12.944	381.10 J	1784.61 U	44.89 J	1784.61 U	21.32 J	11.05 J	
PC-1A Rep 3	3	4	12.944	181.71 J	1588.15 U	35.61 J	1588.15 U	17.92 J	4.87 J	
PC-1A	4	4	12.779	35719.23	666.80 U	6.89 J	6.65 J	16.75 J	8.76 J	
PC-1A	5	5	12.122	166.80 J	796.07 U	24.09 J	796.07 U	8.00 J	796.07 U	
PC-2	1	4	12.313	389.02 J	859.74 U	859.74 U	859.74 U	859.74 U	859.74 U	
PC-2	2	4	12.488	237.59 J	682.90 U	13.45 J	682.90 U	682.90 U	682.90 U	
PC-2	3	4	14.708	167.12 J	774.61 U	14.62 J	774.61 U	8.36 J	774.61 U	
PC-2	4	4	14.903	127.63 J	757.57 U	16.04 J	757.57 U	13.29 J	4.90 J	
PC-2	5	4	14.869	242.92 J	1124.76 U	24.41 J	1124.76 U	19.57 J	1124.76 U	
PC-4	1	4	12.851	356.47 J	774.18 U	15.72 J	774.18 U	12.84 J	774.18 U	
PC-4	2	5	14.206	132.97 J	700.41 U	700.41 U	700.41 U	700.41 U	700.41 U	
PC-4	3	3	12.937	144.78 J	539.00 J	937.23 U	50.71 J	39.27 J	937.23 U	
PC-4	4	3	12.755	79.66 J	929.99 U	929.99 U	67.74 J	12.86 J	929.99 U	
PC-4	5	4	12.989	240.74 J	750.87 U	31.64 J	750.87 U	750.87 U	750.87 U	
PC-5	1	5	12.806	489.69 J	722.47 U	254.18 J	722.47 U	722.47 U	3.20 J	
PC-5	2	4	14.186	245.74 J	1590.72 U	36.16 J	41.31 J	1590.72 U	1590.72 U	
PC-5	3	5	14.039	130.64 J	609.87 U	609.87 U	609.87 U	7.62 J	609.87 U	
PC-5	4	4	13.276	252.26 J	687.93 U	17.32 J	687.93 U	9.79 J	687.93 U	
PC-5	5	3	13.892	53.12 J	941.05 U	24.62 J	63.35 J	941.05 U	941.05 U	
Reference	1	4	12.696	754.88 J	1475.27 U	440.61 J	86.17 J	188.25 J	1475.27 U	
Reference	2	4	14.103	375.17 J	1103.38 U	24.82 J	1103.38 U	1103.38 U	1103.38 U	
Reference Rep 1	3	5	12.986	661.25 J	1503.85 U	609.58 J	1503.85 U	9.93 J	1503.85 U	
Reference Rep 2	3	5	12.986	409.29 J	1527.11 U	65.15 J	1527.11 U	45.36 J	14.79 J	
Reference Rep 3	3	5	12.986	297.01 J	1115.66 U	42.12 J	1115.66 U	1115.66 U	1115.66 U	
Reference	4	3	12.212	96.22 J	1054.45 U	29.89 J	53.14 J	7.37 J	1054.45 U	
Reference	5	3	13.839	98.56 J	926.58 U	41.04 J	74.72 J	6.21 J	5.49 J	

TABLE L.16. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Phthalate Esters ($\mu\text{g/kg}$ dry weight)					
				Bis(2- ethylhexyl phthalate)	Butyl benzyl phthalate	Di-n- butyl phthalate	Di-n- octyl phthalate	Diethyl phthalate	Dimethyl phthalate
<i>M. nasuta</i> Background Rep 1	1	5	16.303	368.34 J	946.94 U	66.49 J	946.94 U	946.94 U	946.94 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	1067.96 J	1182.91 U	18.52 J	1182.91 U	8.34 J	1182.91 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	666.07 J	760.11 U	23.68 J	760.11 U	760.11 U	4.48 J
<i>M. nasuta</i> Control	1	3	15.651	99.93 J	126.00 J	823.59 U	76.03 J	27.60 J	7.80 J
<i>M. nasuta</i> Control	2	3	14.229	49.83 J	921.36 U	29.31 J	51.30 J	6.75 J	921.36 U
<i>M. nasuta</i> Control	3	5	13.711	254.47 J	1115.38 U	21.81 J	1115.38 U	6.56 J	1115.38 U
<i>M. nasuta</i> Control	4	5	14.994	132.52 J	554.02 U	554.02 U	554.02 U	554.02 U	554.02 U
<i>M. nasuta</i> Control	5	5	12.860	299.84 J	578.54 U	157.47 J	578.54 U	6.61 J	1.87 J

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

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

TABLE L.17. Quality Control Summary for Phthalate Ester Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<i>M. nasuta</i> Phthalate Esters (µg/kg wet weight)								
Sediment Treatment	Replicate	Batch	Bis(2-ethyl-hexyl) phthalate	Butyl benzyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Diethyl phthalate	Dimethyl phthalate
<u>Method Blanks</u>								
Blank		3	131.98 U ^(a)	131.98 U	131.98 U	131.98 U	131.98 U	131.98 U
Blank		4	64.01 J ^(b)	8.92 J	8.67 J	3.62 J	3.71 J	3.01 J
Blank		5	26.66 J	104.41 U	68.40 J	104.41 U	104.41 U	104.41 U
<u>Matrix Spikes</u>								
Reference	1	4	95.84 J	187.30 U	55.94 J	10.94 J	23.90 J	187.30 U
Reference MS	1	4	1380.28	1431.14	1554.75	1703.46	1712.32	1715.07
Concentration Recovered			1284.44	1431.14	1498.81	1692.52	1688.42	1715.07
Amount Spiked			1306.62	1306.62	1306.62	1306.62	1340.03	1306.62
Percent Recovery			98%	110%	115%	130% ^(c)	126% ^(c)	131% ^(c)
PC-5	2	4	34.86 J	225.66 U	5.13 J	5.86 J	225.66 U	225.66 U
PC-5 MS	2	4	1213.57	1285.77	1738.41	1483.36	1995.54	2076.84
Concentration Recovered			1178.71	1285.77	1733.28	1477.50	1995.54	2076.84
Amount Spiked			1611.54	1611.54	1611.54	1611.54	1652.75	1611.54
Percent Recovery			73%	80%	108%	92%	121% ^(c)	129% ^(c)
<i>M. nasuta</i> Control	3	5	34.89 J	152.93 U	2.99 J	152.93 U	0.90 J	152.93 U
<i>M. nasuta</i> Control	3	5	651.77	497.85	762.73	1072.47	1229.14	1397.92
Concentration Recovered			616.88	497.85	759.74	1072.47	1228.24	1397.92
Amount Spiked			1149.86	1149.86	1149.86	1149.86	1179.19	1149.87
Percent Recovery			54%	43%	66%	93%	104%	122% ^(c)
<u>Analytical Replicates</u>								
PC-1A Rep 1	3	4	91.39 J	195.92 U	6.80 J	195.92 U	3.60 J	1.41 J
PC-1A Rep 2	3	4	49.33 J	231.00 U	5.81 J	231.00 U	2.76 J	1.43 J
PC-1A Rep 3	3	4	23.52 J ^(d)	205.57 U ^(e)	4.61 J	205.57 U	2.32 J	0.63 J ^(d)
RSD			63% ^(d)	NA ^(e)	19%	NA	22%	39% ^(d)
Reference Rep 1	3	5	85.87 J	195.29 U	79.16 J	195.29 U	1.29 J	195.29 U
Reference Rep 2	3	5	53.15 J	198.31 U	8.46 J	198.31 U	5.89 J	1.92 J
Reference Rep 3	3	5	38.57 J ^(d)	144.88 U	5.47 J ^(d)	144.88 U	144.88 U	144.88 U
RSD			41% ^(d)	NA	134% ^(d)	NA	NA	NA
<i>M. nasuta</i> Background Rep 1	1	5	60.05 J	154.38 U	10.84 J	154.38 U	154.38 U	154.38 U
<i>M. nasuta</i> Background Rep 2	2	5	174.11 J	192.85 U	3.02 J	192.85 U	1.36 J	192.85 U
<i>M. nasuta</i> Background Rep 3	3	5	108.59 J ^(d)	123.92 U	3.86 J ^(d)	123.92 U	123.92 U	0.73 J
RSD			50% ^(d)	NA	73% ^(d)	NA	NA	NA

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

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

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

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

(e) NA Not applicable.

TABLE L.18. Surrogate Recoveries and Quality Control Data for Polychlorinated Aromatic Hydrocarbons (PAH) and Phenol Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	<i>M. nasuta</i> Surrogate Percent Recoveries			
			2-fluoro-phenol	Naph-thalene d8	Acenaph-thene d10	Benzo[a]-pyrene d12
PC-1	1	5	81	90	161 ^(a)	101
PC-1	2	5	83	105	216 ^(a)	91
PC-1	3	5	105	90	205 ^(a)	79
PC-1	4	4	117	72	87	90
PC-1	5	3	80	69	84	76
PC-1A	1	5	96	90	185 ^(a)	65
PC-1A	2	4	45	43	120	70
PC-1A Rep 1	3	4	127 ^(a)	58	88	87
PC-1A Rep 2	3	4	144 ^(a)	81	105	91
PC-1A Rep 3	3	4	148 ^(a)	77	108	84
PC-1A	4	4	96	66	70	70
PC-1A	5	5	106	109	191 ^(a)	66
PC-2	1	4	90	49	56	55
PC-2	2	4	72	62	142 ^(a)	75
PC-2	3	4	68	56	138 ^(a)	68
PC-2	4	4	81	68	149 ^(a)	80
PC-2	5	4	75	65	139 ^(a)	76
PC-4	1	4	73	62	141 ^(a)	90
PC-4	2	5	125 ^(a)	106	381 ^(a)	125 ^(a)
PC-4	3	3	78	77	87	69
PC-4	4	3	81	69	83	71
PC-4	5	4	78	58	130 ^(a)	83
PC-5	1	5	107	89	141 ^(a)	94
PC-5	2	4	78	61	121 ^(a)	66
PC-5	3	5	85	101	195 ^(a)	99
PC-5	4	4	71	66	124 ^(a)	71
PC-5	5	3	95	83	101	83
Reference	1	4	8 ^(a)	7 ^(a)	11 ^(a)	0 ^(a)
Reference	2	4	77	51	153 ^(a)	87
Reference Rep 1	3	5	106	81	128 ^(a)	58
Reference Rep 2	3	5	103	103	199 ^(a)	103
Reference Rep 3	3	5	110	101	139 ^(a)	78
Reference	4	3	90	76	92	77
Reference	5	3	95	79	90	69

TABLE L.18. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>M. nasuta Surrogate Percent Recoveries</u>			
			<u>2-fluoro-phenol</u>	<u>Naph-thalene d8</u>	<u>Acenaph-thene d10</u>	<u>Benzo[a]-pyrene d12</u>
<i>M. nasuta</i> Background Rep 1	1	5	111	95	232 ^(a)	93
<i>M. nasuta</i> Background Rep 2	2	5	102	104	194 ^(a)	95
<i>M. nasuta</i> Background Rep 3	3	5	117	119	227 ^(a)	99
<i>M. nasuta</i> Control	1	3	88	74	91	74
<i>M. nasuta</i> Control	2	3	88	82	94	67
<i>M. nasuta</i> Control	3	5	119	106	176 ^(a)	95
<i>M. nasuta</i> Control	4	5	101	108	205 ^(a)	111
<i>M. nasuta</i> Control	5	5	107	90	173 ^(a)	98

Method Blanks

Blank	3	75	64	65	85
Blank	4	90	61	67	67
Blank	5	2 ^(a)	39 ^(a)	49	52

Matrix Spikes

Reference MS	4	119	89	104	89
PC-5 MS	4	124 ^(a)	90	112	86
<i>M. nasuta</i> Control MS	5	110	90	174 ^(a)	94

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

TABLE L.19. Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4'-DDT), Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides (<i>µg</i> /kg wet weight)									
				Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta BHC	Dieldrin	4,4'-DDD	4,4'-DDE	4,4'-DDT	
Target DL (a)				10	10	10	30	10	10	10	10	10	
Achieved High DL				0.19	0.29	0.29	5.73	0.29	0.23	0.29	0.64	0.60	
Achieved Low DL				0.05	0.08	0.08	1.61	0.08	0.07	0.08	0.18	0.17	
PC-1 Comp			14.424	0.11 U (b)	0.06 J (c)	0.17 U	3.30 U	0.17 U	0.13 U	4.31	0.42	0.19 J (e)	
PC-1	1	5	14.978	0.07 U	0.10	0.02 J	1.99 U	0.10 U	0.08 J	4.17 B (d)	0.80	1.80 B (e)	
PC-1	2	5	14.257	0.07 U	0.14	0.02 J	1.97 U	0.10 U	0.06 J	1.89 B	0.65	0.83 B (e)	
PC-1	3	5	11.647	0.06 U	0.09 J	0.10 U	1.87 U	0.10 U	0.09	4.87 B	0.56	2.16 B (e)	
PC-1	4	4	10.453	0.06 U	0.06 J	0.09 U	1.86 U	0.09 U	0.16	0.46	0.53	0.19 U	
PC-1	5	3	12.981	0.11 U	0.16 U	0.05 J	3.23 U	0.16 U	0.13 U	0.72	0.42	0.34 U	
PC-1A Comp			14.505	0.05 U	0.08 J	0.08 U	1.61 U	0.08 U	0.07 U	1.18	0.34	0.07 J (e)	
PC-1A	1	5	13.331	0.06 U	0.10 J	0.10 U	1.95 U	0.10 U	0.08 U	0.44 B	0.40	0.27 B (e)	
PC-1A	2	4	14.133	0.06 U	0.06 J	0.01 J	1.81 U	0.09 U	0.02 J	0.16	0.40	0.19 U	
PC-1A Rep 1	3	4	12.944	0.16 U	0.16 J	0.25 U	4.86 U	0.25 U	0.04 J	0.32	0.61	0.51 U	
PC-1A Rep 2	3	4	12.944	0.19 U	0.13 J	0.29 U	5.74 U	0.29 U	0.07 J	0.30	0.59 J	0.60 U	
PC-1A Rep 3	3	4	12.944	0.17 U	0.15 J	0.26 U	5.10 U	0.26 U	0.07 J	0.36	0.63	0.54 U	
PC-1A	4	4	12.779	0.07 U	0.07 J	0.03 J	2.12 U	0.11 U	0.03 J	0.25	0.46	0.22 U (e)	
PC-1A	5	5	12.122	0.08 U	0.11 J	0.12 U	2.40 U	0.12 U	0.10 U	0.87 B	0.45	0.82 B (e)	
PC-2 Comp			14.158	0.05 U	0.08 J	0.08 U	1.65 U	0.08 U	0.07 U	2.73	0.35	0.12 J	
PC-2	1	4	12.313	0.09 U	0.05 J	0.13 U	2.63 U	0.13 U	0.03 J	0.13 J	0.38	0.28 U	
PC-2	2	4	12.488	0.07 U	0.15	0.04 J	2.12 U	0.11 U	0.03 J	0.34	0.69	0.08 J	
PC-2	3	4	14.708	0.09 U	0.07 J	0.14 U	2.83 U	0.14 U	0.01 J	0.20	0.49	0.30 U	
PC-2	4	4	14.903	0.09 U	0.08 J	0.02 J	2.80 U	0.14 U	0.03 J	0.28	0.59	0.29 U	
PC-2	5	4	14.869	0.14 U	0.09 J	0.21 U	4.15 U	0.21 U	0.07 J	0.26	0.55	0.44 U	
PC-4 Comp			14.542	0.05 U	0.11	0.08 U	1.65 U	0.08 U	0.05 J	3.81	0.35	0.22	
PC-4	1	4	12.851	0.08 U	0.09 J	0.02 J	2.47 U	0.13 U	0.03 J	0.12 J	0.44	0.26 U	
PC-4	2	5	14.206	0.08 U	0.16	0.05 J	2.47 U	0.13 U	0.02 J	0.44 B	0.61	0.26 B	
PC-4	3	3	12.937	0.10 U	0.07 J	0.15 U	3.01 U	0.15 U	0.12 U	0.15 U	0.34 U	0.32 U	
PC-4	4	3	12.755	0.10 U	0.15 U	0.15 U	2.95 U	0.15 U	0.12 U	0.15 U	0.33 U	0.31 U	
PC-4	5	4	12.989	0.08 U	0.09 J	0.02 J	2.42 U	0.12 U	0.04 J	0.15	0.46	0.25 U	
PC-5 Comp			14.684	0.05 U	0.11	0.08 U	1.65 U	0.08 U	0.15	10.23	0.59	0.46 (e)	
PC-5	1	5	12.806	0.08 U	0.13	0.05 J	2.30 U	0.12 U	0.15	5.48 B	0.76	2.74 B (e)	
PC-5	2	4	14.186	0.19 U	0.10 J	0.29 U	5.60 U	0.29 U	0.08 J	0.15 J	0.58 J	0.59 U	
PC-5	3	5	14.039	0.07 U	0.11 U	0.01 J	2.13 U	0.11 U	0.07 J	0.99 B	0.62	0.72 B	
PC-5	4	4	13.276	0.08 U	0.11 J	0.02 J	2.27 U	0.12 U	0.03 J	0.19	0.72	0.24 U	
PC-5	5	3	13.892	0.11 U	0.17 U	0.17 U	3.25 U	0.17 U	0.13 U	0.71	0.69	0.34 U	

TABLE L.19. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides (lb/kg wet weight)						
				Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta BHC	Dieldrin	4,4'-DDT
Reference Comp										
Reference	1	4	13.976	0.05 U	0.11	0.08 U	1.65 U	0.08 U	0.10	3.98
Reference	2	4	12.696	0.15 U	0.01 J	0.24 U	4.65 U	0.24 U	0.06 J	0.24 U
Reference Rep 1	3	5	14.103	0.13 U	0.09 J	0.20 U	3.86 U	0.20 U	0.06 J	0.20 U
Reference Rep 2	3	5	12.986	0.16 U	0.15 J	0.25 U	4.85 U	0.25 U	0.97 (e)	55.00 B (e)
Reference Rep 3	3	5	12.986	0.16 U	0.32	0.25 U	4.92 U	0.25 U	0.99 (e)	54.33 B (e)
Reference	4	3	12.986	0.12 U	0.20	0.18 U	3.60 U	0.18 U	0.62 (e)	40.12 B (e)
Reference	4	3	12.212	0.11 U	0.16 U	0.16 U	3.20 U	0.16 U	0.13 U	0.16 U
Reference	5	3	13.839	0.11 U	0.16 U	0.16 U	3.18 U	0.16 U	0.13 U	0.13 J
<i>M. nasuta</i> Background Rep 1	1	5	16.303	0.13 U	0.13 J	0.07 J	3.83 U	0.20 U	0.42	20.69 B
<i>M. nasuta</i> Background Rep 2	2	5	16.303	0.16 U	0.36	0.16 J	4.79 U	0.24 U	0.47	23.69 B
<i>M. nasuta</i> Background Rep 3	3	5	16.303	0.10 U	0.13 J	0.09 J	3.08 U	0.16 U	0.39	16.88 B
<i>M. nasuta</i> Control Comp										
<i>M. nasuta</i> Control	1	3	14.815	0.05 U	0.08	0.08 U	1.62 U	0.08 U	0.07	1.17
<i>M. nasuta</i> Control	2	3	15.651	0.11 U	0.09 J	0.16 U	3.20 U	0.16 U	0.13 U	0.29
<i>M. nasuta</i> Control	3	5	14.229	0.11 U	0.07 J	0.17 U	3.26 U	0.17 U	0.13 U	0.17 U
<i>M. nasuta</i> Control	4	5	13.711	0.13 U	0.12 J	0.02 J	3.80 U	0.19 U	0.14 J	3.27 B
<i>M. nasuta</i> Control	5	5	14.994	0.07 U	0.16	0.04 J	2.06 U	0.11 U	0.11	2.41 B
<i>M. nasuta</i> Control	5	5	12.860	0.06 U	0.12	0.04 J	1.85 U	0.09 U	0.12	3.81 B

(a) DL Detection limit.

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

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

(d) B Procedural blank amount was detected at >1/5 of the target detection limit.

(e) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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TABLE L.20. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet weight)									
				Endo sulfan I		Endo sulfan II		Endo sulfan sulfate		Endrin		Alde-hyde	
				Endo sulfan I	Endo sulfan II	Endo sulfan I	Endo sulfan II	Endo sulfan sulfate	Endrin	Endrin	Alde-hyde	Hepta-chlor Epoxide	Hepta-chlor Epoxide
Reference Comp				0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.07 U	0.17 U	0.17 U	0.09 U	0.08 U
Reference	1	4	13.976	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.20 U	0.47 U	0.47 U	0.25 U	0.22 U
Reference	2	4	14.103	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.16 U	0.39 U	0.39 U	0.21 U	0.19 U
Reference Rep 1	3	5	12.986	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.20 U	0.53 (d)	0.26 U	0.23 U	0.25 U
Reference Rep 2	3	5	12.986	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.21 U	0.44 J	0.27 U	0.24 U	0.25 U
Reference Rep 3	3	5	12.986	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.15 U	0.38	0.20 U	0.17 U	0.18 U
Reference	4	3	12.212	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.13 U	0.32 U	0.17 U	0.15 U	0.16 U
Reference	5	3	13.839	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.13 U	0.32 U	0.17 U	0.15 U	0.16 U
<i>M. nasuta</i> Background Rep 1	1	5	16.303	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.16 U	0.28 J	0.21 U	0.18 U	0.20 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.20 U	0.44 J	0.26 U	0.23 U	0.24 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.13 U	0.23 J	0.17 U	0.15 U	0.16 U
<i>M. nasuta</i> Control Comp				0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.07 U	0.16 U	0.09 U	0.08 U	0.08 U
<i>M. nasuta</i> Control	1	3	14.815	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.13 U	0.32 U	0.17 U	0.15 U	0.16 U
<i>M. nasuta</i> Control	2	3	14.229	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U
<i>M. nasuta</i> Control	3	5	13.711	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.16 U	0.17 J	0.21 U	0.18 U	0.19 U
<i>M. nasuta</i> Control	4	5	14.994	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.09 U	0.08 J	0.11 U	0.10 U	0.11 U
<i>M. nasuta</i> Control	5	5	12.860	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.08 U	0.06 J	0.10 U	0.09 U	0.09 U

(a) DL Detection limit.

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

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

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE L.21. Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4'-DDT), Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)									
				Aldrin	Alpha-BHC	Beta-BHC	Chlor-dane	Delta-BHC	Dieldrin	4,4'-DDO	4,4'-DDE	4,4'-DDT	
PC-1 Comp													
PC-1	1	5	14.424	0.76 U ^(a)	0.42 J ^(b)	1.16 U	22.86 U	1.16 U	0.94 U	29.90	2.88	1.29 J ^(d)	
PC-1			14.978	0.47 U	0.67	0.13 J	13.29 U	0.67 U	0.53 J	27.84 B ^(c)	5.34	12.02 B ^(d)	
PC-1	2	5	14.257	0.49 U	0.98	0.14 J	13.82 U	0.70 U	0.42 J	13.26 B	4.56	5.82 B ^(d)	
PC-1	3	5	11.647	0.52 U	0.77 J	0.86 U	16.06 U	0.86 U	0.77	41.81 B	4.81	18.55 B ^(d)	
PC-1	4	4	10.453	0.57 U	0.57 J	0.86 U	17.79 U	0.86 U	1.53	4.40	5.07	1.82 U	
PC-1	5	3	12.981	0.85 U	1.23 U	0.39 J	24.88 U	1.23 U	1.00 U	5.55	3.24	2.62 U	
PC-1A Comp													
PC-1A	1	5	14.505	0.37 U	0.53 J	0.56 U	11.08 U	0.56 U	0.45 U	8.14	2.33	0.50 J ^(d)	
PC-1A			13.331	0.45 U	0.75 J	0.75 U	14.63 U	0.75 U	0.60 U	3.30 B	3.00	2.03 B ^(d)	
PC-1A	2	4	14.133	0.42 U	0.42 J	0.07 J	12.81 U	0.64 U	0.14 J	1.13	2.83	1.34 U	
PC-1A Rep 1	3	4	12.944	1.24 U	1.24 J	1.93 U	37.55 U	1.93 U	0.31 J	2.47	4.71	3.94 U	
PC-1A Rep 2	3	4	12.944	1.47 U	1.00 J	2.24 U	44.34 U	2.24 U	0.54 J	2.32	4.56 J	4.64 U	
PC-1A Rep 3	3	4	12.944	1.31 U	1.16 J	2.01 U	39.40 U	2.01 U	0.54 J	2.78	4.87	4.17 U	
PC-1A	4	4	12.779	0.55 U	0.55 J	0.23 J	16.59 U	0.86 U	0.23 J	1.96	3.60	1.72 U ^(d)	
PC-1A	5	5	12.122	0.66 U	0.91 J	0.99 U	19.80 U	0.99 U	0.82 U	7.18 B	3.71	6.76 B ^(d)	
PC-2 Comp													
PC-2	1	4	14.158	0.39 U	0.54 J	0.59 U	11.65 U	0.59 U	0.48 U	19.26	2.50	0.82 J	
PC-2			12.313	0.73 U	0.41 J	1.06 U	21.36 U	1.06 U	0.24 J	1.06 J	3.09	2.27 U	
PC-2	2	4	12.488	0.56 U	1.20	0.32 J	16.98 U	0.88 U	0.24 J	2.72	5.53	0.64 J	
PC-2	3	4	14.708	0.61 U	0.48 J	0.95 U	19.24 U	0.95 U	0.07 J	1.36	3.33	2.04 U	
PC-2	4	4	14.903	0.60 U	0.54 J	0.13 J	18.79 U	0.94 U	0.20 J	1.88	3.96	1.95 U	
PC-2	5	4	14.869	0.94 U	0.61 J	1.41 U	27.91 U	1.41 U	0.47 J	1.75	3.70	2.96 U	
PC-4 Comp													
PC-4	1	4	14.542	0.38 U	0.78	0.58 U	11.34 U	0.58 U	0.35 J	26.23	2.40	1.51	
PC-4			12.851	0.62 U	0.70 J	0.16 J	19.22 U	1.01 U	0.23 J	0.93 J	3.42	2.02 U	
PC-4	2	5	14.206	0.56 U	1.13	0.35 J	17.39 U	0.92 U	0.14 J	3.10 B	4.29	1.83 B	
PC-4	3	3	12.937	0.77 U	0.54 J	1.16 U	23.27 U	1.16 U	0.93 U	1.16 U	2.63 U	2.47 U	
PC-4	4	3	12.755	0.78 U	1.18 U	1.18 U	23.13 U	1.18 U	0.94 U	1.18 U	2.59 U	2.43 U	
PC-4	5	4	12.989	0.62 U	0.69 J	0.15 J	18.63 U	0.92 U	0.31 J	1.15	3.54	1.92 U	
PC-5 Comp													
PC-5	1	5	14.684	0.37 U	0.73	0.57 U	11.25 U	0.57 U	1.03	69.65	4.03	3.15	
PC-5			12.806	0.62 U	1.02	0.39 J	17.96 U	0.94 U	1.17	42.79 B	5.93	21.40 B ^(d)	
PC-5	2	4	14.186	1.34 U	0.70 J	2.04 U	39.48 U	2.04 U	0.56 J	1.06 J	4.09 J	4.16 U	
PC-5	3	5	14.039	0.50 U	0.78 U	0.07 J	15.17 U	0.78 U	0.50 J	7.05 B	4.42	5.13 B	
PC-5	4	4	13.276	0.60 U	0.83 J	0.15 J	17.10 U	0.90 U	0.23 J	1.43	5.42	1.81 U	
PC-5	5	3	13.892	0.79 U	1.22 U	1.22 U	23.39 U	1.22 U	0.94 U	5.11	4.97	2.45 U	

TABLE L.21. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)									
				Aldrin	Alpha-BHC	Beta-BHC	Chlor-dane	Delta-BHC	Dieldrin	DDD	4,4'-DDE	4,4'-DDT	
Reference Comp													
Reference	1	4	13.976	0.39 U	0.76	0.60 U	11.83 U	0.60 U	0.69	28.51	1.89	4.45	
Reference	2	4	12.696	1.18 U	0.08 J	1.89 U	36.63 U	1.89 U	0.47 J	1.89 U	0.24 J	3.86 U	
Reference	3	4	14.103	0.92 U	0.64 J	1.42 U	27.37 U	1.42 U	0.43 J	1.42 (d)	1.91 J	2.91 U	
Reference Rep 1	3	5	12.986	1.23 U	1.16 J	1.93 U	37.35 U	1.93 U	7.47 (d)	423.53 B	8.62 (d)	200.22 B (d)	
Reference Rep 2	3	5	12.986	1.23 U	2.46	1.93 U	37.89 U	1.93 U	7.62 (d)	418.37 B (d)	8.62 (d)	194.75 B (d)	
Reference Rep 3	3	5	12.986	0.92 U	1.54	1.39 U	27.72 U	1.39 U	4.77 (d)	308.95 B (d)	6.47 (d)	147.00 B (d)	
Reference	4	3	12.212	0.90 U	1.31 U	1.31 U	26.20 U	1.31 U	1.06 U	1.31 U	1.47 J	2.78 U	
Reference	5	3	13.839	0.79 U	1.16 U	1.16 U	22.98 U	1.16 U	0.94 U	0.94 J	1.95 J	2.38 U	
<i>M. nasuta</i> Background Rep 1	1	5	16.303	0.80 U	0.80 J	0.43 J	23.49 U	1.23 U	2.58	126.91 B	2.58 J	60.17 B	
<i>M. nasuta</i> Background Rep 2	2	5	16.303	0.98 U	2.21	0.98 J	29.38 U	1.47 U	2.88	145.31 B	2.94 J	66.12 B	
<i>M. nasuta</i> Background Rep 3	3	5	16.303	0.61 U	0.80 J	0.55 J	18.89 U	0.98 U	2.39	103.54 B	2.21	49.25 B	
<i>M. nasuta</i> Control Comp													
<i>M. nasuta</i> Control	1	3	14.815	0.36 U	0.57	0.56 U	10.97 U	0.56 U	0.47	7.91	1.30	0.40 J	
<i>M. nasuta</i> Control	2	3	15.651	0.70 U	0.58 J	1.02 U	20.45 U	1.02 U	0.83 U	1.85	2.30 U	2.17 U	
<i>M. nasuta</i> Control	3	3	14.229	0.77 U	0.49 J	1.19 U	22.91 U	1.19 U	0.91 U	1.19 U	1.05 J	2.39 U	
<i>M. nasuta</i> Control	3	5	13.711	0.95 U	0.88 J	0.15 J	27.71 U	1.39 U	1.02 J	23.85 B	2.48 J	16.85 B (d)	
<i>M. nasuta</i> Control	4	5	14.994	0.47 U	1.07	0.27 J	13.74 U	0.73 U	0.73	16.07 B	2.20	11.54 B (d)	
<i>M. nasuta</i> Control	5	5	12.860	0.47 U	0.93	0.31 J	14.39 U	0.70 U	0.93	29.63 B	2.26	17.81 B (d)	

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

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

(c) B Procedural blank amount was detected at >1/5 of the target detection limit.

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE L.22. Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene), Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sample Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)									
				Endo sulfan I	Endo sulfan II	Endo sulfan sulfate	Endrin Aldehyde	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxa-phene		
PC-1 Comp			14.424	2.29 U ^(a)	2.29 U	2.29 U	0.96 U	2.29 U	1.24 U	1.10 U	1.16 U	22.86 U	22.86 U
PC-1	1	5	14.978	1.34 U	1.34 U	1.34 U	0.53 U	0.60 J ^(b)	0.73 U	0.67 U	1.80 U	13.29 U	13.29 U
PC-1	2	5	14.257	1.40 U	1.40 U	1.40 U	0.56 U	0.49 J	0.77 U	0.70 U	0.70 U	13.82 U	13.82 U
PC-1	3	5	11.647	1.63 U	4.00 U	1.63 U	0.69 U	0.77 J	0.86 U	0.77 U	0.86 U	16.06 U	16.06 U
PC-1	4	4	10.453	1.82 U	1.82 U	1.82 U	0.77 U	1.82 U	0.96 U	0.86 U	1.82 U	17.79 U	17.79 U
PC-1	5	3	12.981	2.47 U	2.47 U	2.47 U	1.08 U	2.47 U	1.39 U	1.23 U	1.62 U	24.88 U	24.88 U
PC-1A Comp			14.505	1.11 U	1.11 U	1.11 U	0.46 U	1.11 U	0.60 U	0.53 U	0.56 U	11.08 U	11.08 U
PC-1A	1	5	13.331	1.43 U	1.43 U	1.43 U	0.60 U	0.45 J	0.83 U	0.68 U	0.75 U	14.63 U	14.63 U
PC-1A	2	4	14.133	1.27 U	1.27 U	1.27 U	0.57 U	1.27 U	0.71 U	0.64 U	1.20 U	12.81 U	12.81 U
PC-1A Rep 1	3	4	12.944	3.79 U	3.79 U	3.79 U	1.55 U	3.79 U	2.01 U	1.78 U	2.24 U	37.55 U	37.55 U
PC-1A Rep 2	3	4	12.944	4.40 U	4.40 U	4.40 U	1.85 U	4.40 U	2.39 U	2.16 U	2.24 U	44.34 U	44.34 U
PC-1A Rep 3	3	4	12.944	3.94 U	3.94 U	3.94 U	1.62 U	3.94 U	2.16 U	1.93 U	2.01 U	39.40 U	39.40 U
PC-1A	4	4	12.779	1.64 U	1.64 U	1.64 U	0.70 U	1.64 U	0.94 U	0.78 U	1.49 U	16.59 U	16.59 U
PC-1A	5	5	12.122	1.98 U	1.98 U	1.98 U	0.82 U	0.49 J	1.07 U	0.99 U	0.99 U	19.80 U	19.80 U
PC-2 Comp			14.158	1.17 U	1.17 U	1.17 U	0.49 U	1.17 U	0.63 U	0.56 U	0.59 U	11.65 U	11.65 U
PC-2	1	4	12.313	2.11 U	2.11 U	2.11 U	0.89 U	2.11 U	1.14 U	1.06 U	1.22 U	21.36 U	21.36 U
PC-2	2	4	12.488	1.68 U	1.68 U	1.68 U	0.72 U	1.68 U	0.48 J	0.80 U	1.92 U ^(c)	16.98 U	16.98 U
PC-2	3	4	14.708	1.90 U	1.90 U	1.90 U	0.82 U	1.90 U	1.02 U	0.95 U	1.70 U ^(c)	19.24 U	19.24 U
PC-2	4	4	14.903	1.88 U	1.88 U	1.88 U	0.81 U	1.88 U	1.01 U	0.94 U	1.48 U	18.79 U	18.79 U
PC-2	5	4	14.869	2.82 U	2.82 U	2.82 U	1.14 U	2.82 U	1.55 U	1.35 U	1.41 U	27.91 U	27.91 U
PC-4 Comp			14.542	1.13 U	1.13 U	1.13 U	0.48 U	1.13 U	0.62 U	0.55 U	0.58 U	11.34 U	11.34 U
PC-4	1	4	12.851	1.95 U	1.95 U	1.95 U	0.78 U	1.95 U	1.01 U	0.93 U	1.56 U	19.22 U	19.22 U
PC-4	2	5	14.206	1.76 U	1.76 U	1.76 U	0.70 U	0.49 J	0.92 U	0.84 U	0.92 U	17.39 U	17.39 U
PC-4	3	3	12.937	2.32 U	2.32 U	2.32 U	1.00 U	2.32 U	1.24 U	1.16 U	1.16 U	23.27 U	23.27 U
PC-4	4	3	12.755	2.27 U	2.27 U	2.27 U	0.94 U	2.27 U	1.25 U	1.10 U	1.18 U	23.13 U	23.13 U
PC-4	5	4	12.989	1.85 U	1.85 U	1.85 U	0.77 U	1.85 U	0.62 J	0.92 U	1.85 U ^(c)	18.63 U	18.63 U
PC-5 Comp			14.684	1.12 U	1.12 U	1.12 U	0.47 U	1.12 U	0.61 U	0.54 U	0.57 U	11.25 U	11.25 U
PC-5	1	5	12.806	1.80 U	1.80 U	1.80 U	0.78 U	0.62 J	1.02 U	0.86 U	0.94 U	17.96 U	17.96 U
PC-5	2	4	14.186	3.95 U	3.95 U	3.95 U	1.69 U	3.95 U	2.11 U	1.90 U	2.04 U	39.48 U	39.48 U
PC-5	3	5	14.039	1.50 U	1.50 U	1.50 U	0.64 U	0.43 J	0.85 U	0.71 U	0.78 U	15.17 U	15.17 U
PC-5	4	4	13.276	1.73 U	1.73 U	1.73 U	0.75 U	1.73 U	0.90 U	0.83 U	1.36 U	17.10 U	17.10 U
PC-5	5	3	13.892	2.38 U	2.38 U	2.38 U	1.01 U	2.38 U	1.30 U	1.15 U	1.22 U	23.39 U	23.39 U

TABLE L.22. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ dry weight)									
				Endo sulfan I	Endo- sulfan II	Endo- sulfate	Endrin	Aldehyde	Hepta- chlor	Hepta- chlor Epoxide	Lindane	Methoxy- chlor	Toxa- phene
Reference Comp			13.976	1.18 U	1.18 U	1.18 U	0.50 U	1.18 U	0.64 U	0.57 U	0.60 U	11.83 U	11.83 U
Reference	1	4	12.696	3.70 U	3.70 U	3.70 U	1.58 U	3.70 U	1.97 U	1.73 U	1.89 U	36.63 U	36.63 U
Reference	2	4	14.103	2.77 U	2.77 U	2.77 U	1.13 U	2.77 U	1.49 U	1.35 U	1.77 (c)	27.37 U	27.37 U
Reference Rep 1	3	5	12.986	3.77 U	3.77 U	3.77 U	1.54 U	4.08 (c)	2.00 U	1.77 U	1.93 U	37.35 U	37.35 U
Reference Rep 2	3	5	12.986	3.77 U	3.77 U	3.77 U	1.62 U	3.39 J	2.08 U	1.85 U	1.93 U	37.89 U	37.89 U
Reference Rep 3	3	5	12.986	2.77 U	2.77 U	2.77 U	1.16 U	2.93	1.54 U	1.31 U	1.39 U	27.72 U	27.72 U
Reference	4	3	12.212	2.62 U	2.62 U	2.62 U	1.06 U	2.62 U	1.39 U	1.23 U	1.31 U	26.20 U	26.20 U
Reference	5	3	13.839	2.31 U	2.31 U	2.31 U	0.94 U	2.31 U	1.23 U	1.08 U	1.16 U	22.98 U	22.98 U
<i>M. nasuta</i> Background Rep 1	1	5	16.303	2.33 U	2.33 U	2.33 U	0.98 U	1.72 J	1.29 U	1.10 U	1.23 U	23.49 U	23.49 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	2.94 U	2.94 U	2.94 U	1.23 U	2.70 J	1.59 U	1.41 U	1.47 U	29.38 U	29.38 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	1.90 U	1.90 U	1.90 U	0.80 U	1.41 J	1.04 U	0.92 U	0.98 U	18.85 U	18.89 U
<i>M. nasuta</i> Control Comp			14.815	1.10 U	1.10 U	1.10 U	0.46 U	1.10 U	0.60 U	0.53 U	0.56 U	10.97 U	10.97 U
<i>M. nasuta</i> Control	1	3	15.651	2.04 U	2.04 U	2.04 U	0.83 U	2.04 U	1.09 U	0.96 U	1.02 U	20.45 U	20.45 U
<i>M. nasuta</i> Control	2	3	14.229	2.32 U	2.32 U	2.32 U	0.98 U	2.32 U	1.27 U	1.12 U	1.19 U	22.91 U	22.91 U
<i>M. nasuta</i> Control	3	5	13.711	2.77 U	2.77 U	2.77 U	1.17 U	1.24 J	1.53 U	1.31 U	1.39 U	27.71 U	27.71 U
<i>M. nasuta</i> Control	4	5	14.994	1.40 U	1.40 U	1.40 U	0.60 U	0.53 J	0.73 U	0.67 U	0.73 U	13.74 U	13.74 U
<i>M. nasuta</i> Control	5	5	12.860	1.48 U	1.48 U	1.48 U	0.62 U	0.47 J	0.78 U	0.70 U	0.70 U	14.39 U	14.39 U

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

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

(c) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE L.23. Quality Control Summary for Chlorinated Pesticide Analysis (alphabetical, Aldrin - 4,4'-DDT), Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet weight)									
Sediment Treatment	Replicate	Batch	Percent Dry Weight	Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta BHC	4,4'-DDD 4,4'-DDE 4,4'-DDT
Method Blanks									
Blank				0.06 U ^(a)	0.09 U	0.09 U	1.77 U	0.09 U	0.09 U 0.20 U 0.19 U
Blank	3			0.11 U	0.17 U	0.17 U	3.28 U	0.17 U	0.17 U 0.37 U 0.34 U
Blank	4			0.10 U	0.15 U	0.15 U	2.90 U	0.15 U	0.15 U 0.33 U 0.30 U
Blank	5			0.09 U	0.13 U	0.13 U	2.59 U	0.13 U	67.59 B ^(b) 1.08 37.32 B
Matrix Spikes									
PC-5	2	4	14.186	0.19 U	0.10 J	0.29 U	5.60 U ^(d)	0.29 U	0.15 J 0.58 J 0.59 U
PC-5 MS	2	4		5.70	3.66	4.17	NA ^(d)	4.11	5.16 5.25 4.22
Concentration Recovered				5.70	3.56	4.17	NA ^(e)	4.11	5.01 4.67 4.22
Amount Spiked				3.84	4.04	3.84	NS ^(e)	3.84	3.84 3.84 3.84
Percent Recovery				149% ^(f)	88%	109%	NA	107%	131% ^(f) 122% ^(f) 110%
Reference	1	4	12.696	0.15 U	0.01 J	0.24 U	4.65 U	0.24 U	0.24 U 0.03 J 0.49 U
Reference MS	1	4		4.79	2.97	3.68	NA	3.43	4.50 4.01 4.02
Concentration Recovered				4.79	2.96	3.68	NA	3.43	4.60 3.98 4.02
Amount Spiked				3.11	3.27	3.11	NS	3.11	3.11 3.11 3.11
Percent Recovery				154% ^(f)	90%	118%	NA	110%	148% ^(f) 128% ^(f) 129% ^(f)
<i>M. nasuta</i> Control	3	5	13.711	0.13 U	0.12 J	0.02 J	3.80 U	0.19 U	3.27 B 0.34 J 2.31 B ^(g)
<i>M. nasuta</i> Control MS	3	5		4.74	2.45	3.95	NA	2.56	3.56 B 3.47 4.26 B
Concentration Recovered				4.74	2.33	3.93	NA	2.56	0.29 3.13 1.95
Amount Spiked				3.07	3.23	3.07	NS	3.07	3.07 3.07 3.07
Percent Recovery				154% ^(f)	72%	128% ^(f)	NA	83%	9% ^(f) 102% 64%
Analytical Replicates									
PC-1A Rep 1	3	4	12.944	0.16 U	0.16 J	0.25 U	4.86 U	0.25 U	0.32 0.61 0.51 U
PC-1A Rep 2	3	4	12.944	0.19 U	0.13 J	0.29 U	5.74 U	0.29 U	0.30 0.59 J 0.60 U
PC-1A Rep 3	3	4	12.944	0.17 U	0.15 J	0.26 U	5.10 U	0.26 U	0.36 0.63 0.54 U
RSD				NA	10%	NA	NA	NA	3% NA
Reference Rep 1	3	5	12.986	0.16 U	0.15 J	0.25 U	4.85 U	0.25 U	55.00 B ^(g) 1.12 ^(g) 26.00 B ^(g)
Reference Rep 2	3	5	12.986	0.16 U	0.32	0.25 U	4.92 U	0.25 U	54.33 B ^(g) 1.12 ^(g) 25.29 B ^(g)
Reference Rep 3	3	5	12.986	0.12 U	0.20 ^(h)	0.18 U	3.60 U	0.18 U	40.12 B ^(g) 0.84 ^(g) 19.09 B ^(g)
RSD				NA	39%	NA	NA	NA	17% 16%

TABLE L.23. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet weight)								
				Aldrin	Alpha-BHC	Beta-BHC	Chlordane	Delta BHC	Dieldrin	4,4'-DDD	4,4'-DDE	4,4'-DDT
<i>M. nasuta</i> Background Rep 1	1	5	16.303	0.13 U	0.13 J	0.07 J	3.83 U	0.20 U	0.42	20.69 B	0.42 J	9.81 B
<i>M. nasuta</i> Background Rep 2	2	5	16.303	0.16 U	0.36	0.16 J	4.79 U	0.24 U	0.47	23.69 B	0.48 J	10.78 B
<i>M. nasuta</i> Background Rep 3	3	5	16.303	0.10 U	0.13 J	0.09 J	3.08 U	0.16 U	0.39	16.88 B	0.36	8.03 B
RSD				NA	64% ^(h)	44% ^(h)	NA	NA	9%	17%	14%	15%

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

(b) B Procedural blank amount was detected at $>1/5$ of the target detection limit.

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

(d) NA Not applicable.

(e) NS Not spiked.

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

(g) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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

TABLE L.24. Quality Control Summary for Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene), Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

			<i>M. nasuta</i> Pesticides ($\mu\text{g/kg}$ wet weight)										
Sediment Treatment	Replicate	Batch	Percent Dry Weight	Endo sulfan I	Endo sulfan II	Endo sulfan	Endrin Aldehyde	Hepta-chlor	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxaphene	
Method Blanks													
Blank				0.18 U ^(a)	0.18 U	0.18 U	0.07 U	0.18 U	0.10 U	0.09 U	0.09 U	1.77 U	
Blank	3			0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U	3.28 U	
Blank	4			0.29 U	0.29 U	0.29 U	0.12 U	0.29 U	0.16 U	0.14 U	0.15 U	2.90 U	
Blank	5			0.26 U	0.26 U	0.26 U	0.11 U	0.26 U	0.14 U	0.13 U	0.13 U	2.59 U	
Matrix Spikes													
PC-5	2	4	14.186	0.56 U	0.56 U	0.56 U	0.24 U	0.56 U	0.30 U	0.27 U	0.29 U	5.60 U	
PC-5 MS	2	4		2.94	4.10	3.03	3.99	0.14	3.59	3.80	4.30	2.58	
Concentration Recovered				2.94	4.10	3.03	3.99	0.14	3.59	3.80	4.30	2.58	
Amount Spiked				3.84	3.84	3.84	3.93	3.84	3.84	3.84	3.84	3.84	
Percent Recovery				77%	107%	79%	102%	4%	94%	99%	112%	67%	
Reference	1	4	12.696	0.47 U	0.47 U	0.47 U	0.20 U	0.47 U	0.25 U	0.22 U	0.24 U	4.65 U	
Reference MS	1	4		2.79	3.80	3.05	3.53	0.15	3.23	3.34	3.64	2.57	
Concentration Recovered				2.79	3.80	3.05	3.53	0.15	3.23	3.34	3.64	2.57	
Amount Spiked				3.11	3.11	3.11	3.18	3.11	3.11	3.11	3.11	3.11	
Percent Recovery				90%	122%	98%	111%	5%	104%	107%	117%	83%	
<i>M. nasuta</i> Control	3	5	13.711	0.38 U	0.38 U	0.38 U	0.16 U	0.17 U ^(e)	0.21 U	0.18 U	0.19 U	3.80 U	
<i>M. nasuta</i> Control MS	3	5		2.24	3.27	2.49	4.38	3.39	3.44	2.90	3.16	2.77	
Concentration Recovered				2.24	3.27	2.49	4.38	3.22	3.44	2.90	3.16	2.77	
Amount Spiked				3.07	3.07	3.07	3.14	3.07	3.07	3.07	3.07	3.07	
Percent Recovery				73%	107%	81%	140%	105%	112%	95%	103%	90%	
Analytical Replicates													
PC-1A Rep 1	3	4	12.944	0.49 U	0.49 U	0.49 U	0.20 U	0.49 U	0.26 U	0.23 U	0.29 U ^(f)	4.86 U	
PC-1A Rep 2	3	4	12.944	0.57 U	0.57 U	0.57 U	0.24 U	0.57 U	0.31 U	0.28 U	0.29 U	5.74 U	
PC-1A Rep 3	3	4	12.944	0.51 U	0.51 U	0.51 U	0.21 U	0.51 U	0.28 U	0.25 U	0.26 U	5.10 U	
RSD				NA	NA	NA	NA	NA	NA	NA	NA	NA	
Reference Rep 1	3	5	12.986	0.49 U	0.49 U	0.49 U	0.20 U	0.53 U ^(f)	0.26 U	0.23 U	0.25 U	4.85 U	
Reference Rep 2	3	5	12.986	0.49 U	0.49 U	0.49 U	0.21 U	0.44 U	0.27 U	0.24 U	0.25 U	4.92 U	
Reference Rep 3	3	5	12.986	0.36 U	0.36 U	0.36 U	0.15 U	0.38 U	0.20 U	0.17 U	0.18 U	3.60 U	
RSD				NA	NA	NA	NA	17%	NA	NA	NA	NA	

TABLE L.24. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasua</i> Pesticides ($\mu\text{g/kg}$ wet weight)									
				Endo sulfan I	Endo sulfan II	Endo sulfan	Endrin	Hepta-chlor	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxa-phene	
							Alde- hyde						
<i>M. nasua</i> Background Rep 1	1	5	16.303	0.38 U	0.38 U	0.38 U	0.16 U	0.28 J	0.21 U	0.18 U	0.20 U	3.83 U	3.83 U
<i>M. nasua</i> Background Rep 2	2	5	16.303	0.48 U	0.48 U	0.48 U	0.20 U	0.44 J	0.26 U	0.23 U	0.24 U	4.79 U	4.79 U
<i>M. nasua</i> Background Rep 3	3	5	16.303	0.31 U	0.31 U	0.31 U	0.13 U	0.23 J	0.17 U	0.15 U	0.16 U	3.08 U	3.08 U
RSD				NA	NA	NA	35%(g)	NA	NA	NA	NA	NA	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

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

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

(f) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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

TABLE L.25. Polychlorinated Biphenyl (PCB) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs (µg/kg wet weight)					
				Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL (a)				20	20	20	20	20	20
Achieved High DL				5.73	5.73	5.73	5.73	5.73	5.73
Achieved Low DL				1.61	1.61	1.61	1.61	1.61	1.61
PC-1 Comp			14.424	3.30 U ^(b)	3.30 U	3.30 U	3.30 U	12.24	3.30 U
PC-1	1	5	14.978	1.99 U	1.99 U	1.99 U	1.99 U	6.29	1.99 U
PC-1	2	5	14.257	1.97 U	1.97 U	1.97 U	1.97 U	6.19	1.97 U
PC-1	3	5	11.647	1.87 U	1.87 U	1.87 U	1.87 U	5.02	1.87 U
PC-1	4	4	10.453	1.86 U	1.86 U	1.86 U	1.86 U	16.43	1.86 U
PC-1	5	3	12.981	3.23 U	3.23 U	3.23 U	14.51	3.23 U	3.23 U
PC-1A Comp			14.505	1.61 U	1.61 U	1.61 U	1.61 U	7.34	1.61 U
PC-1A	1	5	13.331	1.95 U	1.95 U	1.95 U	1.95 U	3.81	1.95 U
PC-1A	2	4	14.133	1.81 U	1.81 U	1.81 U	1.81 U	10.40	1.81 U
PC-1A Rep 1	3	4	12.944	4.86 U	4.86 U	4.86 U	4.86 U	20.72	4.86 U
PC-1A Rep 2	3	4	12.944	5.74 U	5.74 U	5.74 U	5.74 U	17.99	5.74 U
PC-1A Rep 3	3	4	12.944	5.10 U	5.10 U	5.10 U	5.10 U	18.96	5.10 U
PC-1A	4	4	12.779	2.12 U	2.12 U	2.12 U	2.12 U	13.87	2.12 U
PC-1A	5	5	12.122	2.40 U	2.40 U	2.40 U	2.40 U	4.21	2.40 U
PC-2 Comp			14.158	1.65 U	1.65 U	1.65 U	1.65 U	5.77	1.65 U
PC-2	1	4	12.313	2.63 U	2.63 U	2.63 U	2.63 U	10.58	2.63 U
PC-2	2	4	12.488	2.12 U	2.12 U	2.12 U	2.12 U	12.38	2.12 U
PC-2	3	4	14.708	2.83 U	2.83 U	2.83 U	2.83 U	11.85	2.83 U
PC-2	4	4	14.903	2.80 U	2.80 U	2.80 U	2.80 U	14.17	2.80 U
PC-2	5	4	14.869	4.15 U	4.15 U	4.15 U	4.15 U	14.29	4.15 U
PC-4 Comp			14.542	1.65 U	1.65 U	1.65 U	1.65 U	3.05	1.65 U
PC-4	1	4	12.851	2.47 U	2.47 U	2.47 U	2.47 U	8.25	2.47 U
PC-4	2	5	14.206	2.47 U	2.47 U	2.47 U	2.47 U	3.20	2.47 U
PC-4	3	3	12.937	3.01 U	3.01 U	3.01 U	7.78 ^(c)	3.01 U	3.01 U
PC-4	4	3	12.755	2.95 U	2.95 U	2.95 U	5.25 ^(c)	2.95 U	2.95 U
PC-4	5	4	12.989	2.42 U	2.42 U	2.42 U	2.42 U	8.33	2.42 U
PC-5 Comp			14.684	1.65 U	1.65 U	1.65 U	1.65 U	5.05	1.65 U
PC-5	1	5	12.806	2.30 U	2.30 U	2.30 U	2.30 U	3.07	2.30 U
PC-5	2	4	14.186	5.60 U	5.60 U	5.60 U	5.60 U	5.60 U	5.60 U
PC-5	3	5	14.039	2.13 U	2.13 U	2.13 U	2.13 U	3.08	2.13 U
PC-5	4	4	13.276	2.27 U	2.27 U	2.27 U	2.27 U	12.29	2.27 U
PC-5	5	3	13.892	3.25 U	3.25 U	3.25 U	12.19 ^(c)	3.25 U	3.25 U
Reference Comp			13.976	1.65 U	1.65 U	1.65 U	1.65 U	1.65 U	1.65 U
Reference	1	4	12.696	4.65 U	4.65 U	4.65 U	4.65 U	4.65 U	4.65 U
Reference	2	4	14.103	3.86 U	3.86 U	3.86 U	3.86 U	3.86 U	3.86 U
Reference Rep 1	3	5	12.986	4.85 U	4.85 U	4.85 U	4.85 U	4.85 U	4.85 U
Reference Rep 2	3	5	12.986	4.92 U	4.92 U	4.92 U	4.92 U	4.92 U	4.92 U
Reference Rep 3	3	5	12.986	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U
Reference	4	3	12.212	3.20 U	3.20 U	3.20 U	3.20 U	3.20 U	3.20 U
Reference	5	3	13.839	3.18 U	3.18 U	3.18 U	8.09 ^(c)	3.18 U	3.18 U
<i>M. nasuta</i> Background Rep 1	1	5	16.303	3.83 U	3.83 U	3.83 U	3.83 U	3.83 U	3.83 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	4.79 U	4.79 U	4.79 U	4.79 U	4.79 U	4.79 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	3.08 U	3.08 U	3.08 U	3.08 U	3.08 U	3.08 U

TABLE L.25. (contd)

Sediment Treatment	Replicate	Batch	Percent	<i>M. nasuta</i> PCBs ($\mu\text{g}/\text{kg}$ wet weight)					
			Dry Weight	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>M. nasuta</i> Control Comp			14.815	1.62 U	1.62 U	1.62 U	1.62 U	1.62 U	1.62 U
<i>M. nasuta</i> Control	1	3	15.651	3.20 U	3.20 U	3.20 U	3.20 U	3.20 U	3.20 U
<i>M. nasuta</i> Control	2	3	14.229	3.26 U	3.26 U	3.26 U	3.26 U	3.26 U	3.26 U
<i>M. nasuta</i> Control	3	5	13.711	3.80 U	3.80 U	3.80 U	3.80 U	3.80 U	3.80 U
<i>M. nasuta</i> Control	4	5	14.994	2.06 U	2.06 U	2.06 U	2.06 U	2.06 U	2.06 U
<i>M. nasuta</i> Control	5	5	12.860	1.85 U	1.85 U	1.85 U	1.85 U	1.85 U	1.85 U

(a) DL Detection limit.

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

(c) Suspect value due to analytical laboratory contamination; tissue composite used in statistical analysis.

TABLE L.26. Polychlorinated Biphenyl (PCB) Analysis, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

S I	Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs (µg/kg dry weight)					
					Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
P	PC-1 Comp			14.424	22.86 U ^(a)	22.86 U	22.86 U	22.86 U	84.86	22.86 U
P	PC-1	1	5	14.978	13.29 U	13.29 U	13.29 U	13.29 U	41.99	13.29 U
P	PC-1	2	5	14.257	13.82 U	13.82 U	13.82 U	13.82 U	43.42	13.82 U
P	PC-1	3	5	11.647	16.06 U	16.06 U	16.06 U	16.06 U	43.10	16.06 U
P	PC-1	4	4	10.453	17.79 U	17.79 U	17.79 U	17.79 U	157.18	17.79 U
P	PC-1	5	3	12.981	24.88 U	24.88 U	24.88 U	111.78	24.88 U	24.88 U
P	PC-1A Comp			14.505	11.08 U	11.08 U	11.08 U	11.08 U	50.57	11.08 U
P	PC-1A	1	5	13.331	14.63 U	14.63 U	14.63 U	14.63 U	28.58	14.63 U
P	PC-1A	2	4	14.133	12.81 U	12.81 U	12.81 U	12.81 U	73.59	12.81 U
P	PC-1A Rep 1	3	4	12.944	37.55 U	37.55 U	37.55 U	37.55 U	160.07	37.55 U
P	PC-1A Rep 2	3	4	12.944	44.34 U	44.34 U	44.34 U	44.34 U	138.98	44.34 U
P	PC-1A Rep 3	3	4	12.944	39.40 U	39.40 U	39.40 U	39.40 U	146.48	39.40 U
P	PC-1A	4	4	12.779	16.59 U	16.59 U	16.59 U	16.59 U	108.54	16.59 U
P	PC-1A	5	5	12.122	19.80 U	19.80 U	19.80 U	19.80 U	34.73	19.80 U
P	PC-2 Comp			14.158	11.65 U	11.65 U	11.65 U	11.65 U	40.74	11.65 U
P	PC-2	1	4	12.313	21.36 U	21.36 U	21.36 U	21.36 U	85.93	21.36 U
P	PC-2	2	4	12.488	16.98 U	16.98 U	16.98 U	16.98 U	99.14	16.98 U
P	PC-2	3	4	14.708	19.24 U	19.24 U	19.24 U	19.24 U	80.57	19.24 U
P	PC-2	4	4	14.903	18.79 U	18.79 U	18.79 U	18.79 U	95.08	18.79 U
P	PC-2	5	4	14.869	27.91 U	27.91 U	27.91 U	27.91 U	96.11	27.91 U
P	PC-4 Comp			14.542	11.34 U	11.34 U	11.34 U	11.34 U	20.98	11.34 U
P	PC-4	1	4	12.851	19.22 U	19.22 U	19.22 U	19.22 U	64.20	19.22 U
P	PC-4	2	5	14.206	17.39 U	17.39 U	17.39 U	17.39 U	22.53	17.39 U
P	PC-4	3	3	12.937	23.27 U	23.27 U	23.27 U	60.14 ^(b)	23.27 U	23.27 U
P	PC-4	4	3	12.755	23.13 U	23.13 U	23.13 U	41.16 ^(b)	23.13 U	23.13 U
P	PC-4	5	4	12.989	18.63 U	18.63 U	18.63 U	18.63 U	64.13	18.63 U
P	PC-5 Comp			14.684	11.25 U	11.25 U	11.25 U	11.25 U	34.42	11.25 U
P	PC-5	1	5	12.806	17.96 U	17.96 U	17.96 U	17.96 U	23.97	17.96 U
P	PC-5	2	4	14.186	39.48 U	39.48 U	39.48 U	39.48 U	39.48 U	39.48 U
P	PC-5	3	5	14.039	15.17 U	15.17 U	15.17 U	15.17 U	21.94	15.17 U
P	PC-5	4	4	13.276	17.10 U	17.10 U	17.10 U	17.10 U	92.57	17.10 U
P	PC-5	5	3	13.892	23.39 U	23.39 U	23.39 U	87.75 ^(b)	23.39 U	23.39 U
Re	Reference Comp			13.976	11.83 U	11.83 U	11.83 U	11.83 U	11.83 U	11.83 U
Re	Reference	1	4	12.696	36.63 U	36.63 U	36.63 U	36.63 U	36.63 U	36.63 U
Re	Reference	2	4	14.103	27.37 U	27.37 U	27.37 U	27.37 U	27.37 U	27.37 U
Re	Reference Rep 1	3	5	12.986	37.35 U	37.35 U	37.35 U	37.35 U	37.35 U	37.35 U
Re	Reference Rep 2	3	5	12.986	37.89 U	37.89 U	37.89 U	37.89 U	37.89 U	37.89 U
Re	Reference Rep 3	3	5	12.986	27.72 U	27.72 U	27.72 U	27.72 U	27.72 U	27.72 U
Re	Reference	4	3	12.212	26.20 U	26.20 U	26.20 U	26.20 U	26.20 U	26.20 U
Re	Reference	5	3	13.839	22.98 U	22.98 U	22.98 U	58.46 ^(b)	22.98 U	22.98 U
M.	<i>M. nasuta</i> Background Rep 1	1	5	16.303	23.49 U	23.49 U	23.49 U	23.49 U	23.49 U	23.49 U
M.	<i>M. nasuta</i> Background Rep 2	2	5	16.303	29.38 U	29.38 U	29.38 U	29.38 U	29.38 U	29.38 U
M.	<i>M. nasuta</i> Background Rep 3	3	5	16.303	18.89 U	18.89 U	18.89 U	18.89 U	18.89 U	18.89 U

TABLE L.26. (contd)

Sediment Treatment	Replicate	Batch	Percent	<i>M. nasua</i> PCBs ($\mu\text{g/kg}$ dry weight)					
			Dry Weight	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>M. nasua</i> Control Comp			14.815	10.97 U	10.97 U	10.97 U	10.97 U	10.97 U	10.97 U
<i>M. nasua</i> Control	1	3	15.651	20.45 U	20.45 U	20.45 U	20.45 U	20.45 U	20.45 U
<i>M. nasua</i> Control	2	3	14.229	22.91 U	22.91 U	22.91 U	22.91 U	22.91 U	22.91 U
<i>M. nasua</i> Control	3	5	13.711	27.71 U	27.71 U	27.71 U	27.71 U	27.71 U	27.71 U
<i>M. nasua</i> Control	4	5	14.994	13.74 U	13.74 U	13.74 U	13.74 U	13.74 U	13.74 U
<i>M. nasua</i> Control	5	5	12.860	14.39 U	14.39 U	14.39 U	14.39 U	14.39 U	14.39 U

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

(b) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE L.27. Quality Control Summary for Polychlorinated Biphenyl (PCB) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>M. nasuta</i> PCBs ($\mu\text{g/kg}$ wet weight)					
				Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Method Blanks									
Blank				1.77 U ^(a)	1.77 U	1.77 U	1.77 U	1.77 U	1.77 U
Blank		3		3.28 U	3.28 U	3.28 U	3.28 U	3.28 U	3.28 U
Blank		4		2.90 U	2.90 U	2.90 U	2.90 U	2.90 U	2.90 U
Blank		5		2.59 U	2.59 U	2.59 U	2.59 U	2.59 U	2.59 U
Matrix Spikes									
PC-5	2	4	14.186	5.60 U ^(b)	5.60 U	5.60 U	5.60 U	5.60 U	5.60 U
PC-5 MS	2	4		NA	NA	NA	NA	101.17	NA
Concentration Recovered				NA ^(c)	NA	NA	NA	101.17	NA
Amount Spiked				NS	NS	NS	NS	43.17	NS
Percent Recovery				NA	NA	NA	NA	234% ^(d)	NA
Reference	1	4	12.696	4.65 U	4.65 U	4.65 U	4.65 U	4.650 U	4.65 U
Reference MS	1	4		NA	NA	NA	NA	85.94	NA
Concentration Recovered				NA	NA	NA	NA	85.94	NA
Amount Spiked				NS	NS	NS	NS	35.00	NS
Percent Recovery				NA	NA	NA	NA	246% ^(d)	NA
<i>M. nasuta</i> Control	3	5	13.711	3.80 U	3.80 U	3.80 U	3.80 U	3.80 U	3.80 U
<i>M. nasuta</i> Control MS	3	5		NA	NA	NA	NA	24.00	NA
Concentration Recovered				NA	NA	NA	NA	24.00	NA
Amount Spiked				NS	NS	NS	NS	51.11	NS
Percent Recovery				NA	NA	NA	NA	47%	NA
Analytical Replicates									
PC-1A Rep 1	3	4	12.944	4.86 U	4.86 U	4.86 U	4.86 U	20.72	4.86 U
PC-1A Rep 2	3	4	12.944	5.74 U	5.74 U	5.74 U	5.74 U	17.99	5.74 U
PC-1A Rep 3	3	4	12.944	5.10 U	5.10 U	5.10 U	5.10 U	18.96	5.10 U
RSD				NA	NA	NA	NA	7%	NA
Reference Rep 1	3	5	12.986	4.85 U	4.85 U	4.85 U	4.85 U	4.85 U	4.85 U
Reference Rep 2	3	5	12.986	4.92 U	4.92 U	4.92 U	4.92 U	4.92 U	4.92 U
Reference Rep 3	3	5	12.986	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U	3.60 U
RSD				NA	NA	NA	NA	NA	NA
<i>M. nasuta</i> Background Rep 1	1	5	16.303	3.83 U	3.83 U	3.83 U	3.83 U	3.83 U	3.83 U
<i>M. nasuta</i> Background Rep 2	2	5	16.303	4.79 U	4.79 U	4.79 U	4.79 U	4.79 U	4.79 U
<i>M. nasuta</i> Background Rep 3	3	5	16.303	3.08 U	3.08 U	3.08 U	3.08 U	3.08 U	3.08 U
RSD				NA	NA	NA	NA	NA	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

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

TABLE L.28. Surrogate Percent Recoveries and Quality Control Data for Chlorinated Pesticide and Polychlorinated Biphenyl (PCB) Analysis, Wet Weight, in Tissue of *M. nasuta* Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u><i>M. nasuta</i></u> <u>Surrogate Percent Recoveries</u>		
			<u>DBOFB</u>	<u>CL5(103)</u>	<u>CL5(112)</u>
PC-1 Comp			64	61	58
PC-1	1	5	94	NA ^(a)	62
PC-1	2	5	83	NA	58
PC-1	3	5	89	NA	65
PC-1	4	4	118	NA	45
PC-1	5	3	77	NA	43
PC-1A Comp			73	58	56
PC-1A	1	5	89	NA	57
PC-1A	2	4	86	NA	41
PC-1A Rep 1	3	4	91	NA	46
PC-1A Rep 2	3	4	94	NA	56
PC-1A Rep 3	3	4	98	NA	65
PC-1A	4	4	83	NA	41
PC-1A	5	5	89	NA	65
PC-2 Comp			71	56	56
PC-2	1	4	46	NA	25 ^(b)
PC-2	2	4	101	NA	47
PC-2	3	4	103	NA	51
PC-2	4	4	98	NA	50
PC-2	5	4	92	NA	46
PC-4 Comp			93	70	65
PC-4	1	4	85	NA	43
PC-4	2	5	88	NA	57
PC-4	3	3	71	NA	26 ^(b)
PC-4	4	3	80	NA	41
PC-4	5	4	119	NA	44
PC-5 Comp			84	67	59
PC-5	1	5	86	NA	61
PC-5	2	4	86	NA	39 ^(b)
PC-5	3	5	93	NA	60
PC-5	4	4	89	NA	41
PC-5	5	3	98	NA	40

TABLE L.28. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>M. nasuta</u>		
			<u>Surrogate</u>	<u>Percent</u>	<u>Recoveries</u>
			<u>DBO/FB</u>	<u>CL5(103)</u>	<u>CL5(112)</u>
Reference Comp			70	72	64
Reference	1	4	6 ^(b)	NA	4 ^(b)
Reference	2	4	100	NA	46
Reference Rep 1	3	5	91	NA	80
Reference Rep 2	3	5	96	NA	74
Reference Rep 3	3	5	93	NA	63
Reference	4	3	88	NA	52
Reference	5	3	73	NA	25 ^(b)
<i>M. nasuta</i> Background Rep 1	1	5	89	NA	56
<i>M. nasuta</i> Background Rep 2	2	5	90	NA	62
<i>M. nasuta</i> Background Rep 3	3	5	105	NA	66
<i>M. nasuta</i> Control Comp			70	67	60
<i>M. nasuta</i> Control	1	3	76	NA	27 ^(b)
<i>M. nasuta</i> Control	2	3	129 ^(b)	NA	31 ^(b)
<i>M. nasuta</i> Control	3	5	89	NA	66
<i>M. nasuta</i> Control	4	5	97	NA	60
<i>M. nasuta</i> Control	5	5	96	NA	56

Quality Control DataMethod Blanks

Blank			71	82	69
Blank		3	121 ^(b)	NA	79 ^(b)
Blank		4	72 ^(b)	NA	75
Blank		5	55	NA	52

Matrix Spikes

PC-5 MS		4	99	NA	48
Reference MS		4	103	NA	56
<i>M. nasuta</i> Control MS		5	90	NA	62

(a) NA Not applicable.

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

TABLE L.29. Percent Lipid Results, Wet Weight, in Tissue of *M. nasuta*,
Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Percent Lipid</u>
Target DL ^(a)			0.1
Achieved DL			NA ^(b)
PC-1	1	5	3.26
PC-1	2	5	2.69
PC-1	3	5	2.30
PC-1	4	4	3.03
PC-1	5	3	1.85
PC-1A	1	5	2.78
PC-1A	2	4	2.03
PC-1A Rep 1	3	4	8.76
PC-1A Rep 2	3	4	5.57
PC-1A Rep 3	3	4	4.87
PC-1A	4	4	4.01
PC-1A	5	5	3.07
PC-2	1	4	3.75
PC-2	2	4	1.83
PC-2	3	4	2.84
PC-2	4	4	2.97
PC-2	5	4	6.52
PC-4	1	4	3.11
PC-4	2	5	3.05
PC-4	3	3	1.75
PC-4	4	3	1.60
PC-4	5	4	1.78
PC-5	1	5	3.10
PC-5	2	4	6.68
PC-5	3	5	2.20
PC-5	4	4	2.65
PC-5	5	3	2.01
Reference	1	4	7.69
Reference	2	4	10.69
Reference Rep 1	3	5	5.57
Reference Rep 2	3	5	5.37
Reference Rep 3	3	5	2.99
Reference	4	3	1.43
Reference	5	3	1.79
<i>M. nasuta</i> Background Rep 1	1	5	6.85
<i>M. nasuta</i> Background Rep 2	2	5	8.56
<i>M. nasuta</i> Background Rep 3	3	5	7.52

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TABLE L.29. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Percent Lipid</u>
<i>M. nasuta</i> Control	1	3	2.26
<i>M. nasuta</i> Control	2	3	2.20
<i>M. nasuta</i> Control	3	5	5.72
<i>M. nasuta</i> Control	4	5	2.65
<i>M. nasuta</i> Control	5	5	2.68

-
- (a) DL Detection limit.
(b) NA Not applicable.

TABLE L.30.

Metals Analysis by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS), X-Ray Fluorescence (XRF), Graphite Furnace Atomic Absorption (GFAA), and Cold Vapor Atomic Absorption (CVAA), Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Percent Dry Weight	M. nasuta Metals (mg/kg dry weight)													
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn	
			ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVAA	ICP/MS	GFAA	ICP/MS	XRF	ICP/MS	XRF	
Target DL (a)																
	Achieved High DL		0.1	0.1	0.2	0.1	0.6	0.1	0.01	1.0	0.1	0.1	0.3	0.1	0.3	
	Achieved Low DL		0.03	1.2	0.080	0.04	0.01	0.05	0.014	0.05	0.04	0.02	0.56	0.020	27	
			0.01	1.2	0.010	0.01	0.01	0.02	0.003	0.02	0.04	0.01	0.54	0.005	27	
PC-1	1	19.02	0.236	31.5	0.010 U ^(b)	0.382	0.914	9.05	0.129	2.48	1.30	0.010 U	1.56	0.006 U	73.3	
PC-1	2	12.10	0.219	28.6	0.010 U	0.305	1.10	7.68	0.137	2.75	1.20	0.021	1.43	0.006 U	80.5	
PC-1	3	14.12	0.093	30.8	0.010 U	0.179	0.86	6.41	0.087	1.74	0.919	0.010	1.57	0.006 U	75.9	
PC-1	4	13.73	0.102	23.2	0.020 U	0.324	1.41	8.59	0.110	2.25	1.22	0.020 U	1.41	0.005 U	67.4	
PC-1 Rep 1	5	12.90	0.090	24.5	0.020 U	0.217	0.751	6.80	0.091	1.71	0.976	0.020 U	1.22	0.005 U	71.5	
PC-1 Rep 2	5	12.90	0.089	24.9	0.020 U	0.235	0.875	7.21	0.090	1.68	1.00	0.020 U	1.70	0.005 U	74.1	
PC-1 Rep 3	5	12.90	0.090	24.9	0.020 U	0.226	0.905	7.27	0.089	1.63	1.00	0.020 U	1.61	0.005 U	74.0	
PC-1A	1	12.84	0.218	24.8	0.010 U	0.309	0.935	6.82	0.127	2.83	1.26	0.014	1.61	0.006 U	70.0	
PC-1A	2	14.84	0.134	28.3	0.010 U	0.349	1.02	8.24	0.121	2.22	1.34	0.019	1.64	0.006 U	73.7	
PC-1A	3	14.45	0.240	30.2	0.020 U	0.285	0.942	11.0	0.088	2.41	1.43	0.020 U	1.77	0.005 U	74.5	
PC-1A	4	13.06	0.176	25.3	0.020 U	0.281	1.02	9.16	0.117	2.34	1.35	0.020 U	1.24	0.005 U	77.5	
PC-1A	5	13.92	0.163	22.7	0.010 U	0.202	1.01	7.95	0.108	2.09	1.07	0.032	1.67	0.006 U	69.1	
PC-2	1	14.70	0.197	21.6	0.020 U	0.216	1.17	10.0	0.061	1.69	1.26	0.020 U	1.27	0.005 U	73.2	
PC-2	2	13.84	0.114	31.8	0.020 U	0.227	1.38	8.09	0.102	2.07	1.26	0.020 U	1.46	0.005 U	73.2	
PC-2	3	14.88	0.118	26.5	0.010 U	0.241	0.973	7.09	0.092	2.09	1.03	0.019	1.56	0.006 U	75.1	
PC-2	4	16.00	0.179	25.4	0.010 U	0.240	1.13	8.08	0.114	2.19	1.17	0.015	2.10	0.006 U	74.8	
PC-2	5	16.31	0.138	25.9	0.010 U	0.173	0.945	9.24	0.124	1.96	0.916	0.018	2.08	0.006 U	74.6	
PC-4	1	14.17	0.197	25.2	0.010 U	0.246	1.01	9.39	0.123	2.92	1.25	0.035	2.13	0.006 U	90.1	
PC-4	2	14.51	0.184	28.5	0.010 U	0.377	1.14	7.79	0.139	2.84	1.37	0.023	2.47	0.006 U	100	
PC-4	3	14.61	0.345	27.6	0.080 U	0.345	0.956	10.4	0.093	3.03	1.35	0.136	1.72	0.020 U	99.5	
PC-4	4	13.23	0.263	24.1	0.084	0.216	1.44	10.1	0.117	2.83	1.25	0.130	2.12	0.020 U	91.6	
PC-4	5	15.14	0.142	27.1	0.010 U	0.277	0.897	8.08	0.105	3.31	1.17	0.040	1.43	0.006 U	103	
PC-5	1	10.61	0.232	22.7	0.010 U	0.247	1.32	11.0	0.098	2.90	1.60	0.042	1.80	0.006 U	80.6	
PC-5	2	14.68	0.207	24.7	0.020 U	0.229	1.09	9.81	0.102	1.86	1.39	0.020 U	1.29	0.005 U	67.6	
PC-5	3	13.51	0.116	25.9	0.010 U	0.298	0.891	7.54	0.140	3.91	1.36	0.022	2.12	0.006 U	99.5	
PC-5 Rep 1	4	12.53	0.171	27.4	0.020 U	0.239	1.11	8.68	0.101	2.69	1.62	0.020 U	1.47	0.005 U	73.7	
PC-5 Rep 2	4	12.53	0.172	27.1	0.020 U	0.233	1.19	8.83	0.100	2.61	1.52	0.020 U	1.46	0.005 U	74.7	
PC-5 Rep 3	4	12.53	0.190	27.5	0.020 U	0.245	1.13	8.76	0.099	2.66	1.51	0.020 U	1.26	0.005 U	76.1	
PC-5	5	14.08	0.160	25.5	0.020 U	0.233	1.12	9.17	0.082	2.22	1.75	0.020 U	1.68	0.005 U	85.2	

TABLE L.30. (contd)

Sediment Treatment	Replicate	Percent Dry Weight	<i>M. nasuta</i> Metals (mg/kg dry weight)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
			ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVA	ICP/MS	GFAA	ICP/MS	XRF	ICP/MS	XRF
Reference	1	12.46	0.398	25.2	0.026	0.304	0.924	11.0	0.073	2.64	1.40	0.020	1.23	0.005	111
Reference	2	15.81	0.121	27.3	0.010	0.290	0.985	7.45	0.121	2.41	0.843	0.010	1.98	0.006	69.2
Reference	3	16.16	0.128	22.3	0.010	0.268	0.661	7.79	0.124	2.39	0.740	0.029	1.91	0.006	75.3
Reference	4	13.02	0.301	30.0	0.020	0.310	0.714	9.32	0.091	2.21	1.31	0.020	1.22	0.005	91.9
Reference	5	15.50	0.160	28.5	0.020	0.357	0.908	7.43	0.140	2.88	0.966	0.020	2.38	0.005	89.2
<i>M. nasuta</i> Background Rep 1	1	14.19	0.275	30.6	0.010	0.338	2.03	11.2	0.108	4.47	1.16	0.042	1.89	0.006	89.9
<i>M. nasuta</i> Background Rep 2	2	14.19	0.249	31.1	0.010	0.363	1.47	11.6	0.104	4.34	1.22	0.059	1.84	0.006	91.3
<i>M. nasuta</i> Background Rep 3	3	14.19	0.275	30.1	0.010	0.361	1.66	12.0	0.111	4.47	1.47	0.113	1.42	0.006	93.0
<i>M. nasuta</i> Control	1	14.20	0.127	34.9	0.020	0.330	2.23	10.1	0.116	4.90	1.38	0.023	1.94	0.005	70.4
<i>M. nasuta</i> Control	2	15.73	0.113	29.6	0.020	0.275	1.69	9.67	0.100	3.46	1.20	0.020	2.14	0.005	77.7
<i>M. nasuta</i> Control	3	15.21	0.193	29.3	0.010	0.222	1.70	8.77	0.079	3.35	1.14	0.010	1.28	0.006	74.3
<i>M. nasuta</i> Control	4	16.49	0.152	28.0	0.010	0.278	1.99	10.1	0.086	3.78	1.10	0.031	1.38	0.006	81.9
<i>M. nasuta</i> Control Rep 1	5	15.04	0.115	30.0	0.010	0.260	1.47	9.45	0.096	3.80	1.30	0.023	1.81	0.006	67.6
<i>M. nasuta</i> Control Rep 2	5	15.04	0.114	30.0	0.010	0.252	1.59	9.47	0.095	4.22	1.33	0.036	1.70	0.006	71.7
<i>M. nasuta</i> Control Rep 3	5	15.04	0.117	29.2	0.010	0.248	1.49	9.21	0.094	3.74	1.30	0.018	1.53	0.006	68.8

(a) DL Detection limit.

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

TABLE L.31.

Metals Analysis by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS), X-Ray Fluorescence (XRF), Graphite Furnace Atomic Absorption (GFAA), and Cold Vapor Atomic Absorption (CVAA), Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Percent		<i>M. nasuta</i> Metals (mg/kg wet weight)													
	Replicate	Dry Weight	Ag	As	Be	Cd	Cr	Cu	CvAA	Hg	Ni	Pb	Sb	Se	Tl	Zn
			ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	ICP/MS	ICP/MS	ICP/MS	GFAA	ICP/MS	XRF	ICP/MS	XRF
PC-1	1	19.02	0.044	6.0	0.002 U ^(a)	0.073	0.174	1.72	0.025	0.017	0.33	0.247	0.002 U	0.30	0.001 U	13.9
PC-1	2	12.10	0.026	3.5	0.001 U	0.037	0.13	0.93	0.017	0.017	0.33	0.145	0.003	0.17	0.001 U	9.7
PC-1	3	14.12	0.013	4.3	0.001 U	0.025	0.12	0.91	0.012	0.012	0.25	0.130	0.001	0.22	0.001 U	10.7
PC-1	4	13.73	0.013	3.2	0.003 U	0.044	0.19	1.18	0.015	0.015	0.31	0.168	0.003 U	0.19	0.001 U	9.3
PC-1 Rep 1	5	12.90	0.011	3.2	0.003 U	0.028	0.097	0.88	0.012	0.012	0.22	0.126	0.003 U	0.16	0.001 U	9.2
PC-1 Rep 2	5	12.90	0.011	3.2	0.003 U	0.030	0.113	0.93	0.012	0.012	0.22	0.129	0.003 U	0.22	0.001 U	9.6
PC-1 Rep 3	5	12.90	0.011	3.2	0.003 U	0.029	0.117	0.94	0.011	0.011	0.21	0.129	0.003 U	0.21	0.001 U	9.5
PC-1A	1	12.84	0.028	3.2	0.001 U	0.040	0.120	0.88	0.016	0.016	0.36	0.162	0.002	0.21	0.001 U	9.0
PC-1A	2	14.84	0.019	4.2	0.001 U	0.052	0.15	1.22	0.018	0.018	0.33	0.199	0.003	0.24	0.001 U	10.9
PC-1A	3	14.45	0.034	4.4	0.003 U	0.041	0.136	1.59	0.013	0.013	0.35	0.207	0.003 U	0.26	0.001 U	10.8
PC-1A	4	13.06	0.022	3.3	0.003 U	0.037	0.13	1.2	0.015	0.015	0.31	0.176	0.003 U	0.16	0.001 U	10.1
PC-1A	5	13.92	0.022	3.2	0.001 U	0.028	0.14	1.11	0.015	0.015	0.29	0.149	0.004	0.23	0.001 U	9.6
PC-2	1	14.70	0.029	3.2	0.003 U	0.032	0.17	1.47	0.009	0.009	0.25	0.185	0.003 U	0.19	0.001 U	10.8
PC-2	2	13.84	0.015	4.4	0.003 U	0.031	0.19	1.12	0.014	0.014	0.29	0.174	0.003 U	0.20	0.001 U	10.1
PC-2	3	14.88	0.017	3.9	0.001 U	0.036	0.145	1.05	0.014	0.014	0.31	0.153	0.003	0.23	0.001 U	11.2
PC-2	4	16.00	0.028	4.1	0.002 U	0.038	0.18	1.29	0.018	0.018	0.35	0.187	0.002	0.34	0.001 U	12.0
PC-2	5	16.31	0.022	4.2	0.002 U	0.028	0.154	1.51	0.020	0.020	0.32	0.149	0.003	0.34	0.001 U	12.2
PC-4	1	14.17	0.027	3.6	0.001 U	0.035	0.14	1.33	0.017	0.017	0.41	0.177	0.005	0.30	0.001 U	12.8
PC-4	2	14.51	0.026	4.1	0.001 U	0.055	0.17	1.13	0.020	0.020	0.41	0.199	0.003	0.36	0.001 U	15.0
PC-4	3	14.61	0.050	4.0	0.012 U	0.050	0.140	1.52	0.014	0.014	0.44	0.197	0.020	0.25	0.003 U	14.5
PC-4	4	13.23	0.034	3.2	0.011	0.029	0.19	1.34	0.015	0.015	0.37	0.165	0.017	0.28	0.003 U	12.1
PC-4	5	15.14	0.021	4.1	0.002 U	0.042	0.136	1.22	0.016	0.016	0.50	0.177	0.006	0.22	0.001 U	16.0
PC-5	1	10.61	0.024	2.4	0.001 U	0.026	0.14	1.17	0.010	0.010	0.31	0.170	0.004	0.19	0.001 U	8.6
PC-5	2	14.68	0.030	3.6	0.003 U	0.034	0.16	1.44	0.015	0.015	0.27	0.204	0.003 U	0.19	0.001 U	9.9
PC-5	3	13.51	0.015	3.5	0.001 U	0.040	0.120	1.02	0.019	0.019	0.53	0.184	0.003	0.29	0.001 U	13.4
PC-5 Rep 1	4	12.53	0.021	3.4	0.003 U	0.030	0.14	1.02	0.013	0.013	0.34	0.203	0.003 U	0.18	0.001 U	9.2
PC-5 Rep 2	4	12.53	0.021	3.4	0.003 U	0.029	0.15	1.11	0.013	0.013	0.33	0.190	0.003 U	0.18	0.001 U	9.4
PC-5 Rep 3	4	12.53	0.023	3.4	0.003 U	0.031	0.14	1.1	0.012	0.012	0.33	0.189	0.003 U	0.16	0.001 U	9.5
PC-5	5	14.08	0.022	3.6	0.003 U	0.033	0.16	1.29	0.012	0.012	0.31	0.246	0.003 U	0.24	0.001 U	12.0
Reference	1	12.46	0.049	3.1	0.003	0.038	0.115	1.37	0.009	0.009	0.33	0.174	0.002 U	0.15	0.001 U	14.0
Reference	2	15.81	0.019	4.3	0.002 U	0.046	0.156	1.18	0.019	0.019	0.38	0.133	0.002 U	0.31	0.001 U	10.9
Reference	3	16.16	0.020	3.6	0.002 U	0.043	0.107	1.26	0.020	0.020	0.39	0.120	0.005	0.31	0.001 U	12.2
Reference	4	13.02	0.039	3.9	0.003 U	0.040	0.093	1.21	0.012	0.012	0.29	0.171	0.003 U	0.16	0.001 U	12.0
Reference	5	15.50	0.024	4.4	0.003 U	0.055	0.141	1.15	0.022	0.022	0.45	0.150	0.003 U	0.37	0.001 U	13.8

TABLE L.31. (contd)

Sediment Treatment	Replicate	Percent		<i>M. nasua</i> Metals (mg/kg wet weight)													
		Dry Weight	Ag ICP/MS	As XRF	Be ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVA	Ni ICP/MS	Pb GFA	Sb ICP/MS	Se XRF	Tl ICP/MS	Zn XRF		
<i>M. nasua</i> Background Rep 1	1	14.19	0.039	4.3	0.001 U	0.048	0.29	1.59	0.015	0.63	0.165	0.005	0.27	0.001 U	12.8		
<i>M. nasua</i> Background Rep 2	2	14.19	0.035	4.4	0.001 U	0.052	0.21	1.65	0.015	0.62	0.173	0.008	0.26	0.001 U	13.0		
<i>M. nasua</i> Background Rep 3	3	14.19	0.039	4.3	0.001 U	0.051	0.24	1.7	0.016	0.63	0.209	0.016	0.20	0.001 U	13.2		
<i>M. nasua</i> Control	1	14.20	0.017	5.0	0.003 U	0.047	0.32	1.43	0.016	0.70	0.196	0.003	0.28	0.001 U	10.0		
<i>M. nasua</i> Control	2	15.73	0.017	4.7	0.003 U	0.043	0.27	1.52	0.016	0.54	0.189	0.003 U	0.34	0.001 U	12.2		
<i>M. nasua</i> Control	3	15.21	0.029	4.5	0.002 U	0.034	0.26	1.33	0.012	0.51	0.173	0.002 U	0.19	0.001 U	11.3		
<i>M. nasua</i> Control	4	16.49	0.025	4.6	0.002 U	0.046	0.33	1.67	0.014	0.62	0.181	0.005	0.23	0.001 U	13.5		
<i>M. nasua</i> Control Rep 1	5	15.04	0.017	4.5	0.002 U	0.039	0.22	1.42	0.014	0.57	0.196	0.003	0.27	0.001 U	10.2		
<i>M. nasua</i> Control Rep 2	5	15.04	0.017	4.5	0.002 U	0.038	0.24	1.42	0.014	0.63	0.200	0.005	0.26	0.001 U	10.8		
<i>M. nasua</i> Control Rep 3	5	15.04	0.017	4.4	0.002 U	0.037	0.22	1.39	0.014	0.56	0.196	0.003	0.23	0.001 U	10.3		

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

TABLE L.32.

Quality Control for Metals Analysis By Inductively Coupled Plasma/Mass Spectrometry (ICP/MS), X-Ray Fluorescence (XRF), Graphite Furnace Atomic Absorption and Cold Vapor Atomic Absorption, Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

		M. nasuta Metals (µg dry weight)													Zn
Sediment Treatment	Replicate	Ag	As	Be	Cd	Cr	Cu	h	Ni	Pb	Sb	Se	Tl	Zn	
		GFAA	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVAA	ICP/MS	GFAA	ICP/MS	XRF	ICP/MS	XRF	
Method Blanks															
Blank-1		0.093	NA ^(a)	0.080 U ^(b)	0.051	0.369	0.050 U	0.003 U	0.020 U	0.022	0.040	NA	0.020 U	NA	
Blank-2		0.083	NA	0.080 U	0.051	0.449	0.121	0.003 U	0.020 U	0.022	0.034	NA	0.020 U	NA	
Blank-3		0.021	NA	0.020 U	0.010	0.369	0.020 U	0.004	0.020 U	0.023	0.020 U	NA	0.005 U	NA	
Blank-4		0.024	NA	0.020 U	0.018	0.449	0.020 U	0.003 U	0.020 U	0.003	0.020 U	NA	0.005 U	NA	
Blank-5		0.031	NA	0.010 U	0.027	0.644	0.005 U	NA	0.050 U	0.040 U	0.010 U	NA	0.006 U	NA	
Blank-6		0.018	NA	0.010 U	0.019	0.523	0.005 U	NA	0.050 U	0.040 U	0.010 U	NA	0.006 U	NA	
Matrix Spikes															
PC-1A	1	0.218	24.8	0.010 U	0.309	0.935	6.82	0.127	2.83	1.26	0.014	1.61	0.006 U	70.0	
PC-1A MS	1	2.29	NA	1.077	2.76	5.42	16.8	0.970	7.90	3.63	0.968	NA	1.04	NA	
Amount Recovered		2.07	NA ^(c)	1.077	2.46	4.48	9.99	0.843	5.07	2.37	0.955	NA	1.04	NA	
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.800	4.00	2.00	0.800	NS	0.800	NS	
Percent Recovery		104%	NA	135%	123%	112%	125%	105%	127%	119%	119%	NA	131%	(d) NA	
PC-1A	2	0.134	28.3	0.010 U	0.349	1.02	8.24	0.121	2.22	1.34	0.019	1.64	0.006 U	73.7	
PC-1A MS	2	2.27	NA	1.114	2.64	5.56	17.4	0.846	6.75	3.49	0.975	NA	1.02	NA	
Amount Recovered		2.14	NA	1.114	2.29	4.54	9.17	0.725	4.54	2.15	0.956	NA	1.02	NA	
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.798	4.00	2.00	0.800	NS	0.800	NS	
Percent Recovery		107%	NA	139%	115%	113%	115%	91%	113%	108%	120%	NA	128%	(d) NA	
PC-2	2	0.114	31.8	0.020 U	0.227	1.38	8.09	0.102	2.07	1.26	0.020 U	1.46	0.005 U	73.2	
PC-2 MS	2	2.14	NA	1.122	2.65	5.68	17.9	0.873	6.89	4.90	0.955	NA	1.01	NA	
Amount Recovered		2.02	NA	1.122	2.42	4.31	9.80	0.771	4.82	3.64	0.955	NA	1.01	NA	
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.798	4.00	2.00	0.800	NS	0.800	NS	
Percent Recovery		101%	NA	140%	121%	108%	122%	97%	121%	182%	(d) 119%	NA	127%	(d) NA	
PC-4	3	0.345	27.6	0.080 U	0.345	0.956	10.4	0.093	3.03	1.35	0.136	1.72	0.020 U	99.5	
PC-4 MS	3	1.70	NA	1.025	2.55	5.27	18.6	0.836	7.04	3.26	1.04	NA	0.787	NA	
Amount Recovered		1.35	NA	1.025	2.20	4.31	8.15	0.743	4.01	1.91	0.900	NA	0.787	NA	
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.796	4.00	2.00	0.800	NS	0.800	NS	
Percent Recovery		68%	(d) NA	128%	110%	108%	102%	93%	100%	95%	113%	NA	98%	NA	
Reference	5	0.160	28.5	0.020 U	0.357	0.908	7.43	0.140	2.88	0.966	0.020 U	2.38	0.005 U	89.2	
Reference MS	5	2.20	NA	1.083	2.59	5.25	17.3	0.886	7.53	3.35	0.958	NA	1.00	NA	
Amount Recovered		2.04	NA	1.083	2.23	4.34	9.87	0.746	4.65	2.38	0.958	NA	1.00	NA	
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.800	4.00	2.00	0.800	NS	0.800	NS	
Percent Recovery		102%	NA	135%	112%	109%	123%	93%	116%	119%	120%	NA	126%	(d) NA	

TABLE L.32. (contd)

Sediment Treatment	Replicate	M. nasua Metals (mg/kg dry weight)													Zn
		Ag GFAA	As XRF	Be ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVA	Ni ICP/MS	Pb GFAA	Sb ICP/MS	Se XRF	Tl ICP/MS	XRF	
Standard Reference Material															
Certified Value		1.68 ±0.15	14.0 ±1.2	NC ^(e) NC	4.15 ±0.38	1.43 ±0.46	56.3 ±4.3	0.064 ±0.0067	2.25 ±0.44	0.371 ±0.014	NC	2.21 ±0.24	NC	830 ±57	
1566a	1	1.74	15.1	0.080 U	4.59	1.30	71.2	0.064	2.77	0.410	0.044	2.21	0.020 U	855	
1566a	2	1.78	14.9	0.080 U	4.69	1.44	65.0	0.066	1.77	0.376	0.040	2.53	0.020 U	839	
1566a	3	1.66	14.6	0.020 U	4.54	1.24	71.0	0.063	2.39	0.400	0.020 U	2.14	0.005 U	852	
1566a	4	1.73	15.0	0.020 U	4.77	1.28	74.2	0.067	1.72	0.481	0.020 U	2.08	0.005 U	849	
1566a	5	1.74	NA	0.010 U	4.35	1.37	68.0	NA	1.79	0.370	0.010 U	NA	0.006 U	NA	
1566a	6	1.84	NA	0.010 U	4.55	1.56	72.5	NA	1.84	0.390	0.010 U	NA	0.006 U	NA	
Analytical Replicates															
PC-1 Rep 1	5	0.090	24.5	0.020 U	0.217	0.751	6.80	0.091	1.71	0.976	0.020 U	1.22	0.005 U	71.5	
PC-1 Rep 2	5	0.089	24.9	0.020 U	0.235	0.875	7.21	0.090	1.68	1.00	0.020 U	1.70	0.005 U	74.1	
PC-1 Rep 3	5	0.090	24.9	0.020 U	0.226	0.905	7.27	0.089	1.63	1.00	0.020 U	1.61	0.005 U	74.0	
RSD		1%	1%	NA	4%	10%	4%	1%	3%	1%	NA	17%	NA	2%	
PC-5 Rep 1	4	0.171	27.4	0.020 U	0.239	1.11	8.68	0.101	2.69	1.62	0.020 U	1.47	0.005 U	73.7	
PC-5 Rep 2	4	0.172	27.1	0.020 U	0.233	1.19	8.83	0.100	2.61	1.52	0.020 U	1.46	0.005 U	74.7	
PC-5 Rep 3	4	0.190	27.5	0.020 U	0.245	1.13	8.76	0.099	2.66	1.51	0.020 U	1.26	0.005 U	76.1	
RSD		6%	1%	NA	2%	4%	1%	1%	2%	4%	NA	8%	NA	2%	
M. nasua Background Rep 1	1	0.275	30.6	0.010 U	0.338	2.03	11.2	0.108	4.47	1.16	0.042	1.89	0.006 U	89.9	
M. nasua Background Rep 2	2	0.249	31.1	0.010 U	0.363	1.47	11.6	0.104	4.34	1.22	0.059	1.84	0.006 U	91.3	
M. nasua Background Rep 3	3	0.275	30.1	0.010 U	0.361	1.66	12.0	0.111	4.47	1.47	0.113	1.42	0.006 U	93.0	
RSD		6%	2%	NA	4%	17%	3%	3%	2%	13%	52%(f)	15%	NA	2%	
M. nasua Control Rep 1	5	0.115	30.0	0.010 U	0.260	1.47	9.45	0.096	3.80	1.30	0.023	1.81	0.006 U	67.6	
M. nasua Control Rep 2	5	0.114	30.0	0.010 U	0.252	1.59	9.47	0.095	4.22	1.33	0.036	1.70	0.006 U	71.7	
M. nasua Control Rep 3	5	0.117	29.2	0.010 U	0.248	1.49	9.21	0.094	3.74	1.30	0.018	1.53	0.006 U	68.8	
RSD		1%	2%	NA	2%	4%	2%	1%	7%	1%	35%(f)	8%	NA	3%	

(a) NA Not applicable.

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

(c) NS Not spiked.

(d) Recovery outside quality control range (75%-125%).

(e) NC Not certified.

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

TABLE L.33. Butyltin Results, Wet and Dry Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Surrogate Percent Recovery	<i>M. nasuta</i>				<i>M. nasuta</i>			
			Butyltins (µg/kg wet weight)		Butyltins (µg/kg dry weight)		Butyltins (µg/kg dry weight)		Butyltins (µg/kg dry weight)	
			Tri- butyltin	Di- butyltin	Tri- butyltin	Di- butyltin	Tri- butyltin	Di- butyltin	Tri- butyltin	Di- butyltin
Target DL (a)			10	10	10	10				
Achieved DL			5	5	8	8				
PC-1	1	94	5.0 U ^(b)	5.0 U	8.0 U	8.0 U	33.3 U	33.3 U	53.3 U	53.3 U
PC-1	2	92	5.0 U	5.0 U	8.0 U	8.0 U	33.6 U	33.6 U	53.7 U	53.7 U
PC-1	3	88	5.0 U	5.0 U	8.0 U	8.0 U	35.9 U	35.9 U	57.5 U	57.5 U
PC-1	4	104	8.6	5.0 U	8.0 U	8.0 U	59.0	34.3 U	54.9 U	54.9 U
PC-1	5	51	5.0 U	5.0 U	8.0 U	8.0 U	43.3 U	43.3 U	69.2 U	69.2 U
PC-1A	1	84	5.0 U	5.0 U	8.0 U	8.0 U	32.9 U	32.9 U	52.7 U	52.7 U
PC-1A	2	82	5.0 U	5.0 U	8.0 U	8.0 U	35.2 U	35.2 U	56.4 U	56.4 U
PC-1A	3	92	5.0 U	5.0 U	8.0 U	8.0 U	33.6 U	33.6 U	53.8 U	53.8 U
PC-1A	4	76	5.0 U	5.0 U	8.0 U	8.0 U	36.9 U	36.9 U	59.0 U	59.0 U
PC-1A	5	94	5.0 U	5.0 U	8.0 U	8.0 U	36.2 U	36.2 U	58.0 U	58.0 U
PC-2	1	74	7.7	5.0 U	8.0 U	8.0 U	56.9	36.9 U	59.1 U	59.1 U
PC-2	2	102	5.1	5.0 U	8.0 U	8.0 U	39.2	38.6 U	61.8 U	61.8 U
PC-2	3	119	5.0 U	5.0 U	8.0 U	8.0 U	32.7 U	32.7 U	52.3 U	52.3 U
PC-2	4	111(c)	5.0 U	5.0 U	8.0 U	8.0 U	39.3 U	39.3 U	62.9 U	62.9 U
PC-2	5	126(c)	5.0 U	5.0 U	8.0 U	8.0 U	30.3 U	30.3 U	48.5 U	48.5 U
PC-4	1	96	5.0 U	5.0 U	8.0 U	8.0 U	35.2 U	35.2 U	56.3 U	56.3 U
PC-4	2	88	5.0 U	5.0 U	8.0 U	8.0 U	31.8 U	31.8 U	50.9 U	50.9 U
PC-4	3	41(c)	5.0 U	5.0 U	8.0 U	8.0 U	35.9 U	35.9 U	57.5 U	57.5 U
PC-4	4	39(c)	5.0 U	5.0 U	8.0 U	8.0 U	37.0 U	37.0 U	59.2 U	59.2 U
PC-4 Rep 1	5	72	5.6	5.0 U	8.0 U	8.0 U	40.2	35.7 U	57.1 U	57.1 U
PC-4 Rep 2	5	73	6.4	5.0 U	8.0 U	8.0 U	45.8	35.7 U	57.1 U	57.1 U
PC-4 Rep 3	5	100	5.0 U	5.0 U	8.0 U	8.0 U	35.7 U	35.7 U	57.1 U	57.1 U

TABLE L.33. (contd)

Sediment Treatment	Replicate	Surrogate Percent Recovery	<i>M. nasuta</i>				<i>M. nasuta</i>			
			Butyltins ($\mu\text{g/kg}$ wet weight)				Butyltins ($\mu\text{g/kg}$ dry weight)			
			Tri- butyltin	Di- butyltin	Mono- butyltin	Percent Dry Weight	Tri- butyltin	Di- butyltin	Mono- butyltin	
PC-5	1	86	5.2	5.0 U	8.0 U	15.06	34.3	33.2 U	53.1 U	
PC-5	2	105	5.9	5.0 U	8.0 U	16.67	35.5	30.0 U	48.0 U	
PC-5	3	100	5.5	5.0 U	8.0 U	15.11	36.4	33.1 U	52.9 U	
PC-5	4	61	5.0 U	5.0 U	8.0 U	13.58	36.8 U	36.8 U	58.9 U	
PC-5	5	107	5.0 U	5.0 U	8.0 U	12.89	38.8 U	38.8 U	62.1 U	
Reference Rep 1	1	62	5.5	5.0 U	8.0 U	13.68	40.5	36.5 U	58.5 U	
Reference Rep 2	1	81	5.0 U	5.0 U	8.0 U	13.68	36.5 U	36.5 U	58.5 U	
Reference Rep 3	1	81	20.4	5.0 U	8.0 U	13.68	149.0	36.5 U	58.5 U	
Reference	2	90	5.0 U	5.0 U	8.0 U	14.94	33.5 U	33.5 U	53.5 U	
Reference	3	93	5.0 U	5.0 U	8.0 U	14.63	34.2 U	34.2 U	54.7 U	
Reference	4	75	5.0 U	5.0 U	8.0 U	13.52	37.0 U	37.0 U	59.2 U	
Reference	5	74	7.9	5.0 U	8.0 U	14.29	55.2	35.0 U	56.0 U	
<i>M. nasuta</i> Background Rep 1	1	98	5.0 U	5.0 U	8.0 U	18.21	27.5 U	27.5 U	43.9 U	
<i>M. nasuta</i> Background Rep 2	2	91	5.0 U	5.0 U	8.0 U	18.21	27.5 U	27.5 U	43.9 U	
<i>M. nasuta</i> Background Rep 3	3	97	5.0 U	5.0 U	8.0 U	18.21	27.5 U	27.5 U	43.9 U	
<i>M. nasuta</i> Control	1	48	5.0 U	5.0 U	8.0 U	13.17	38.0 U	38.0 U	60.7 U	
<i>M. nasuta</i> Control	2	70	8.1	5.0 U	8.0 U	13.64	59.6	36.7 U	58.7 U	
<i>M. nasuta</i> Control	3	82	5.0 U	5.0 U	8.0 U	15.92	31.4 U	31.4 U	50.3 U	
<i>M. nasuta</i> Control	4	93	5.0 U	5.0 U	8.0 U	17.39	28.8 U	28.8 U	46.0 U	
<i>M. nasuta</i> Control	5	102	5.0 U	5.0 U	8.0 U	14.24	35.1 U	35.1 U	56.2 U	

(a) DL Detection limit.

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

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

TABLE L.34. Quality Control Summary for Butyltin Results, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Replicate	Surrogate	<i>M. nasuta</i>		
		Percent Recovery Triphenyltin	Butyltins ($\mu\text{g/kg}$ wet weight)		
			Tri-butyltin	Di-butyltin	Mono-butyltin
<u>Method Blanks</u>					
Blank-1	1	44	5.0 U ^(a)	5.0 U	8.0 U
Blank-2	2	45	5.0 U	5.0 U	5.0 U
Blank-3	3	96	5.0 U	5.0 U	8.0 U
Blank-4	4	101	5.0 U	5.0 U	8.0 U
<u>Matrix Spikes</u>					
PC-1	5	51	5.0 U	5.0 U	8.0 U
PC-1 MS	5	52	57.1	54.0	14.4
Concentration Recovered			57.1	54.0	14.4
Amount Spiked			46.1	46.1	46.1
Percent Recovery			124% ^(b)	117%	31% ^(b)
PC-2	2	102	5.1	5.0 U	8.0 U
PC-2 MS	2	76	51.9	47.5	11.5
Concentration Recovered			46.8	47.5	11.5
Amount Spiked			45.5	45.5	45.5
Percent Recovery			103%	105%	25% ^(b)
PC-5	5	107	5.0 U	5.0 U	8.0 U
PC-5 MS	5	71	71.1	55.7	13.5
Concentration Recovered			71.1	55.7	13.5
Amount Spiked			48.4	48.4	48.4
Percent Recovery			147% ^(b)	115%	28% ^(b)
<i>M. nasuta</i> Control	5	102	5.0 U	5.0 U	8.0 U
<i>M. nasuta</i> Control	5	87	78.5	84.6	23.1
Concentration Recovered			78.5	84.6	23.1
Amount Spiked			94.5	94.5	94.5
Percent Recovery			83%	90%	24% ^(b)
<u>Analytical Replicates</u>					
PC-4 Rep 1	5	72	5.6	5.0 U	8.0 U
PC-4 Rep 2	5	73	6.4	5.0 U	8.0 U
PC-4 Rep 3	5	100	5.0 U	5.0 U	8.0 U
RSD		NA ^(c)	NA	NA	NA
Reference Rep 1	1	62	5.5	5.0 U	8.0 U
Reference Rep 2	1	81	5.0 U	5.0 U	8.0 U
Reference Rep 3	1	81	20.4	5.0 U	8.0 U
RSD		NA	NA	NA	NA
<i>M. nasuta</i> Background Rep 1	1	98	5.0 U	5.0 U	8.0 U
<i>M. nasuta</i> Background Rep 2	2	91	5.0 U	5.0 U	8.0 U
<i>M. nasuta</i> Background Rep 3	3	97	5.0 U	5.0 U	8.0 U
RSD		NA	NA	NA	NA

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

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

(c) NA Not applicable.

TABLE L.35. Total Polychlorinated Dibenzodioxins (PCDD) and Dibenzofurans (PCDF) Analysis, Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Percent Dry Weight (a)</u>	<u><i>M. nasuta</i> Dioxins and Furans (ng/kg wet weight)</u>							
		<u>Total TCDD</u>	<u>Total PeCDD</u>	<u>Total HxCDD</u>	<u>Total HpCDD</u>	<u>Total TCDF</u>	<u>Total PeCDF</u>	<u>Total HxCDF</u>	<u>Total HpCDF</u>
Target DL (b)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
PC-1	13.769	0.30	ND (c)	1.59	5.55	1.15	ND	0.65	0.43
PC-2	14.052	0.21	ND	1.03	3.60	1.47	ND	0.34	0.27
Reference	13.979	ND	ND	0.72	1.50	ND	ND	0.23	0.15

(a) Value is average percent dry weight from PAH analysis.

(b) DL Detection limit.

(c) ND Not detected.

TABLE L.36. Polychlorinated Dibenzodioxins (PCDD) Analysis and Quality Control Data (2378-TCDD - OCDD), Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment	Percent Dry Weight (a)	<i>M. nasuta</i> Dioxins (ng/kg wet weight)						
		2378-TCDD	12378-PeCDD	123478-HxCDD	123678-HxCDD	123789-HxCDD	1234678-HpCDD	OCDD
Target DL (b)		1.0	1.0	1.0	1.0	1.0	1.0	1.0
Achieved DL		0.2	0.1	0.1	0.1	0.2	0.7	<2.27
PC-1	13.769	0.4 U (c)	0.2 U	0.1 U	0.4 U	0.3 U	1.47 (d)(e)	12.45
PC-2	14.052	0.3 U	0.2 U	0.2 U	0.3 U	0.3 U	2.9 U (d)	9.53
Reference	13.979	0.2 U	0.2 U	0.1 U	0.1 U	0.2 U	0.50 (d)	4.52
Quality Control Data								
Method Blank								
Blank		0.2 U	0.1 U	0.1 U	0.2 U	0.2 U	0.7 U	2.27
Matrix Spikes								
PC-1	13.769	0.4 U	0.2 U	0.1 U	0.4 U	0.3 U	1.47 (d)(e)	12.45
PC-1 MS		21	101	103	81	102	91	217
Amount Spiked		20	100	100	100	100	100	200
Percent Recovery (f)		105%	101%	103%	81%	102%	90%	102%
PC-1	13.769	0.4 U	0.2 U	0.1 U	0.4 U	0.3 U	1.47 (d)(e)	12.45
PC-1 MSD		21	98	106	88	91	108	242
Amount Spiked		20	100	100	100	100	100	200
Percent Recovery (f)		105%	98%	106%	88%	91%	106%	114%
RPD		0%	3%	3%	8%	11%	16%	11%
I-Stat		0.00	0.02	0.01	0.04	0.06	0.08	0.06

(a) Value is average percent dry weight from PAH analysis.

(b) DL Detection limit.

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

(d) Calibration response factor at beginning of day out of limits.

(e) Mass ratio out of limits.

(f) Percent recovery = [(matrix spike concentration)/(amount spiked + original sample concentration)]*100

TABLE L.37. Polychlorinated Dibenzofurans (PCDF) Analysis and Quality Control Summary (2378-TCDF - OCDF), Wet Weight, in Tissue of *M. nasuta*, Panama City Harbor Project

Sediment Treatment		Percent Dry Weight (a)	M. nasuta Furans (ng/kg wet weight)									
			2378-TCDF	12378-PeCDF	23478-PeCDF	123478-HxCDF	123678-HxCDF	123789-HxCDF	234678-HxCDF	1234678-HpCDF	1234789-HpCDF	OCDF
Target DL (b)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Achieved DL			0.2	0.1	0.1	0.1	0.1	0.4	0.1	0.4	0.1	<0.24
PC-1		13.769	0.39	0.2 U(c)	0.1 U	0.1 U	0.1 U	0.19	0.1 U	1.1 U	0.1 U	0.55
PC-2		14.052	0.55	0.2 U	0.1 U	0.1 U	0.1 U	0.4 U	0.1 U	0.7 U	0.1 U	0.25
Reference		13.979	0.3 U	0.1 U	0.1 U	0.1 U	0.1 U	0.15	0.1 U	1.6 U	0.1 U	0.24(d)
Quality Control Data												
Method Blank												
Blank			0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.1 U	0.4 U	0.2 U	0.24
Matrix Spikes												
PC-1		13.769	0.39	0.2 U	0.1 U	0.1 U	0.1 U	0.19	0.1 U	1.1 U	0.1 U	0.55
PC-1 MS			20	95	89	90	89	90	76	83	94	204
Amount Spiked			20	100	100	100	100	100	100	100	100	200
Percent Recovery (e)			98%	95%	89%	90%	89%	90%	76%	83%	94%	102%
PC-1		13.769	0.39	0.2 U	0.1 U	0.1 U	0.1 U	0.19	0.1 U	1.1 U	0.1 U	0.55
PC-1 MSD			20	84	84	98	99	98	99	85	105	207
Amount Spiked			20	100	100	100	100	100	100	100	100	200
Percent Recovery (e)			98%	84%	84%	98%	99%	98%	99%	85%	105%	103%
RPD			0%	12%	6%	9%	11%	9%	26%	2%	11%	1%
I-Stat			0.00	0.06	0.03	0.04	0.05	0.04	0.13	0.01	0.06	0.01

(a) Value is average percent dry weight from PAH analysis.

(b) DL Detection limit.

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

(d) Mass ratio out of limits.

(e) Percent recovery = [(matrix spike concentration)/(amount spiked + original sample concentration)]*100

TABLE L.38. Total Polychlorinated Dibenzodioxins (PCDD) and Dibenzofurans (PCDF) Analysis in Tissue of *M. nasuta*, Dry Weight, Panama City Harbor Project

Sediment Treatment	Percent Dry Weight (a)	<i>M. nasuta</i> Dioxins and Furans (ng/kg dry weight)							
		Total TCDD	Total PeCDD	Total HxCDD	Total HpCDD	Total TCDF	Total PeCDF	Total HxCDF	Total HpCDF
PC-1	13.769	2.18	ND ^(b)	11.55	40.31	8.35	ND	4.72	3.12
PC-2	14.052	1.49	ND	7.33	25.62	10.46	ND	2.42	1.92
Reference	13.979	ND	ND	5.15	10.73	ND	ND	1.65	1.07

(a) Value is average percent dry weight from PAH analysis.

(b) ND Not detected.

TABLE L.39. Polychlorinated Dibenzodioxins (PCDD) Analysis and Quality Control Data (2378-TCDD - OCDD) in Tissue of *M. nasuta*, Dry Weight, Panama City Harbor Project

Sediment Treatment	Percent Dry Weight (a)	<i>M. nasuta</i> Dioxins (ng/kg dry weight)						OCDD
		2378- TCDD	12378- PeCDD	123478- HxCDD	123678- HxCDD	123789- HxCDD	1234678- HpCDD	
PC-1	13.769	2.9 U(b)	1.5 U	0.7 U	2.9 U	2.2 U	10.7 ^{(c)(d)}	90.4
PC-2	14.052	2.1 U	1.4 U	1.4 U	2.1 U	2.1 U	20.6 ^(c)	67.8
Reference	13.979	1.4 U	1.4 U	0.7 U	0.7 U	1.4 U	3.6 ^(c)	32.3

(a) Value is average percent dry weight from PAH analysis.

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

(c) Calibration response factor at beginning of day out of limits.

(d) Mass ratio out of limits.

TABLE L.40. Polychlorinated Dibenzofurans (PCDF) Analysis and Quality Control Summary (2378-TCDF - OCDF) in Tissue of *M. nasuta*, Dry Weight, Panama City Harbor Project

Sediment Treatment	Percent Dry Weight (a)	<i>M. nasuta</i> Furans (ng/kg dry weight)									
		2378-TCDF	12378-PeCDF	23478-PeCDF	123478-HxCDF	123678-HxCDF	123789-HxCDF	234678-HxCDF	1234678-HpCDF	1234789-HpCDF	OCDF
PC-1	13.769	2.83	1.45 U ^(b)	0.73 U	0.73 U	0.73 U	1.38	0.73 U	7.99 U	0.73 U	3.99
PC-2	14.052	5.91	1.42 U	0.71 U	0.71 U	0.71 U	2.85 U	0.71 U	4.98 U	0.71 U	1.78 ^(c)
Reference	13.979	2.15 U	0.72 U	0.72 U	0.72 U	0.72 U	1.07	0.72 U	11.45 U	0.72 U	1.72 ^(c)

(a) Value is average percent dry weight from PAH analysis
 (b) U Analyte was not present above the associated value.
 (c) Mass ratio out of limits.

TABLE L.41. Surrogate Percent Recovery of Polychlorinated Dibenzodioxins (PCDD) in Tissue of *M. nasuta*, Wet Weight, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Surrogate Percent Recoveries</u>					
	<u>2378-TCDD-C13</u>	<u>12378-PeCDD-C13</u>	<u>123478-HxCDD-C13</u>	<u>123678-HxCDD-C13</u>	<u>1234678-HpCDD-C13</u>	<u>OCDD-C13</u>
PC-1	88	96	82	90	84	65
PC-2	82	101	86	94	60	65
Reference	93	106	106	104	89	54
<u>Quality Control Data</u>						
<u>Method Blank</u>						
Blank	62	71	59	60	62	53
<u>Matrix Spikes</u>						
PC-1 MS	86	104	77	84	83	71
PC-1 MSD	90	95	90	100	41	76

TABLE L.42. Surrogate Percent Recovery of Polychlorinated Dibenzofurans (PCDF) in Tissue of *M. nasuta*, Wet Weight, Panama City Harbor Project

Sediment Treatment	Surrogate Percent Recoveries											
	2378- TCDF-C13	12378- PeCDF-C13	23478- PeCDF-C13	123478- HxCDF-C13	123678- HxCDF-C13	123789- HxCDF-C13	234678- HxCDF-C13	1234678- HxCDF-C13	1234789- HxCDF-C13	2378- TCDF-C13	1234789- TCDD-37CL4	
PC-1	75	80	86	77	75	77	72	75	76	92		
PC-2	75	35(a)	76	77	76	76	80	83	79	88		
Reference	79	81	90	90	89	90	85	95	83	94		
<u>Quality Control Data</u>												
<u>Method Blank</u>												
Blank	54	57	58	59	57	58	62	66	60	63		
<u>Matrix Spikes</u>												
PC-1 MS	74	81	79	72	72	71	60	63	73	85		
PC-1 MSD	79	82	90	76	80	82	80	74	81	91		

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

APPENDIX M

N. VIRENS TISSUE CHEMISTRY
AND QUALITY CONTROL DATA

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Polynuclear Aromatic Hydrocarbons (PAHs)
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: *N. virens* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
EPA Method 8270 (1986a)	40-120%	≤30%	≤30%	30 µg/kg

HOLDING TIMES All samples were stored frozen (-20°C) in sealed containers until ready for extraction. The tissue samples were extracted within 2 months of receipt at the laboratory and were analyzed within 40 days.

DETECTION LIMITS The achieved detection limits for PAHs were all well below the target detection limits.

METHOD BLANKS Four method blanks were analyzed with the tissue samples. At least one of the three blanks analyzed with the Batch 1, 2, and 3 tissue samples were contaminated with the PAHs naphthalene, 2-methylnaphthalene, 1-methylnaphthalene, and phenanthrene at levels >1/5 the target detection limit. The data associated with these blanks were flagged with a "B."

MATRIX SPIKES The recovery of target PAHs in the matrix spikes ranged from 66% to 283%. Ten of the 36 low-molecular-weight PAH (LPAH) matrix spike recoveries ranged from 121% to 283%. The RPD between PC-4 COMP MS and MSD matrix spike recoveries ranged from 1% to 3%, all within the target goal of 30%. Twelve of the 60 high-molecular-weight PAH (HPAH) matrix spike recoveries ranged from 121% to 129%, most due to the fact that the concentrations of PAHs in the samples were suspect due to the analytical laboratory contamination.

SRMs The standard reference material NIST 1974 was analyzed with the PAH samples. The percent difference of certified PAHs in the tissue SRMs were acceptable in 22 of the 32 reported SRM values.

REPLICATES Precision was measured by relative standard deviation (RSD) between triplicates. Fourteen of the calculable 21 LPAHs had RSD values that exceeded the 30% limit. These elevated RSD values ranged from 32% to 94%, generally due to one of the replicates being suspect or associated with contamination from the blank sample. Thirteen of the calculable 33 HPAHs had RSD values that exceeded the 30% limit and ranged from 32% to 54%.

SURROGATES

Three surrogate compounds were analyzed with the samples: naphthalene-d₈, acenaphthene-d₁₀, and benzo(a)-pyrene-d₁₂. The recovery of the surrogate internal standard (SIS) compounds for 29 of the 153 tissue samples were outside the 40% to 120% acceptable range.

ADDITIONAL INFORMATION

The individual replicate tissue samples analyzed for PAHs in the *N. virens* tissues were contaminated in the analytical laboratory during analysis. Existing leftover uncontaminated tissue samples were combined into a single composite for each sediment treatment and reanalyzed. The composite and original data are presented in Appendix M.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Phenols, Substituted Phenols, and Phthalate Esters
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: *N. virens* Tissue

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Phenols	EPA Method 8270 (1986a)	40-120%	NA	≤30%	330 µg/kg
Phthalate Esters	EPA Method 8270	40-120%	NA	≤30%	100 µg/kg

HOLDING TIMES All samples were stored frozen (-20°C) in sealed containers until ready for extraction. The tissue samples were extracted within 2 months of receipt at the laboratory and were analyzed within the 40-day holding period.

DETECTION LIMITS The samples analyzed for phenols and phthalate esters were slightly elevated above the target detection limits. These elevations do not present a problem due to all but two samples having concentrations of phenols and phthalate esters that were undetected or detected below the method detection limit.

METHOD BLANKS The method blanks analyzed with the samples had concentrations of phenols and phthalate esters that were either undetected or detected below the method detection limit.

MATRIX SPIKES Matrix spike recovery criteria for phenols and phthalate esters in tissues have not been established by the EPA. This may be due to the difficulty involved with recovering phenols both from the extraction procedures as well as the gas chromatograph. Nineteen of the 61 matrix spike recoveries ranged either from 121% to 226% or from 0% to 39%, outside the target range of 40% to 120%. These exceedences were generally due to relatively high concentrations of phenols and phthalate esters that were spiked into the samples.

SRMs NA

REPLICATES Precision was measured by relative standard deviation (RSDs) between triplicates. The concentrations of phenols and phthalate esters were either undetected or detected below the MDL so RSDs could not be calculated.

SURROGATES

The surrogate compound 2-fluorophenol was analyzed with the samples. The recovery of the surrogate internal standard (SIS) compound exceeded the target goal of 30% for 12 of the 51 tissue samples processed with the analytical batches.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs)
LABORATORY: Battelle Ocean Sciences, Duxbury, Massachusetts
MATRIX: *N. virens* Tissue

QA/QC DATA QUALITY OBJECTIVES

<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
EPA Method 8080 (1986a)	40-120%	NA	≤30%	10-30 µg/kg

HOLDING TIMES All samples were stored frozen (-20°C) in sealed containers until ready for extraction. The tissue samples were extracted within 2 months of receipt at the laboratory and were analyzed within the 40-day holding period.

DETECTION LIMITS The achieved detection limits for pesticides and PCBs were all within the target detection limits.

METHOD BLANKS The three method blanks analyzed with the samples were free of contamination.

MATRIX SPIKES The recovery of target pesticides and PCBs in the tissue samples were generally acceptable with the exception of 18 with ranges of 124% to 317% or 1% to 10%.

SRMs NA

REPLICATES Precision was measured by relative standard deviation (RSDs) between triplicates. Nine of the calculable 19 RSD values exceeded the relative precision goal of 30%, ranging from 31% to 140%.

SURROGATES Two surrogate compounds were analyzed with the samples: DBOFB and Cl₅(112). The recovery of the surrogate internal standard (SIS) compounds was acceptable, with the exception of 26 of the 102 tissue samples.

NA Not applicable.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Metals
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *N. virens* Tissues

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (dry wt)</u>
Antimony	ICP/MS (EPA 1990b)	75-125	≤30%	≤20%	0.1 mg/kg
Arsenic	XRF (PNL SOP)	75-125	≤30%	≤20%	0.1 mg/kg
Beryllium	ICP/MS	75-125	≤30%	≤20%	0.2 mg/kg
Cadmium	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Chromium	ICP/MS	75-125	≤30%	≤20%	0.6 mg/kg
Copper	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Lead	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Mercury	CVAA (Bloom/Crecelius 1984)	75-125	≤30%	≤20%	0.01 mg/kg
Nickel	ICP/MS	75-125	≤30%	≤20%	1.0 mg/kg
Selenium	XRF	75-125	≤30%	≤20%	0.3 mg/kg
Silver	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Thallium	ICP/MS	75-125	≤30%	≤20%	0.1 mg/kg
Zinc	XRF	75-125	≤30%	≤20%	0.3 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 were held frozen and then freeze-dried and stored in sealed containers until ready for analysis.

DETECTION LIMITS Achieved detection limits based on dry weight concentrations were lower than the target detection limits for all metals except As, Hg, Se, and Zn. These four metals were detected in all the tissue samples at concentrations above the target detection limit. Sample concentrations of these four metals were well above the achieved detection limits, therefore no corrective action was taken.

METHOD BLANKS The method blank analyzed for metals had low levels of Ag, Cd, Cr, Cu, Hg, Pb, and Sb. The data associated with these blanks were corrected for the amount in the method blank.

MATRIX SPIKES Four of the 30 calculable matrix spike recovery values were 49%, 129%, 132%, and 138%, outside of the 75% to 125% range.

SRMs The oyster tissue standard reference material (SRM) 1566a was analyzed for all the metals. The values were all within the 30% limit set in the QA plan.

REPLICATES

Precision between triplicates was measured by Relative Standard Deviation (RSDs). Five of the calculable 44 RSDs ranged from 21% to 80%, exceeding the target goal of 20%.

QA/QC SUMMARY

PROGRAM: Panama City Harbor Program
PARAMETER: Butyltins
LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington
MATRIX: *N. virens* Tissues

QA/QC DATA QUALITY OBJECTIVES

	<u>Reference Method</u>	<u>Range of Recovery</u>	<u>SRM Accuracy</u>	<u>Relative Precision</u>	<u>Detection Limit (wet wt)</u>
Tributyltin	Unger et al. 1986	40-120	NA	≤30%	10 µg/kg
Dibutyltin	Unger et al. 1986	40-120	NA	≤30%	10 µg/kg
Monobutyltin	Unger et al. 1986	40-120	NA	≤30%	10 µg/kg

HOLDING TIMES Samples were extracted within the 14-day holding period and analyzed within 40 days of extraction.

DETECTION LIMITS The detection limit of 10µg/kg was met for all samples.

METHOD BLANKS The method blanks analyzed with the samples were free of contamination.

MATRIX SPIKES Six of the monobutyltin matrix spike percent recoveries ranged from 11% to 24%, outside the target range of 40% to 120%. The matrix spike recoveries for dibutyltin and tributyltin were all within range. Low recoveries for monobutyltin are standard, due to inefficiency of the method used to extract this compound.

SRMs NA

REPLICATES Precision between triplicates was measured by Relative Standard Deviation (RSDs). There was at least one replicate that was undetected above the method detection limit; therefore, there were no calculable RSDs.

SURROGATES The surrogate internal standard (SIS) compound triphenyltin was analyzed with the samples. The recovery of six of the 44 sample percent recoveries ranged from 27% to 39%, outside the 40% to 120% targeted range.

NA Not applicable.

TABLE M.1. Total Polynuclear Aromatic Hydrocarbon (PAH) Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
PC-1 COMP			9	2	11
PC-1	1	2	42	5	47
PC-1	2	1	7	3	10
PC-1	3	2	17	6	23
PC-1	4	1	16	2	18
PC-1	5	2	13	4	17
PC-1A COMP			6	2	8
PC-1A	1	2	31	4	35
PC-1A	2	1	9	2	11
PC-1A	3	2	16	4	20
PC-1A	4	2	10	3	13
PC-1A	5	1	6	1	7
PC-2 COMP			9	2	11
PC-2	1	3	102	9	111
PC-2	2	2	32	5	37
PC-2	3	1	8	3	11
PC-2	4	1	6	1	7
PC-2	5	1	12	2	14
PC-4 COMP			19	3	22
PC-4	1	1	18	0	18
PC-4 Rep 1	2	2	21	6	27
PC-4 Rep 2	2	2	49	7	56
PC-4 Rep 3	2	2	21	5	26
PC-4	3	1	8	1	9
PC-4 Rep 1	4	2	15	6	21
PC-4 Rep 2	4	2	29	6	35
PC-4 Rep 3	4	2	86	9	95
PC-4	5	3	463	17	480
PC-5 COMP			12	4	16
PC-5	1	2	49	7	56
PC-5	2	2	13	8	21
PC-5	3	1	9	7	16
PC-5	4	3	308	16	324
PC-5	5	1	7	3	10
Reference COMP			11	2	13
Reference	1	3	237	10	247
Reference	2	2	39	4	43
Reference	3	2	33	4	37
Reference	4	1	12	3	15
Reference	5	3	51	5	56
<i>N. virens</i> Background Rep 1	1	3	230	11	241
<i>N. virens</i> Background Rep 2	2	3	507	22	529
<i>N. virens</i> Background Rep 3	3	3	193	11	204

TABLE M.1. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
Control COMP			11	3	14
<i>N. virens</i> Control	1	2	9	4	13
<i>N. virens</i> Control	2	3	272	14	286
<i>N. virens</i> Control	3	1	10	2	12
<i>N. virens</i> Control	4	1	10	1	11
<i>N. virens</i> Control Rep 1	5	1	13	9	22
<i>N. virens</i> Control Rep 2	5	1	17	5	22
<i>N. virens</i> Control Rep 3	5	1	12	5	17

TABLE M.2. Low Molecular Weight Polynuclear Aromatic Hydrocarbon (LPAH) Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> LPAHs ($\mu\text{g/kg}$ wet weight)											
				2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene					
Target DL (a)				30	30	30	30	30	30	30					
				2.70	1.37	1.42	2.49	0.94	1.59	1.76					
Achieved High DL				0.88	0.45	0.46	0.82	0.31	0.52	0.58					
Achieved Low DL															
PC-1 COMP	1	1	15.18	5.42	0.40 J ^(b)	0.49	0.09 J ^(d)	0.24 J	0.16 J	1.82	0.07 J ^(d)				
	2	2	14.15	31.16 B ^(c)	0.61 J ^(e)	2.7 J ^(d)	0.47 J ^(d)	0.46	0.71 U	6.35 B	0.40 J ^(d)				
	3	1	14.03	2.60	1.36 J ^(d)	0.83	0.34 J ^(d)	0.33 U	0.55 U	1.29	0.48 J ^(d)				
	4	2	12.32	12.23 B	0.66 J ^(d)	0.68 J ^(d)	0.21 J	0.25 J	0.20 J ^(d)	3.78 B	0.22 J ^(d)				
	5	2	14.17	4.77	3.70 J ^(d)	2.00 J ^(d)	0.94 U ^(d)	0.36 U	3.34 J ^(d)	1.62	0.70 J ^(d)				
PC-1A COMP	1	1	13.39	8.33 B	0.52 U	0.53 U	0.50 J ^(d)	0.28 J	0.25 J	2.87 B	0.31 J ^(d)				
	2	2	14.84	3.62	0.45 J	0.46 J ^(d)	0.09 J ^(d)	0.22 J	0.13 J	1.42	0.08 J ^(d)				
	3	1	12.85	23.46 B ^(d)	0.46 J ^(d)	1.81 J ^(d)	0.30 J ^(d)	0.27 J	0.20 J ^(d)	4.61 B	0.30 J ^(d)				
	4	2	14.13	2.85	1.97 J ^(d)	1.08	0.24 J ^(d)	0.25 J	0.88 J ^(d)	1.07	0.26 J ^(d)				
	5	2	13.54	10.55 B	0.48 U	0.49 U	0.41 J ^(d)	0.27 J	0.22 J	3.67 B	0.41 J ^(d)				
PC-2 COMP	1	1	14.00	6.65 B	0.58 U	0.60 U	0.38 J ^(d)	0.28 J	0.21 J ^(d)	2.34 B	0.24 J ^(d)				
	2	2	13.39	2.03	1.19	0.66	0.16 J	0.38	0.56 J ^(d)	0.67	0.07 J				
	3	3	15.38	5.82	0.45 J	0.55	0.09 J ^(d)	0.28 J	0.14 J	1.88	0.45 U				
	4	2	14.28	80.31 B ^(d)	1.25 UB	5.97 B ^(d)	0.49 J ^(d)	0.72 J	0.41 J	13.80 B ^(d)	0.34 J				
	5	2	13.47	25.46 B ^(d)	0.56 J ^(d)	0.58 U	0.30 J ^(d)	0.45	0.26 J ^(d)	5.09 B	0.25 J				
PC-4 COMP	1	1	14.07	2.88	1.51 J ^(d)	0.57 J	1.00 U	0.44	0.52 J ^(d)	1.06	0.59 U				
	2	2	13.98	2.58	1.43 J ^(d)	0.85	0.91 U	0.35 U	0.72 J ^(d)	0.91	0.50 U				
	3	1	14.45	4.16	2.35 J ^(d)	1.43	0.27 J ^(d)	0.53 J	1.32 J ^(d)	1.32	0.40 J				
	4	2	15.17	12.95	0.80 J	0.67 J	1.64 U	0.29 J	0.25 J	4.11	0.89 U				
	5	2	14.33	18.23	0.57 U	0.59 U	1.04 U	0.39 U	0.66 U	0.73 U	0.56 U				
PC-4 Rep 1	1	1	14.75	14.85 B	1.37 U	0.82 J ^(d)	0.49 J	0.32 J	0.30 J	4.22 B	0.35 J				
	2	2	14.75	37.40 B	1.37 U	2.50 J ^(d)	0.56 J	0.56 J	0.34 J	7.62 B	0.48 J				
	3	2	14.75	14.55 B	1.05 U	0.77 J	0.50 J	0.32 J	0.21 J ^(d)	4.10 B	0.35 J				
	4	1	14.21	3.02	1.69	0.95	0.99 U	0.39	0.78 J ^(d)	1.02	0.27 J				
	5	2	14.22	10.49 B	1.35 U	1.39 U	0.46 J	0.32 J	0.31 J	2.94 B	0.36 J				
PC-4 Rep 2	1	1	14.22	21.75 B ^(d)	1.36 U	1.40 U	0.43 J	0.28 J	0.33 J	5.90 B ^(d)	0.32 J				
	2	2	14.22	72.26 B ^(d)	1.12 U ^(d)	1.15 U ^(d)	0.67 J	0.77 J ^(d)	1.29 U	12.92 B ^(d)	0.50 J				
	3	2	13.57	322.14 B	67.34 B	24.01 B	2.29	6.26 J ^(d)	1.05 U	39.56 B ^(d)	1.59				
	4	3	13.57												
	5	3	13.57												

TABLE M.2. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> [PAHs ($\mu\text{g/kg}$ wet weight)]							
				Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
PC-5 COMP											
PC-5	1	2	14.58	7.40	0.50	0.48	0.10 J(d)	0.24 J	0.17 J	2.61	0.44 U
PC-5	2	2	13.62	37.19 B(d)	0.49 U	2.87 (d)	0.53 J(d)	0.56	0.56 U	7.25 B	0.43 J
PC-5	3	1	13.47	8.92 B	0.91 U	0.94 U	0.49 J(d)	0.63 U	0.22 J	2.65 B	0.46 J
PC-5	4	3	13.83	3.18	2.50 U	1.30	0.34 J(d)	0.34 U	0.86	0.98	0.19 J
PC-5	5	1	14.84	228.71 B(d)	25.94 B(d)	17.04 B(d)	2.10 J(d)	4.23 J(d)	1.05 U	28.32 B(d)	1.37
PC-5			14.17	2.39	1.42	1.05	0.34 J(d)	0.31 J	0.67 J(d)	0.81	0.24 J
Reference COMP											
Reference	1	3	15.49	7.14	0.50	0.53	0.14 J(d)	0.31 J(d)	0.13 J	2.43	0.11 J(d)
Reference	2	2	12.70	191.91 B(d)	0.83 UB	14.39 B(d)	1.67 J(d)	3.54 J(d)	0.97 U	24.71 B(d)	1.20 J
Reference	3	2	14.22	29.28 B(d)	0.49 U	2.42 B	0.49 J(d)	0.46	0.32 J	5.58 B	0.27 J
Reference	4	1	13.74	26.38 B(d)	0.48 U	0.49 U	0.42 J(d)	0.38	0.24 J	5.45 B	0.29 J
Reference	5	3	14.50	5.41	3.33 J(d)	2.08 J(d)	1.66 U	0.63 U	1.06 U	1.33	0.31 J
Reference			14.72	40.26 B(d)	0.91 UB	3.41 B(d)	0.59 J(d)	0.88	1.05 U	5.45 B	0.31 J
<i>N. virens</i> Background Rep 1	1	3	14.39	186.38 B	0.97 UB	13.91 B	1.57 J	3.72	1.13 U	23.28 B	1.17
<i>N. virens</i> Background Rep 2	2	3	14.39	408.16 B	0.95 UB	32.10 B	3.32	7.35	1.11 U	53.77 B	2.06
<i>N. virens</i> Background Rep 3	3	3	14.39	155.83 B	0.90 UB	11.67 B	1.41 J	3.04	1.04 U	20.21 B	1.11
Control COMP											
<i>N. virens</i> Control	1	2	13.9	7.06	0.46	0.53	0.09 J(d)	0.30 J	0.15 J	2.29	0.45 U
<i>N. virens</i> Control	2	3	14.32	5.68 B	0.53 U	0.54 U	0.37 J(d)	0.18 J	0.18 J	2.04 B	0.30 J
<i>N. virens</i> Control	3	1	14.82	219.79 B(d)	0.91 UB	16.42 B(d)	2.03 J(d)	4.54 J(d)	1.05 U	28.51 B(d)	1.09
<i>N. virens</i> Control	4	1	13.20	4.90	2.04 J(d)	1.75 J(d)	1.48 U	0.56 U	0.94 U	1.50	0.80 U
<i>N. virens</i> Control	5	1	14.60	3.56	2.65 J(d)	1.61 J(d)	1.47 U	0.56 U	1.32 J(d)	0.98 J	0.80 U
<i>N. virens</i> Control Rep 1	1	1	14.16	6.74	2.77 J(d)	1.90 J(d)	2.48 U	0.94 U	1.58 U	2.07	1.35 U
<i>N. virens</i> Control Rep 2	5	1	14.16	7.13	4.93 J(d)	3.31 J(d)	2.42 U	0.92 U	1.54 U	1.82	1.32 U
<i>N. virens</i> Control Rep 3	5	1	14.16	4.57	3.14 J(d)	1.83 J(d)	1.89 U	0.72 U	1.14 J(d)	1.39	0.42 J

(a) DL Detection limit.

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

(c) B Procedural blank amount was detected at $\geq 1/5$ of the target detection limit.

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

(e) U Analyte was not present above the associated value.

TABLE M.3. High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis (elution order, Fluoranthene - Benzo[b]fluoranthene), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> HPAHs (Ug/kg wet weight)				
				Fluor-anthene	Pyrene	Benzo[a] anthra-cene	Chrysene	Benzo[b] fluor-anthene
Target DL (a)				30	30	30	30	30
Achieved High DL				2.35	1.69	2.15	2.45	2.42
Achieved Low DL				0.77	0.55	0.70	0.80	0.79
PC-1 COMP			15.18	0.65 J ^(b)	0.42 J	0.14 J	0.38 J	0.19 J
PC-1	1	2	14.15	1.34	1.05	0.34 J	0.57 J	0.52 J
PC-1	2	1	14.03	0.92	0.68	0.22 J	0.43 J	0.13 J
PC-1	3	2	12.32	1.07 J	0.76 J	0.36 J	0.67 J	0.78 J ^(c)
PC-1	4	1	14.15	1.22	0.98	0.81 U ^(d)	0.93 U	0.92 U
PC-1	5	2	14.17	1.06	0.86	0.21 J	0.81 J	0.36 J
PC-1A COMP			14.84	0.63 J	0.38 J	0.11 J	0.36 J	0.18 J
PC-1A	1	2	12.85	1.03	0.73	0.26 J	0.47 J	0.43 J
PC-1A	2	1	14.13	0.87 U	0.71	0.23 J	0.54 J	0.43 J
PC-1A	3	2	13.54	1.05	0.65	0.23 J	0.66 J	0.49 J
PC-1A	4	2	14.00	0.86 J	0.52 J	0.21 J	0.38 J	0.30 J
PC-1A	5	1	13.39	0.82 U	0.49 J	0.15 J	0.29 J	0.85 U
PC-2 COMP			15.38	0.64 J	0.34 J	0.12 J	0.33 J	0.19 J
PC-2	1	3	14.28	2.24 ^(c)	1.64 ^(c)	0.70 J ^(c)	0.97 J	1.16 J ^(c)
PC-2	2	2	13.47	1.37	0.96	0.31 J	0.56 J	0.47 J
PC-2	3	1	14.07	0.97	0.75	0.18 J	0.31 J	0.11 J
PC-2	4	1	13.98	0.86 U	0.57 J	0.21 J	0.49 J	0.89 U
PC-2	5	1	14.45	1.41 U	0.84 J	0.31 J	0.61 J	0.48 J
PC-4 COMP			15.17	0.94 J	0.49 J	0.22 J	0.66 J	0.34 J
PC-4	1	1	14.33	0.98 U	0.70 U	0.89 U	1.02 U	1.01 U
PC-4 Rep 1	2	2	14.75	1.15 J	0.68 J	0.43 J	0.89 J	0.62 J
PC-4 Rep 2	2	2	14.75	1.63 J	1.01 J	0.44 J	1.14 J	0.82 J
PC-4 Rep 3	2	2	14.75	1.14 J	0.70 J	0.38 J	0.80 J	0.50 J
PC-4	3	1	14.21	0.93 U	0.52 J	0.85 U	0.97 U	0.96 U
PC-4 Rep 1	4	2	14.22	1.12 J	0.98 J	0.41 J	0.69 J	0.65 J
PC-4 Rep 2	4	2	14.22	1.32 J	0.77 J ^(c)	0.47 J	0.85 J	0.79 J
PC-4 Rep 3	4	2	14.22	2.15	1.47 ^(c)	0.58 J	1.15 J	1.04 J ^(c)
PC-4	5	3	13.57	4.68	4.33 ^(c)	1.17 J ^(c)	2.03	1.67 ^(c)
PC-5 COMP			14.58	1.01	0.90	0.16 J	0.64 J	0.45 J
PC-5	1	2	13.62	1.61	1.37	0.43 J	0.83 J	0.90
PC-5	2	2	13.47	1.62	2.05	0.43 J	1.31 J	0.97 J
PC-5	3	1	13.83	1.83	1.92 ^(c)	0.43 J ^(c)	1.14	0.79 J ^(c)
PC-5	4	3	14.84	4.41 ^(c)	4.17 ^(c)	0.99 J ^(c)	2.13	1.71 ^(c)
PC-5	5	1	14.17	1.03 U	1.11	0.27 J	0.64 J	0.56 J
Reference COMP			15.49	0.68 J ^(c)	0.35 J ^(c)	0.07 J	0.36 J ^(c)	0.23 J ^(c)
Reference	1	3	12.70	3.03 ^(c)	2.75 ^(c)	0.76 J ^(c)	1.29 J ^(c)	1.12 J ^(c)
Reference	2	2	14.22	1.14	0.71	0.27 J ^(c)	0.59 J	0.47 J
Reference	3	2	13.74	1.23	0.85	0.27 J ^(c)	0.49 J	0.35 J
Reference	4	1	14.50	1.33 J	0.82 J ^(c)	0.41 J ^(c)	0.70 J	1.62 U
Reference	5	3	14.72	1.24 J	1.05 J ^(c)	0.39 J ^(c)	0.51 J	0.50 J
<i>N. virens</i> Background Rep 1	1	3	14.39	2.89	2.62	0.75 J	1.39 J	1.08 J
<i>N. virens</i> Background Rep 2	2	3	14.39	6.49	5.88	1.51	2.61	1.95
<i>N. virens</i> Background Rep 3	3	3	14.39	2.60	2.40	0.79 J	1.45 J	1.28 J

TABLE M.3.

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> HPAHs ($\mu\text{g/kg}$ wet weight)				
				Fluor- anthene	Pyrene	Benzo[a] anthra- cene	Chrysene	Benzo[b] fluor- anthene
Control COMP			13.90	0.84	0.57	0.14 J	0.54 J	0.24 J
<i>N. virens</i> Control	1	2	14.32	1.08	0.80	0.20 J	0.59 J	0.36 J
<i>N. virens</i> Control	2	3	14.82	3.85 ^(c)	3.53 ^(c)	0.97 J ^(c)	1.81 ^(c)	1.36 J ^(c)
<i>N. virens</i> Control	3	1	13.20	1.18 J	0.90 J	1.27 U	1.46 U	1.44 U
<i>N. virens</i> Control	4	1	14.60	1.38 U	0.87 J	1.26 U	1.45 U	1.43 U
<i>N. virens</i> Control Rep 1	5	1	14.16	2.16 J	2.69 ^(c)	1.00 J ^(c)	1.42 J	0.99 J ^(c)
<i>N. virens</i> Control Rep 2	5	1	14.16	1.69 J	1.44 J	0.65 J ^(c)	0.92 J	0.74 J ^(c)
<i>N. virens</i> Control Rep 3	5	1	14.16	1.40 J	1.20 J	0.53 J ^(c)	0.85 J	0.63 J

(a) DL Detection limit.

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

(c) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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

TABLE M.4. High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis (elution order, Benzo[k]fluoranthene - Benzo[g,h,i]perylene), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> HPAHs (µg/kg wet weight)				
				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)				30	30	30	30	30
Achieved High DL				1.13	0.90	1.97	1.78	1.66
Achieved Low DL				0.37	0.30	0.65	0.58	0.54
PC-1 COMP			15.18	0.18 J ^(b)	0.07 J	0.85 U ^(c)	0.59 U	0.25 J
PC-1	1	2	14.15	0.13 J	0.09 J	0.28 J	0.09 J	0.38 J
PC-1	2	1	14.03	0.20 J	0.31 U	0.69 U	0.62 U	0.58 U
PC-1	3	2	12.32	0.30 J	0.24 J ^(d)	0.59 J	0.16 J	0.86 ^(d)
PC-1	4	1	14.15	0.43 U	0.34 U	0.75 U	0.68 U	0.63 U
PC-1	5	2	14.17	0.11 J	0.34 U	0.21 J	0.67 U	0.31 J
PC-1A COMP			14.84	0.13 J	0.07 J	0.66 U	0.59 U	0.39 J
PC-1A	1	2	12.85	0.12 J	0.30 U	0.24 J	0.07 J	0.38 J
PC-1A	2	1	14.13	0.42 U	0.33 U	0.73 U	0.66 U	0.61 U
PC-1A	3	2	13.54	0.13 J	0.13 J	0.32 J	0.09 J	0.48 J
PC-1A	4	2	14.00	0.11 J	0.38 U	0.18 J	0.06 J	0.29 J
PC-1A	5	1	13.39	0.40 U	0.32 U	0.69 U	0.62 U	0.58 U
PC-2 COMP			15.38	0.11 J	0.30 U	0.65 U	0.59 U	0.24 J
PC-2	1	3	14.28	0.28 J	0.82 U	0.67 J	0.19 J	0.77 J ^(d)
PC-2	2	2	13.47	0.22 J	0.12 J	0.32 J	0.08 J	0.47 J
PC-2	3	1	14.07	0.24 J	0.36 U	0.80 U	0.72 U	0.67 U
PC-2	4	1	13.98	0.41 U	0.33 U	0.72 U	0.65 U	0.61 U
PC-2	5	1	14.45	0.68 U	0.54 U	1.19 U	1.07 U	1.00 U
PC-4 COMP			15.17	0.19 J	0.59 U	1.30 U	1.17 U	0.34 J
PC-4	1	1	14.33	0.47 U	0.38 U	0.82 U	0.74 U	0.69 U
PC-4 Rep 1	2	2	14.75	0.22 J	0.16 J	0.55 J	0.14 J	0.88 J
PC-4 Rep 2	2	2	14.75	0.27 J	0.17 J	0.60 J	0.23 J	1.04 J ^(d)
PC-4 Rep 3	2	2	14.75	0.26 J	0.14 J	0.36 J	0.16 J	0.53 J
PC-4	3	1	14.21	0.45 U	0.36 U	0.78 U	0.71 U	0.66 U
PC-4 Rep 1	4	2	14.22	0.21 J	0.18 J	0.55 J	0.17 J	1.08 J ^(d)
PC-4 Rep 2	4	2	14.22	0.21 J	0.89 U	0.61 J	0.16 J	0.83 J
PC-4 Rep 3	4	2	14.22	0.27 J	0.24 J	0.65 J	0.21 J	0.94 J
PC-4	5	3	13.57	0.53 J	0.68	0.79 J	0.18 J	0.88 J
PC-5 COMP			14.58	0.44	0.17 J	0.20 J	0.58 U	0.46 J
PC-5	1	2	13.62	0.36 J	0.31 J	0.31 J	0.11 J	0.40 J
PC-5	2	2	13.47	0.50 J	0.60 U	0.24 J	0.13 J	0.45 J
PC-5	3	1	13.83	0.74	0.32 U ^(d)	0.71 U ^(d)	0.64 U	0.60 U
PC-5	4	3	14.84	0.70 J	0.76 ^(d)	0.64 J ^(d)	0.20 J	0.77 J
PC-5	5	1	14.17	0.38 J	0.30 J	0.86 U	0.78 U	0.13 J
Reference COMP			15.49	0.12 J	0.05 J	0.66 U	0.59 U	0.29 J
Reference	1	3	12.70	0.24 J	0.55 U	0.47 J	0.15 J	0.62 J
Reference	2	2	14.22	0.10 J	0.32 U	0.33 J	0.09 J	0.48 J
Reference	3	2	13.74	0.13 J	0.08 J	0.20 J	0.07 J	0.31 J
Reference	4	1	14.50	0.76 U	0.60 U	1.32 U	1.19 U	1.11 U
Reference	5	3	14.72	0.16 J	0.60 U	0.29 J	1.18 U	0.44 J

TABLE M.4. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> HPAHs ($\mu\text{g}/\text{kg}$ wet weight)				
				Benzo[k] fluor- anthene	Benzo[a] pyrene	Indeno [1,2,3- c,d] pyrene	Dibenzo [a,h] anthra- cene	Benzo [g,h,i] perylene
<i>N. virens</i> Background Rep 1	1	3	14.39	0.38 J	0.64 U	0.58 J	0.15 J	0.74 J
<i>N. virens</i> Background Rep 2	2	3	14.39	0.89	0.63 U	1.10 J	0.41 J	1.21
<i>N. virens</i> Background Rep 3	3	3	14.39	0.45 J	0.59 U	0.79 J	0.22 J	1.06 J
Control COMP			13.90	0.23 J	0.30 U	0.65 U	0.59 U	0.25 J
<i>N. virens</i> Control	1	2	14.32	0.13 J	0.35 U	0.17 J	0.68 U	0.31 J
<i>N. virens</i> Control	2	3	14.82	0.39 J	0.42 J	0.61 J	0.16 J	0.75 J ^(d)
<i>N. virens</i> Control	3	1	13.20	0.67 U	0.53 U	1.17 U	1.06 U	0.98 U
<i>N. virens</i> Control	4	1	14.60	0.67 U	0.53 U	1.16 U	1.05 U	0.98 U
<i>N. virens</i> Control Rep 1	5	1	14.16	0.82 J	0.90 U	1.97 U	1.77 U	1.65 U
<i>N. virens</i> Control Rep 2	5	1	14.16	1.10 U	0.88 U	1.92 U	1.73 U	1.61 U
<i>N. virens</i> Control Rep 3	5	1	14.16	0.44 J	0.69 U	1.50 U	1.35 U	1.26 U

(a) DL Detection limit.

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

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

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

TABLE M.5. Total Polynuclear Aromatic Hydrocarbon (PAH) Analysis,
Dry Weight, in Tissue of *N. virens*, Panama City Harbor
Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
PC-1 COMP			57	15	72
PC-1	1	2	294	34	328
PC-1	2	1	49	18	67
PC-1	3	2	137	47	184
PC-1	4	1	114	16	130
PC-1	5	2	88	28	116
PC-1A COMP			44	15	59
PC-1A	1	2	241	29	270
PC-1A	2	1	61	14	75
PC-1A	3	2	115	31	146
PC-1A	4	2	72	21	93
PC-1A	5	1	43	7	50
PC-2 COMP			60	13	73
PC-2	1	3	715	60	775
PC-2	2	2	236	36	272
PC-2	3	1	55	18	73
PC-2	4	1	46	9	55
PC-2	5	1	82	15	97
PC-4 COMP			126	21	147
PC-4	1	1	127	0	127
PC-4 Rep 1	2	2	145	39	184
PC-4 Rep 2	2	2	335	50	385
PC-4 Rep 3	2	2	141	34	175
PC-4	3	1	57	4	61
PC-4 Rep 1	4	2	105	42	147
PC-4 Rep 2	4	2	204	42	246
PC-4 Rep 3	4	2	607	61	668
PC-4	5	3	3412	125	3537
PC-5 COMP			79	30	109
PC-5	1	2	358	49	407
PC-5	2	2	95	57	152
PC-5	3	1	68	50	118
PC-5	4	3	2073	111	2184
PC-5	5	1	51	24	75
Reference COMP			73	14	87
Reference	1	3	1869	82	1951
Reference	2	2	273	29	302
Reference	3	2	241	29	270
Reference	4	1	86	22	108
Reference	5	3	346	31	377
<i>N. virens</i> Background Rep 1	1	3	1598	73	1671
<i>N. virens</i> Background Rep 2	2	3	3519	153	3672
<i>N. virens</i> Background Rep 3	3	3	1342	77	1419

TABLE M.5. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Total Low Molecular Weight PAH</u>	<u>Total High Molecular Weight PAH</u>	<u>Total PAH</u>
Control COMP			78	20	98
<i>N. virens</i> Control	1	2	81	25	86
<i>N. virens</i> Control	2	3	1837	93	1930
<i>N. virens</i> Control	3	1	77	16	93
<i>N. virens</i> Control	4	1	69	6	75
<i>N. virens</i> Control Rep 1	5	1	95	64	159
<i>N. virens</i> Control Rep 2	5	1	121	38	159
<i>N. virens</i> Control Rep 3	5	1	88	36	124

TABLE M.6. Low Molecular Weight Polynuclear Aromatic Hydrocarbons (LPAH) Analysis, Dry Weight, in Tissue of *N. virens* Panama City Harbor Project

		N. virens LPAHs ($\mu\text{g/kg}$ dry weight)									
Sediment Treatment	Replicate	Batch	Percent Dry Weight	Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
PC-1 COMP											
	1	2	15.18	35.72	2.66 J(a)	3.20	0.62 J(c)	1.56 J	1.03 J	11.97	0.48 J(c)
	2	1	14.15	220.15 B(b)(c)	4.31 U(d)	19.15 (c)	3.32 J(c)	3.25	5.02 U	44.86 B	2.83 J(c)
	3	2	14.03	18.52	9.69 (c)	5.91	2.42 J(c)	2.35 U	3.92 U	9.19	3.42 J(c)
	4	1	12.32	99.21 B	5.35 U	5.52 U	1.70 J	2.03 J	1.62 J	30.66 B	1.78 J(c)
PC-1	4	1	14.15	33.71	26.15 (c)	14.13 (c)	6.64 U	2.54 U	23.60 (c)	11.45	4.95 J(c)
	5	2	14.17	58.78 B	3.67 U	3.74 U	3.53 J(c)	1.98 J	1.76 J	20.25 B	2.19 J(c)
PC-1A COMP											
	1	2	14.84	24.36	3.01 J	3.09 J	0.60 J(c)	1.48 J	0.89 J	9.57	0.51 J(c)
	2	1	12.85	182.55 B(c)	3.58 U	14.08 (c)	2.33 J(c)	2.10 J	1.56 J	35.87 B	2.33 J(c)
	3	2	14.13	20.16	13.94 (c)	7.64	1.70 J(c)	1.77 J	6.23 (c)	7.57	1.84 J(c)
	4	2	13.54	77.91 B	3.54 U	3.62 U	3.03 J(c)	1.99 J	1.62 J	27.10 B	3.03 J(c)
PC-1A	4	2	14.00	47.47 B	4.14 U	4.28 U	2.71 J(c)	2.00 J	1.56 J	16.70 B	1.71 J(c)
	5	1	13.39	15.15	8.88	4.93	1.19 J	2.84	4.18 (c)	5.00	0.52 J
PC-2 COMP											
	1	3	15.38	37.84	2.90 J	3.58	0.58 J(c)	1.82 J	0.88 J	12.19	2.90 U
	2	3	14.28	562.39 B(c)	8.75 U	41.81 B(c)	3.43 J(c)	5.04 J	2.87 J	96.64 B(c)	2.38 J
	3	2	13.47	189.01 B(c)	4.16 U	4.31 U	2.23 J(c)	3.34	1.93 J	37.79 B	1.86 J
	4	1	14.07	20.47	10.73 (c)	4.05 J	7.11 U	3.13	3.70 J(c)	7.53	4.90
PC-2	4	1	13.98	18.45	10.23 (c)	6.08	6.51 U	2.50 U	5.15 (c)	6.51	3.58 U
	5	1	14.45	28.78	16.26 (c)	9.89	1.87 J(c)	3.67 J	9.13 (c)	9.13	2.77 J
PC-4 COMP											
	1	1	15.17	85.32	5.28 J	4.39 J	10.81 U	1.92 J	1.67 J	27.08	5.88 U
	2	1	14.33	127.22	3.98 U	4.12 U	7.26 U	2.72 U	4.61 U	5.09 U	3.91 U
	2	2	14.75	100.65 B	9.29 U	5.56 J	3.32 J	2.17 J	2.03 J	28.60 B	2.37 J
	3	2	14.75	253.49 B	9.29 U	16.94 (c)	3.80 J	3.80 J	2.30 J	51.65 B	3.25 J
PC-4 Rep 3	2	2	14.75	98.62 B	7.12 U	5.22 J	3.39 J	2.17 J	1.42 J	27.79 B	2.37 J
	3	1	14.21	21.24	11.89	6.68	6.96 U	2.74	5.49 (c)	7.17	1.90 J
PC-4	4	2	14.22	73.76 B	9.49 U	9.77 U	3.23 J	2.25 J	2.18 J	20.67 B	2.53 J
	4	2	14.22	152.93 B(c)	9.56 U	9.84 U	3.02 J	1.97 J	2.32 J	41.49 B(c)	2.25 J
PC-4 Rep 2	4	2	14.22	508.09 B(c)	7.88 U	8.09 U	4.71 J	5.41 U	9.07 U	90.85 B(c)	3.52 J
	5	3	13.57	2373.21 B(c)	496.10 B(c)	176.88 B(c)	16.87	46.12 (c)	7.74 U	291.44 B(c)	11.71
PC-5 COMP											
	1	2	14.58	50.74	3.43	3.28	0.69 J(c)	1.65 J	1.20 J	17.90	3.04 U
	2	2	13.62	272.87 B(c)	3.60 U	21.06 (c)	3.89 J(c)	4.11	4.11 U	53.20 B	3.16 J
	3	2	13.47	66.19 B	6.75 U	6.97 U	3.64 J(c)	4.67 U	1.63 J	19.66 B	3.41 J
	4	3	13.83	22.99 (c)	18.08 (c)	9.40	2.46 J(c)	2.46 U	6.22 (c)	7.09	1.37 J
PC-5	4	3	14.84	1540.55 B(c)	174.74 B(c)	114.79 B(c)	14.15 (c)	28.49 (c)	7.07 U	190.77 B(c)	9.23
	5	1	14.17	16.86	10.02	7.41	2.40 J(c)	2.19 J	4.73 J(c)	5.71	1.69 J

TABLE M.6. (contd)

Sediment Treatment	Percent Dry Weight			<i>N. viridis</i> LPAHs ($\mu\text{g/kg}$ dry weight)							
	Replicate	Batch	Weight	Naphthalene	2-methyl-naphthalene	1-methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Reference COMP											
Reference	1	3	15.49	46.11	3.25	3.44	0.92 J	2.01 J	0.85 J	15.72	0.68 J
Reference	2	2	12.70	1510.98 B (c)	6.53 UB	113.30 B (c)	13.15 (c)	27.87 (c)	7.64 U	194.55 B (c)	9.45 (c)
Reference	3	2	14.22	205.85 B (c)	3.44 U	17.01 (c)	3.44 J (c)	3.23	2.25 J	39.23 B	1.90 J
Reference	4	1	13.74	191.94 B (c)	3.49 U	3.57 U	3.06 J (c)	2.76	1.75 J	39.65 B	2.11 J
Reference	5	3	14.50	37.29	22.95 (c)	14.34 (c)	11.44 U	4.34 U	7.31 U	9.17	2.14 J
			14.72	273.49 B (c)	6.18 UB	23.16 B (c)	4.01 J (c)	5.98	7.13 U	37.02 B	2.11 J
<i>N. viridis</i> Background Rep 1	1	3	14.39	1294.40 B	6.74 UB	96.60 B	10.90 J	25.84	7.85 U	161.68 B	8.13
<i>N. viridis</i> Background Rep 2	2	3	14.39	2834.64 B	6.60 UB	222.93 B	23.06	51.05	7.71 U	373.43 B	14.31
<i>N. viridis</i> Background Rep 3	3	3	14.39	1082.23 B	6.25 UB	81.05 B	9.79 J	21.11	7.22 U	140.36 B	7.71
Control COMP											
<i>N. viridis</i> Control	1	2	13.90	50.77	3.30	3.82	0.63 J	2.15 J	1.06 J	16.45	3.22 U
			14.32	39.66 B	3.70 U	3.77 U	2.58 J (c)	1.26 J	1.26 J	14.24 B	2.09 J
<i>N. viridis</i> Control	2	3	14.82	1482.36 B (c)	6.14 UB	110.74 B (c)	13.69 (c)	30.62 (c)	7.08 U	192.28 B (c)	7.35
<i>N. viridis</i> Control	3	1	13.20	37.11	15.45 (c)	13.25 (c)	11.21 U	4.24 U	7.12 U	11.36	6.06 U
<i>N. viridis</i> Control	4	1	14.60	24.37	18.14 (c)	11.02 (c)	10.06 U	3.83 U	9.04 (c)	6.71 J	5.48 U
<i>N. viridis</i> Control Rep 1	5	1	14.16	47.60	19.56 (c)	13.42 (c)	17.51 U	6.64 U	11.16 U	14.62	9.53 U
<i>N. viridis</i> Control Rep 2	5	1	14.16	50.35	34.81 (c)	23.37 (c)	17.09 U	6.50 U	10.87 U	12.85	9.32 U
<i>N. viridis</i> Control Rep 3	5	1	14.16	32.27	22.17 (c)	12.92 (c)	13.35 U	5.08 U	8.05 J (c)	9.82	2.97 J

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

(b) B Procedural blank amount was detected at $\geq 1/5$ of the target detection limit.

(c) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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

TABLE M.7. High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis (elution order, Fluoranthene - Benzo[b]fluoranthene), Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> HPAHs ($\mu\text{g/kg}$ dry weight)				
				Fluoranthene	Pyrene	Benzo[a]anthracene	Chrysene	Benzo[b]fluoranthene
PC-1 COMP			15.18	4.29 J ^(a)	2.76 J	0.94 J	2.48 J	1.25 J
PC-1	1	2	14.15	9.47	7.42	2.40 J	4.03 J	3.67 J
PC-1	2	1	14.03	6.55	4.84	1.57 J	3.06 J	0.93 J
PC-1	3	2	12.32	8.68 J	6.16 J	2.92 J	5.43 J	6.33 J ^(b)
PC-1	4	1	14.15	8.62	6.93	5.72 U ^(c)	6.57 U	6.50 U
PC-1	5	2	14.17	7.48	6.07	1.48 J	5.72 J	2.54 J
PC-1A COMP			14.84	4.21 J	2.56 J	0.73 J	2.42 J	1.21 J
PC-1A	1	2	12.85	8.01	5.68	2.02 J	3.66 J	3.35 J
PC-1A	2	1	14.13	6.16 U	5.02	1.63 J	3.82 J	3.04 J
PC-1A	3	2	13.54	7.75	4.80	1.70 J	4.87 J	3.62 J
PC-1A	4	2	14.00	6.14 J	3.71 J	1.50 J	2.71 J	2.14 J
PC-1A	5	1	13.39	6.12 U	3.66 J	1.12 J	2.16 J	6.34 U
PC-2 COMP			15.38	4.15 J	2.23 J	0.79 J	2.17 J	1.21 J
PC-2	1	3	14.28	15.69 J ^(b)	11.48 J ^(b)	4.90 J ^(b)	6.79 J	8.12 J ^(b)
PC-2	2	2	13.47	10.17	7.13	2.30 J	4.16 J	3.49 J
PC-2	3	1	14.07	6.89	5.33	1.28 J	2.20 J	0.78 J
PC-2	4	1	13.98	6.15 U	4.08 J	1.50 J	3.50 J	6.37 U
PC-2	5	1	14.45	9.75 U	5.81 J	2.14 J	4.22 J	3.32 J
PC-4 COMP			15.17	6.21 J	3.23 J	1.45 J	4.37 J	2.23 J
PC-4	1	1	14.33	6.84 U	4.88 U	6.21 U	7.12 U	7.05 U
PC-4 Rep 1	2	2	14.75	7.79 J	4.61 J	2.91 J	6.03 J	4.20 J
PC-4 Rep 2	2	2	14.75	11.05 J	6.85 J	2.98 J	7.73 J	5.56 J
PC-4 Rep 3	2	2	14.75	7.73 J	4.74 J	2.58 J	5.42 J	3.39 J
PC-4	3	1	14.21	6.54 U	3.66 J	5.98 U	6.82 U	6.75 U
PC-4 Rep 1	4	2	14.22	7.88 J	6.89 J	2.88 J	4.85 J	4.57 J
PC-4 Rep 2	4	2	14.22	9.28 J	5.41 J	3.30 J	5.98 J	5.55 J
PC-4 Rep 3	4	2	14.22	15.12	10.34 J ^(b)	4.08 J	8.09 J	7.31 J ^(b)
PC-4	5	3	13.57	34.48	31.90 J ^(b)	8.62 J ^(b)	14.96	12.30 J ^(b)
PC-5 COMP			14.58	6.92	6.20	1.11 J	4.37 J	3.12 J
PC-5	1	2	13.62	11.81	10.05	3.16 J	6.09 J	6.60
PC-5	2	2	13.47	12.02	15.21	3.19 J	9.72 J	7.20 J
PC-5	3	1	13.83	13.23	13.88	3.11 J	8.24	5.71 J
PC-5	4	3	14.84	29.71 J ^(b)	28.09 J ^(b)	6.67 J ^(b)	14.35	11.52 J ^(b)
PC-5	5	1	14.17	7.27 U	7.83	1.90 J	4.51 J	3.95 J
Reference COMP			15.49	4.41 J ^(b)	2.25 J ^(b)	0.46 J ^(b)	2.35 J ^(b)	1.47 J
Reference	1	3	12.70	23.86 J ^(b)	21.65 J ^(b)	5.98 J ^(b)	10.16 J ^(b)	8.82 J ^(b)
Reference	2	2	14.22	8.01	4.99	1.90 J ^(b)	4.15 J	3.30 J
Reference	3	2	13.74	8.95	6.18	1.96 J ^(b)	3.57 J	2.55 J
Reference	4	1	14.50	9.17 J	5.65 J ^(b)	2.83 J ^(b)	4.83 J	11.17 U
Reference	5	3	14.72	8.42 J	7.13 J ^(b)	2.65 J ^(b)	3.46 J	3.40 J
<i>N. virens</i> Background Rep 1	1	3	14.39	20.07	18.20	5.21 J	9.65 J	7.50 J
<i>N. virens</i> Background Rep 2	2	3	14.39	45.07	40.84	10.49	18.13	13.54
<i>N. virens</i> Background Rep 3	3	3	14.39	18.06	16.67	5.49 J	10.07 J	8.89 J

TABLE M.7. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> HPAHs ($\mu\text{g/kg}$ dry weight)				
				Fluor- anthene	Pyrene	Benzo[a] anthra- cene	Chrysene	Benzo[b] fluor- anthene
Control COMP			13.90	6.05	4.07	1.00 J	3.91 J	1.71 J
<i>N. virens</i> Control	1	2	14.32	7.54	5.59	1.40 J	4.12 J	2.51 J
<i>N. virens</i> Control	2	3	14.82	25.97 (b)	23.81 (b)	6.54 J(b)	12.21 (b)	9.17 J(b)
<i>N. virens</i> Control	3	1	13.20	8.94 J	6.82 J	9.62 U	11.06 U	10.91 U
<i>N. virens</i> Control	4	1	14.60	9.45 U	5.96 J	8.63 U	9.93 U	9.79 U
<i>N. virens</i> Control Rep 1	5	1	14.16	15.25 J	19.00 (b)	7.06 J(b)	10.03 J	6.99 J(b)
<i>N. virens</i> Control Rep 2	5	1	14.16	11.93 J	10.17 J	4.59 J(b)	6.50 J	5.23 J(b)
<i>N. virens</i> Control Rep 3	5	1	14.16	9.89 J	8.47 J	3.74 J(b)	6.00 J	4.45 J

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.
 (c) U Analyte was not present above the associated value.

TABLE M.8. High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis (elution order, Benzo[k]fluoranthene - Benzo[g,h,i]perylene), Dry Weight, in Tissue of *N. virens* Panama City Harbor Project

Sediment Treatment	Replicate	Batch	<i>N. virens</i> HPAHs ($\mu\text{g/kg}$ dry weight)					
			Percent Dry Weight	Benzo[k] fluoranthene	Benzo[a] pyrene	Indeno [1,2,3-c,d] pyrene	Dibenzo [a,h] anthracene	Benzo [g,h,i] perylene
PC-1 COMP			15.18	1.16 J ^(a)	0.44 J	4.31 U ^(b)	3.89 U	1.63 J
PC-1	1	2	14.15	0.92 J	0.64 J	1.98 J	0.64 J	2.68 J
PC-1	2	1	14.03	1.42 J	2.21 U	4.92 U	4.42 U	4.13 U
PC-1	3	2	12.32	2.43 J	1.95 J ^(c)	4.79 J	1.30 J	6.98 J ^(c)
PC-1	4	1	14.15	3.04 U	2.40 U	5.30 U	4.81 U	4.45 U
PC-1	5	2	14.17	0.78 J	2.40 U	1.48 J	4.73 U	2.19 J
PC-1A COMP			14.84	0.89 J	0.47 J	4.44 U	4.00 U	2.63 J
PC-1A	1	2	12.85	0.93 J	2.33 U	1.87 J	0.54 J	2.96 J
PC-1A	2	1	14.13	2.97 U	2.33 U	5.16 U	4.67 U	4.32 U
PC-1A	3	2	13.54	0.96 J	0.96 J	2.36 J	0.66 J	3.54 J
PC-1A	4	2	14.00	0.79 J	2.71 U	1.28 J	0.43 J	2.07 J
PC-1A	5	1	13.39	2.99 U	2.39 U	5.15 U	4.63 U	4.33 U
PC-2 COMP			15.38	0.69 J	1.93 U	4.22 U	3.81 U	1.54 J
PC-2	1	3	14.28	1.96 J	5.74 U	4.69 J	1.33 J	5.39 J ^(c)
PC-2	2	2	13.47	1.63 J	0.89 J	2.38 J	0.59 J	3.49 J
PC-2	3	1	14.07	1.71 J	2.56 U	5.69 U	5.12 U	4.76 U
PC-2	4	1	13.98	2.93 U	2.36 U	5.15 U	4.65 U	4.36 U
PC-2	5	1	14.45	4.70 U	3.74 U	8.23 U	7.40 U	6.92 U
PC-4 COMP			15.17	1.25 J	3.91 U	8.57 U	7.73 U	2.25 J
PC-4	1	1	14.33	3.28 U	2.65 U	5.72 U	5.16 U	4.82 U
PC-4 Rep 1	2	2	14.75	1.49 J	1.08 J	3.73 J	0.95 J	5.96 J
PC-4 Rep 2	2	2	14.75	1.83 J	1.15 J	4.07 J	1.56 J	7.05 J ^(c)
PC-4 Rep 3	2	2	14.75	1.76 J	0.95 J	2.44 J	1.08 J	3.59 J
PC-4	3	1	14.21	3.17 U	2.53 U	5.49 U	4.99 U	4.64 U
PC-4 Rep 1	4	2	14.22	1.48 J	1.27 J	3.87 J	1.20 J	7.59 J ^(c)
PC-4 Rep 2	4	2	14.22	1.48 J	6.26 U	4.29 J	1.13 J	5.84 J
PC-4 Rep 3	4	2	14.22	1.90 J	1.69 J	4.57 J	1.48 J	6.61 J
PC-4	5	3	13.57	3.90 J	5.01	5.82 J	1.33 J	6.48 J
PC-5 COMP			14.58	3.03	1.19 J	1.35 J	4.00 U	3.14 J
PC-5	1	2	13.62	2.64 J	2.27 J	2.27 J	0.81 J	2.93 J
PC-5	2	2	13.47	3.71 J	4.45 U	1.78 J	0.96 J	3.34 J
PC-5	3	1	13.83	5.35	2.31 U	5.13 U	4.63 U	4.34 U
PC-5	4	3	14.84	4.72 J	5.12 J ^(c)	4.31 J ^(c)	1.35 J	5.19 J
PC-5	5	1	14.17	2.68 J	2.12 J	6.07 U	5.50 U	0.92 J
Reference COMP			15.49	0.79 J	0.34 J	4.25 U	3.84 U	1.90 J
Reference	1	3	12.70	1.89 J	4.33 U	3.70 J	1.18 J	4.88 J
Reference	2	2	14.22	0.70 J	2.25 U	2.32 J	0.63 J	3.37 J
Reference	3	2	13.74	0.95 J	0.58 J	1.46 J	0.51 J	2.26 J
Reference	4	1	14.50	5.24 U	4.14 U	9.10 U	8.20 U	7.65 U
Reference	5	3	14.72	1.09 J	4.08 U	1.97 J	8.02 U	2.99 J
<i>N. virens</i> Background Rep 1	1	3	14.39	2.64 J	4.44 U	4.03 J	1.04 J	5.14 J
<i>N. virens</i> Background Rep 2	2	3	14.39	6.18	4.38 U	7.64 J	2.85 J	8.40
<i>N. virens</i> Background Rep 3	3	3	14.39	3.13 J	4.10 U	5.49 J	1.53 J	7.36 J

TABLE M.8. (contd)

Sediment Treatment	Replicate	Batch	<i>N. virens</i> HPAHs ($\mu\text{g/kg}$ dry weight)					
			Percent Dry Weight	Benzo[k] fluor- anthene	Benzo[a] pyrene	Indeno [1,2,3- c,d] pyrene	Dibenzo [a,h] anthra- cene	Benzo [g,j,i] perylene
Control COMP			13.90	1.07 J	2.15 U	4.70 U	4.24 U	1.83 J
<i>N. virens</i> Control	1	2	14.32	0.91 J	2.44 U	1.19 J	4.75 U	2.16 J
<i>N. virens</i> Control	2	3	14.82	2.63 J	2.83 J	4.11 J	1.08 J	5.06 J ^(c)
<i>N. virens</i> Control	3	1	13.20	5.07 U	4.01 U	8.86 U	8.03 U	7.42 U
<i>N. virens</i> Control	4	1	14.60	4.59 U	3.63 U	7.94 U	7.19 U	6.71 U
<i>N. virens</i> Control Rep 1	5	1	14.16	5.79 J	6.36 U	13.91 U	12.50 U	11.65 U
<i>N. virens</i> Control Rep 2	5	1	14.16	7.77 U	6.21 U	13.56 U	12.22 U	11.37 U
<i>N. virens</i> Control Rep 3	5	1	14.16	3.11 J	4.87 U	10.59 U	9.53 U	8.90 U

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

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

(c) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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TABLE M.9. (contd)

Sediment Treatment	<i>N. virens</i> LPAHs ($\mu\text{g}/\text{kg}$ wet weight)									
	Replicate	Batch	Naph- thalene	2-methyl- naph- thalene	1-methyl- naph- thalene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
Reference MS	4	1	5.41	3.33 (d)	2.08 (d)	1.66 U	0.63 U	1.06 U	1.33	0.31 J
Concentration Recovered	4	1	97.12	NA	NA	98.16	98.61	108.18	109.8	96.29
Amount Spiked			91.71	NA	NA	98.16	98.61	108.18	108.47	95.98
Percent Recovery			96.04	NS	NS	96.04	96.04	96.043	96.04	96.04
			95%	NA	NA	102%	103%	113%	113%	100%
<i>N. virens</i> Control	4	1	3.56	2.65 (d)	1.61 (d)	1.47 U	0.56 U	1.32 (d)	0.98 J	0.80 U
<i>N. virens</i> Control MS	4	1	102.91	NA	NA	98.45	104.78	113.48	115.57	96.04
Concentration Recovered			99.35	NA	NA	98.45	104.78	112.16	114.59	96.04
Amount Spiked			105.40	NS	NS	105.40	105.40	105.4	105.40	105.40
Percent Recovery			94%	NA	NA	93%	99%	106%	109%	91%
<u>Standard Reference Material</u>										
Certified Value			NC (h)	NC	NC	NC	NC	NC	5.6 ± 1.4	0.75 ± 0.21
NIST 1974 COMP										
NIST 1974		1	NA	NA	NA	NA	NA	NA	7.00	0.82 J
NIST 1974		2	NA	NA	NA	NA	NA	NA	6.10	1.40 (i)
NIST 1974		3	NA	NA	NA	NA	NA	NA	8.07 (i)	2.16 (i)
			NA	NA	NA	NA	NA	NA	37.23	4.14 (i)
<u>Analytical Replicates</u>										
PC-4 Rep 1	2	2	14.85 B	1.37 U	0.82 (d)	0.49 J	0.32 J	0.30 J	4.22 B	0.35 J
PC-4 Rep 2	2	2	37.40 B	1.37 U	2.50 (d)	0.56 J	0.56 J	0.34 J	7.62 B	0.48 J
PC-4 Rep 3	2	2	14.55 B	1.05 U	0.77 J	0.50 J	0.32 J	0.21 J	4.10 B	0.35 J
RSD			59% (j)	NA	72% (j)	7%	35% (j)	23%	38% (j)	19%
PC-4 Rep 1	4	2	10.49 B	1.35 U	1.39 U	0.46 J	0.32 J	0.31 J	2.94 B	0.36 J
PC-4 Rep 2	4	2	21.75 B	1.36 U	1.40 U	0.43 J	0.28 J	0.33 J	5.90 B	0.32 J
PC-4 Rep 3	4	2	72.26 B	1.12 U	1.15 U	0.67 J	0.77 U	1.29 U	12.92 B	0.50 J
RSD			94% (j)	NA	NA	25%	NA	NA	71% (j)	24%
<i>N. virens</i> Background Rep 1	1	3	186.38 B	0.97 UB	13.91 B	1.57 J	3.72	1.13 U	23.28 B	1.17
<i>N. virens</i> Background Rep 2	2	3	408.16 B	0.95 UB	32.10 B	3.32	7.35	1.11 U	53.77 B	2.06
<i>N. virens</i> Background Rep 3	3	3	155.83 B	0.90 UB	11.67 B	1.41 J	3.04	1.04 U	20.21 B	1.11
RSD			55% (j)	NA	58% (j)	50% (j)	49% (j)	NA	57% (j)	37% (j)

TABLE M.9. (contd)

Sediment Treatment	Replicate	Batch	Naph- thalene	<i>N. virens</i> LPAHs ($\mu\text{g}/\text{kg}$ wet weight)						
				2-methyl- naph- thalene	1-methyl- naph- thalene	Acenaph- thylene	Acenaph- thene	Fluorene	Phenan- threne	Anthra- cene
<i>N. virens</i> Control Rep 1	5	1	6.74	2.77 (d)	1.90 (d)	2.48 U	0.94 U	1.58 U	2.07	1.35 U
<i>N. virens</i> Control Rep 2	5	1	7.13	4.93 (d)	3.31 (d)	2.42 U	0.92 U	1.54 U	1.82	1.32 U
<i>N. virens</i> Control Rep 3	5	1	4.57	3.14 (d)	1.83 (d)	1.89 U	0.72 U	1.14 J(d)	1.39	0.42 J
RSD			22%	32%(j)	36%(j)	NA	NA	NA	20%	NA

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

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

(c) B Procedural blank amount was detected at $\geq 1/5$ of the target detection limit.

(d) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

(e) NA Not applicable.

(f) NS Not spiked.

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

(h) NC Not certified.

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

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

TABLE M.10. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis (elution order, Fluoranthene - Benzo[b]fluoranthene), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

			<i>N. virens</i> HPAHs (Ug/kg wet weight)				
Sediment Treatment	Replicate	Batch	Fluor-anthene	Pyrene	Benzo[a] anthra-cene	Chrysene	Benzo[b] fluor-anthene
<u>Method Blanks</u>							
COMP Blank			0.10 J ^(a)	0.16 J	0.76 U ^(b)	0.06 J	0.86 U
Blank		1	0.22 J	0.25 J	1.01 U	1.15 U	1.14 U
Blank		2	0.79 J	0.78 J	0.28 J	0.44 J	0.47 J
Blank		3	2.78 B ^(c)	2.68 B	0.77 J	1.20 J	1.04 J
<u>Matrix Spikes</u>							
PC-2	1	3	2.24 ^(d)	1.64 ^(d)	0.70 J ^(d)	0.97 J	1.16 J ^(d)
PC-2 MS	1	3	62.17	62.14	56.03	60.37	50.62
Concentration Recovered			59.93	62.50	55.33	59.40	49.46
Amount Spiked			47.63	47.63	47.63	47.63	47.63
Percent Recovery			126% ^(e)	127% ^(e)	116%	125% ^(e)	104%
PC-4 COMP			0.94 J	0.49 J	0.22 J	0.66 J	0.34 J
PC-4 COMP MS			100.50	99.64	103.40	100.23	103.00
Concentration Recovered			99.56	99.15	103.18	99.57	102.66
Amount Spiked			83.00	83.00	83.001	83.001	83.00
Percent Recovery			120%	119%	124% ^(e)	120%	124% ^(e)
PC-4 COMP			0.94 J	0.49 J	0.22 J	0.66 J	0.34 J
PC-4 COMP MSD			95.37	93.39	96.86	93.81	95.16
Concentration Recovered			94.43	92.90	96.64	93.15	94.82
Amount Spiked			78.62	78.62	78.62	78.62	78.62
Percent Recovery			120%	118%	123% ^(e)	118%	121% ^(e)
RPD			0%	1%	1%	2%	2%
I-Stat			0.00	0.00	0.00	0.01	0.01
PC-5	2	2	1.62	2.05	0.43 J	1.31 J	0.97 J
PC-5 MS	2	2	112.65	112.73	104.66	103.91	105.24
Concentration Recovered			111.03	110.68	104.23	102.60	104.27
Amount Spiked			95.05	95.05	95.05	95.05	95.05
Percent Recovery			117%	116%	110%	108%	110%
Reference	4	1	1.33 J	0.82 J	0.41 J ^(d)	0.70 J	1.62 U
Reference MS	4	1	110.22	106.57	102.47	104.87	97.50
Concentration Recovered			108.89	105.75	102.06	104.17	97.50
Amount Spiked			96.04	96.04	96.04	96.04	96.04
Percent Recovery			113%	110%	106%	108%	102%
<i>N. virens</i> Control	4	1	1.38 U	0.87 J	1.26 U	1.45 U	1.43 U
<i>N. virens</i> Control MS	4	1	112.81	108.46	105.89	109.31	105.86
Concentration Recovered			112.81	107.59	105.89	109.31	105.86
Amount Spiked			105.40	105.40	105.40	105.40	105.40
Percent Recovery			107%	102%	100%	104%	100%

TABLE M.10. (contd)

<i>N. virens</i> HPAHs (µg/kg wet weight)							
Sediment Treatment	Replicate	Batch	Fluor-anthene	Pyrene	Benzo[a] anthra-cene	Chrysene	Benzo[b] fluor-anthene
<u>Standard Reference Material</u>							
Certified Value			33.6 ±58	34.1 ±3.7	NC ^(f)	NC	6.5 ±1.2
NIST 1974 COMP			33.15	31.29	NA ^(g)	NA	6.05
NIST 1974	1		32.17	30.99	NA	NA	5.82
NIST 1974	2		34.64	34.77	NA	NA	9.71 ^(h)
NIST 1974	3		36.03	35.36	NA	NA	8.18
<u>Analytical Replicates</u>							
PC-4 Rep 1	2	2	1.15 J	0.68 J	0.43 J	0.89 J	0.62 J
PC-4 Rep 2	2	2	1.63 J	1.01 J	0.44 J	1.14 J	0.82 J
PC-4 Rep 3	2	2	1.14 J	0.70 J	0.38 J	0.80 J	0.50 J
RSD			21%	23%	8%	19%	25%
PC-4 Rep 1	4	2	1.12 J	0.98 J	0.41 J	0.69 J	0.65 J
PC-4 Rep 2	4	2	1.32 J	0.77 J ^(d)	0.47 J	0.85 J	0.79 J ^(d)
PC-4 Rep 3	4	2	2.15 ⁽ⁱ⁾	1.47 ⁽ⁱ⁾	0.58 J	1.15 J	1.04 J ^(d)
RSD			36% ⁽ⁱ⁾	33% ⁽ⁱ⁾	18%	26%	24%
<i>N. virens</i> Background Rep 1	1	3	2.89	2.62	0.75 J	1.39 J	1.08 J
<i>N. virens</i> Background Rep 2	2	3	6.49	5.88	1.51	2.61	1.95
<i>N. virens</i> Background Rep 3	3	3	2.60 ⁽ⁱ⁾	2.40 ⁽ⁱ⁾	0.79 J ⁽ⁱ⁾	1.45 J ⁽ⁱ⁾	1.28 J ⁽ⁱ⁾
RSD			54% ⁽ⁱ⁾	54% ⁽ⁱ⁾	42% ⁽ⁱ⁾	38% ⁽ⁱ⁾	32% ⁽ⁱ⁾
<i>N. virens</i> Control Rep 1	5	1	2.16 J	2.69 ^(d)	1.00 J ^(d)	1.42 J	0.99 J ^(d)
<i>N. virens</i> Control Rep 2	5	1	1.69 J	1.44 J	0.65 J ^(d)	0.92 J	0.74 J ^(d)
<i>N. virens</i> Control Rep 3	5	1	1.40 J	1.20 J ⁽ⁱ⁾	0.53 J ^(d)	0.85 J	0.63 J
RSD			22%	45% ⁽ⁱ⁾	34% ⁽ⁱ⁾	29%	23%

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) U Analyte was not present above the associated value.
 (c) B Procedural blank amount was detected at $\geq 1/5$ of the target detection limit.
 (d) Suspect value due to analytical laboratory contamination; tissue compsite value used in statistical analysis.
 (e) Recovery outside quality control range (40%-120%).
 (f) NC Not certified.
 (g) NA Not applicable.
 (h) Value exceeds SRM goal of $\leq 30\%$.
 (i) Value exceeds relative precision goal of $\leq 30\%$.

TABLE M.11. Quality Control Data for High Molecular Weight Polynuclear Aromatic Hydrocarbon (HPAH) Analysis (elution order, Benzo[k]fluoranthene - Benzo[g,h,i] perylene), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

			<i>N. virens</i> HPAHs (Ug/kg wet weight)				
Sediment Treatment	Replicate	Batch	Benzo[k] fluor- anthene	Benzo[a] pyrene	Indeno [1,2,3- c,d] pyrene	Dibenzo [a,h] anthra- cene	Benzo [g,h,i] perylene
<u>Method Blanks</u>							
COMP Blank			0.40 U ^(a)	0.32 U	0.70 U	0.63 U	0.59 U
Blank	1		0.53 U	0.42 U	0.93 U	0.84 U	0.78 U
Blank	2		0.16 J ^(b)	0.12 J	0.31 J	0.14 J	0.52 J
Blank	3		0.34 J	0.36 J	0.48 J	0.18 J	0.78 J
<u>Matrix Spikes</u>							
PC-2	1	3	0.28 J	0.82 U	0.67 J	0.19 J	0.77 J ^(c)
PC-2 MS	1	3	55.22	43.23	45.59	45.72	32.23
Concentration Recovered			54.94	43.23	44.92	45.53	31.46
Amount Spiked			47.63	47.63	47.63	47.63	47.63
Percent Recovery			115%	91%	94%	96%	66%
PC-4 COMP			0.19 J	0.59 U	1.30 U	1.17 U	0.34 J
PC-4 COMP MS			105.47	101.62	96.80	107.44	100.23
Concentration Recovered			105.28	101.62	96.80	107.44	99.89
Amount Spiked			83.00	83.00	83.00	83.00	83.00
Percent Recovery			127% ^(d)	122% ^(d)	117%	129% ^(d)	120%
PC-4 COMP			0.19 J	0.59 U	1.30 U	1.17 U	0.34 J
PC-4 COMP MSD			96.86	94.90	80.92	87.97	92.92
Concentration Recovered			96.67	94.90	80.92	87.97	92.58
Amount Spiked			78.62	78.62	78.616	78.62	78.62
Percent Recovery			123% ^(d)	121% ^(d)	103%	112%	118%
RPD			3%	1%	13%	14%	2%
I-Stat			0.02	0.00	0.06	0.07	0.01
PC-5	2	2	0.50 J	0.60 U	0.24 J	0.13 J	0.45 J
PC-5 MS	2	2	101.21	91.54	91.38	85.31	75.86
Concentration Recovered			100.71	91.54	91.14	85.18	75.41
Amount Spiked			95.05	95.05	95.051	95.05	95.05
Percent Recovery			106%	96%	96%	90%	79%
Reference	4	1	0.76 U	0.60 U	1.32 U	1.19 U	1.11 U
Reference MS	4	1	104.33	92.76	96.79	101.27	76.80
Concentration Recovered			104.33	92.76	96.79	101.27	76.80
Amount Spiked			96.04	96.04	96.043	96.04	96.04
Percent Recovery			109%	97%	101%	105%	80%
<i>N. virens</i> Control	4	1	0.67 U	0.53 U	1.16 U	1.05 U	0.98 U
<i>N. virens</i> Control MS	4	1	103.29	92.69	99.25	102.37	79.4
Concentration Recovered			103.29	92.69	99.25	102.37	79.40
Amount Spiked			105.40	105.40	105.40	105.40	105.40
Percent Recovery			98%	88%	94%	97%	75%

TABLE M.11. (contd)

			<i>N. virens</i> HPAHs (µg/kg wet weight)				
Sediment Treatment	Replicate	Batch	Benzo[k] fluor- anthene	Benzo[a] pyrene	Indeno [1,2,3- c,d] pyrene	Dibenzo [a,h] anthra- cene	Benzo [g,h,i] perylene
<u>Standard Reference Material</u>							
Certified Value			NC ^(e)	2.29 ±0.47	1.8 ±.33	NC	2.47 ±.28
NIST 1974 COMP			NA ^(f)	1.61	1.75	NA	3.17
NIST 1974	1		NA	2.30	1.76	NA	5.49 ^(g)
NIST 1974	2		NA	2.70	2.73 ^(g)	NA	7.04 ^(g)
NIST 1974	3		NA	2.35	2.08	NA	4.29 ^(g)
<u>Analytical Replicates</u>							
PC-4 Rep 1	2	2	0.22 J	0.16 J	0.55 J	0.14 J	0.88 J
PC-4 Rep 2	2	2	0.27 J	0.17 J	0.60 J	0.23 J	1.04 J ^(c)
PC-4 Rep 3	2	2	0.26 J	0.14 J	0.38 J	0.16 J	0.53 J
RSD			11%	10%	25%	27%	32% ^(h)
PC-4 Rep 1	4	2	0.21 J	0.18 J	0.55 J	0.17 J	1.08 J ^(c)
PC-4 Rep 2	4	2	0.21 J	0.89 U	0.61 J	0.16 J	0.83 J
PC-4 Rep 3	4	2	0.27 J	0.24 J	0.65 J	0.21 J	0.94 J
RSD			15%	NA	8%	15%	13%
<i>N. virens</i> Background Rep 1	1	3	0.38 J	0.64 U	0.58 J	0.15 J	0.74 J
<i>N. virens</i> Background Rep 2	2	3	0.89	0.63 U	1.10 J	0.41 J	1.21
<i>N. virens</i> Background Rep 3	3	3	0.45 J	0.59 U	0.79 J	0.22 J	1.06 J
RSD			48% ^(h)	NA	32% ^(h)	52% ^(h)	24%
<i>N. virens</i> Control Rep 1	5	1	0.82 J	0.90 U	1.97 U	1.77 U	1.65 U
<i>N. virens</i> Control Rep 2	5	1	1.10 U	0.88 U	1.92 U	1.73 U	1.61 U
<i>N. virens</i> Control Rep 3	5	1	0.44 J	0.69 U	1.50 U	1.35 U	1.26 U
RSD			NA	NA	NA	NA	NA

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

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

(c) Suspect value due to analytical laboratory contamination; tissue composite value used in statistical analysis.

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

(e) NC Not certified.

(f) NA Not applicable.

(g) Value exceeds SRM goal of ≤30%.

(h) Value exceeds relative precision goal of ≤30%.

TABLE M.12. Phenol and Substituted Phenol Analysis, (phenol - 2-chlorophenol), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phenol and Substituted Phenols (Ug/kg wet weight)				
				Phenol	2,4-di-methyl phenol	2,4,6-tri-chloro-phenol	Para-chloro-meta-cresol	2-chloro-phenol
Target DL (a)				330	330	330	330	330
Achieved DL High				998.60	998.60	998.60	998.60	998.60
Achieved DL Low				331.96	331.96	331.96	331.96	331.96
PC-1	1	2	14.15	275.78 J ^(b)	88.12 J	93.34 J	108.49 J	37.91 J
PC-1	2	1	14.04	260.69 U ^(c)	260.69 U	260.69 U	260.69 U	260.69 U
PC-1	3	2	12.33	91.40 J	478.35 U	478.35 U	478.35 U	478.35 U
PC-1	4	1	14.15	284.08 U	284.08 U	284.08 U	284.08 U	284.08 U
PC-1	5	2	14.17	75.31 J	376.86 U	376.86 U	376.86 U	376.86 U
PC-1A	1	2	12.85	81.24 J	331.96 U	331.96 U	331.96 U	331.96 U
PC-1A	2	1	14.13	277.35 U	277.35 U	277.35 U	277.35 U	277.35 U
PC-1A	3	2	13.54	87.11 J	348.00 U	348.00 U	348.00 U	348.00 U
PC-1A	4	2	14.01	32.37 J	420.96 U	420.96 U	420.96 U	420.96 U
PC-1A	5	1	13.40	53.74 J	262.86 U	262.86 U	262.86 U	262.86 U
PC-2	1	3	14.28	84.58 J	910.66 U	910.66 U	910.66 U	910.66 U
PC-2	2	2	13.47	46.35 J	408.78 U	408.78 U	408.78 U	408.78 U
PC-2	3	1	14.07	13.61 J	302.13 U	302.13 U	302.13 U	302.13 U
PC-2	4	1	13.98	273.89 U	273.89 U	273.89 U	273.89 U	2.56 J
PC-2	5	1	14.46	450.72 U	450.72 U	450.72 U	450.72 U	3.81 J
PC-4	1	1	14.33	311.62 U	311.62 U	311.62 U	311.62 U	311.62 U
PC-4 Rep 1	2	2	14.75	110.62 J	995.42 U	995.42 U	995.42 U	995.42 U
PC-4 Rep 2	2	2	14.75	97.11 J	998.60 U	998.60 U	998.60 U	998.60 U
PC-4 Rep 3	2	2	14.75	62.83 J	760.80 U	760.80 U	760.80 U	760.80 U
PC-4	3	1	14.22	7.00 J	297.48 U	297.48 U	0.60 J	297.48 U
PC-4 Rep 1	4	2	14.22	60.73 J	980.68 U	980.68 U	980.68 U	980.68 U
PC-4 Rep 2	4	2	14.22	145.10 J	989.90 U	989.90 U	989.90 U	989.90 U
PC-4 Rep 3	4	2	14.22	98.55 J	0.86 J	812.22 U	812.22 U	812.22 U
PC-4	5	3	13.57	37.69 J	661.07 U	661.07 U	661.07 U	661.07 U
PC-5	1	2	13.63	171.45 J	355.08 U	8.16 J	355.08 U	355.08 U
PC-5	2	2	13.48	60.86 J	665.91 U	665.91 U	665.91 U	665.91 U
PC-5	3	1	13.83	39.43 J	269.07 U	269.07 U	269.07 U	269.07 U
PC-5	4	3	14.85	48.93 J	660.81 U	660.81 U	660.81 U	660.81 U
PC-5	5	1	14.17	71.35 J	6.50 J	327.43 U	327.43 U	327.43 U
Reference	1	3	12.70	28.95 J	607.28 U	607.28 U	607.28 U	607.28 U
Reference	2	2	14.22	358.38 U	358.38 U	358.38 U	358.38 U	358.38 U
Reference	3	2	13.74	71.89 J	347.05 U	347.05 U	347.05 U	347.05 U
Reference	4	1	14.51	499.63 U	499.63 U	499.63 U	499.63 U	499.63 U
Reference	5	3	14.72	61.75 J	661.55 U	661.55 U	661.55 U	661.55 U
<i>N. virens</i> Background Rep 1	1	3	14.40	292.49 J	707.36 U	2.61 J	707.36 U	707.36 U
<i>N. virens</i> Background Rep 2	2	3	14.40	236.40 J	694.64 U	694.64 U	694.64 U	694.64 U
<i>N. virens</i> Background Rep 3	3	3	14.40	235.13 J	656.38 U	656.38 U	656.38 U	656.38 U

TBALE M.12. (contd)

<u>Sediment</u> <u>Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Percent</u> <u>Dry Weight</u>	<u>Phenol and Substituted Phenols (µg/kg wet weight)</u>				
				<u>Phenol</u>	<u>2,4-di-</u> <u>methyl</u> <u>phenol</u>	<u>2,4,6-</u> <u>tri-</u> <u>chloro-</u> <u>phenol</u>	<u>Para-</u> <u>chloro-</u> <u>meta-</u> <u>cresol</u>	<u>2-chloro-</u> <u>phenol</u>
<i>N. virens</i> Control	1	2	14.32	65.29 J	383.94 U	383.94 U	383.94 U	383.94 U
<i>N. virens</i> Control	2	3	14.83	51.73 J	662.78 U	662.78 U	662.78 U	662.78 U
<i>N. virens</i> Control	3	1	13.20	173.90 J	444.15 U	444.15 U	2.15 J	444.15 U
<i>N. virens</i> Control	4	1	14.61	441.23 U	441.23 U	441.23 U	441.23 U	4.93 J
<i>N. virens</i> Control Rep 1	5	1	14.16	745.97 U	745.97 U	745.97 U	745.97 U	745.97 U
<i>N. virens</i> Control Rep 2	5	1	14.16	52.11 J	728.08 U	728.08 U	728.08 U	728.08 U
<i>N. virens</i> Control Rep 3	5	1	14.16	569.52 U	569.52 U	569.52 U	569.52 U	569.52 U

(a) DL Detection limit.

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

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

TABLE M.13 Phenol and Substituted Phenol Analysis, (2,4-dichlorophenol - Pentachlorophenol), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

				<i>N. virens</i>					
				Phenol and Substituted Phenols (µg/kg wet weight)					
Sediment Treatment	Replicate	Batch	Percent Dry Weight	2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
Target DL ^(a)				330	330	330	330	330	330
Achieved DL High				998.60	998.60	998.60	998.60	998.60	998.60
Achieved DL Low				331.96	331.96	331.96	331.96	331.96	331.96
PC-1	1	2	14.15	59.98 J ^(b)	19.47 J	445.10 U ^(c)	445.10 U	445.10 U	445.10 U
PC-1	2	1	14.04	260.69 U	260.69 U	260.69 U	260.69 U	260.69 U	260.69 U
PC-1	3	2	12.33	478.35 U	478.35 U	478.35 U	478.35 U	478.35 U	478.35 U
PC-1	4	1	14.15	284.06 U	284.06 U	284.06 U	284.06 U	284.06 U	284.06 U
PC-1	5	2	14.17	376.86 U	376.86 U	376.86 U	376.86 U	376.86 U	376.86 U
PC-1A	1	2	12.85	331.96 U	331.96 U	331.96 U	331.96 U	331.96 U	331.96 U
PC-1A	2	1	14.13	277.35 U	277.35 U	277.35 U	277.35 U	277.35 U	277.35 U
PC-1A	3	2	13.54	348.00 U	348.00 U	348.00 U	348.00 U	348.00 U	348.00 U
PC-1A	4	2	14.01	420.96 U	420.96 U	420.96 U	420.96 U	420.96 U	420.96 U
PC-1A	5	1	13.40	262.86 U	262.86 U	262.86 U	262.86 U	262.86 U	262.86 U
PC-2	1	3	14.28	910.66 U	910.66 U	910.66 U	910.66 U	910.66 U	910.66 U
PC-2	2	2	13.47	408.78 U	408.78 U	408.78 U	408.78 U	408.78 U	408.78 U
PC-2	3	1	14.07	302.13 U	302.13 U	302.13 U	302.13 U	302.13 U	302.13 U
PC-2	4	1	13.98	273.89 U	273.89 U	273.89 U	273.89 U	273.89 U	273.89 U
PC-2	5	1	14.46	450.72 U	450.72 U	450.72 U	450.72 U	450.72 U	450.72 U
PC-4	1	1	14.33	311.62 U	311.62 U	311.62 U	311.62 U	311.62 U	311.62 U
PC-4 Rep 1	2	2	14.75	995.42 U	995.42 U	995.42 U	995.42 U	995.42 U	995.42 U
PC-4 Rep 2	2	2	14.75	998.60 U	998.60 U	998.60 U	998.60 U	998.60 U	998.60 U
PC-4 Rep 3	2	2	14.75	760.80 U	760.80 U	760.80 U	760.80 U	760.80 U	760.80 U
PC-4	3	1	14.22	3.96 J	297.48 U	297.48 U	297.48 U	297.48 U	297.48 U
PC-4 Rep 1	4	2	14.22	980.68 U	980.68 U	980.68 U	980.68 U	980.68 U	980.68 U
PC-4 Rep 2	4	2	14.22	989.90 U	989.90 U	989.90 U	989.90 U	989.90 U	989.90 U
PC-4 Rep 3	4	2	14.22	812.22 U	812.22 U	812.22 U	812.22 U	812.22 U	812.22 U
PC-4	5	3	13.57	661.07 U	661.07 U	661.07 U	661.07 U	661.07 U	661.07 U
PC-5	1	2	13.63	355.08 U	355.08 U	355.08 U	355.08 U	355.08 U	355.08 U
PC-5	2	2	13.48	665.91 U	665.91 U	665.91 U	665.91 U	665.91 U	665.91 U
PC-5	3	1	13.83	269.07 U	269.07 U	269.07 U	269.07 U	269.07 U	269.07 U
PC-5	4	3	14.85	660.81 U	660.81 U	660.81 U	660.81 U	660.81 U	660.81 U
PC-5	5	1	14.17	327.43 U	327.43 U	327.43 U	327.43 U	327.43 U	327.43 U
Reference	1	3	12.70	607.28 U	607.28 U	607.28 U	607.28 U	607.28 U	607.28 U
Reference	2	2	14.22	358.38 U	358.38 U	358.38 U	358.38 U	358.38 U	358.38 U
Reference	3	2	13.74	347.05 U	347.05 U	347.05 U	347.05 U	347.05 U	347.05 U
Reference	4	1	14.51	499.63 U	499.63 U	499.63 U	499.63 U	499.63 U	499.63 U
Reference	5	3	14.72	661.55 U	661.55 U	661.55 U	661.55 U	661.55 U	661.55 U
<i>N. virens</i> Background Rep 1	1	3	14.40	707.36 U	707.36 U	707.36 U	707.36 U	707.36 U	707.36 U
<i>N. virens</i> Background Rep 2	2	3	14.40	694.64 U	694.64 U	694.64 U	694.64 U	694.64 U	694.64 U
<i>N. virens</i> Background Rep 3	3	3	14.40	656.38 U	656.38 U	656.38 U	656.38 U	656.38 U	656.38 U

TABLE M.13. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g/kg}$ wet weight)					
				2,4-di- chloro- phenol	2-nitro- phenol	4-nitro- phenol	2,4-di- nitro- phenol	4,6-di- nitro- o-cresol	Penta- chloro- phenol
<i>N. virens</i> Control	1	2	14.32	383.94 U	383.94 U	383.94 U	383.94 U	383.94 U	383.94 U
<i>N. virens</i> Control	2	3	14.83	662.78 U	662.78 U	662.78 U	662.78 U	662.78 U	662.78 U
<i>N. virens</i> Control	3	1	13.20	444.15 U	444.15 U	444.15 U	5.20 J	444.15 U	444.15 U
<i>N. virens</i> Control	4	1	14.61	441.23 U	441.23 U	441.23 U	441.23 U	441.23 U	441.23 U
<i>N. virens</i> Control Rep 1	5	1	14.16	745.97 U	745.97 U	745.97 U	745.97 U	745.97 U	745.97 U
<i>N. virens</i> Control Rep 2	5	1	14.16	728.08 U	728.08 U	728.08 U	728.08 U	728.08 U	728.08 U
<i>N. virens</i> Control Rep 3	5	1	14.16	569.52 U	569.52 U	569.52 U	569.52 U	569.52 U	569.52 U

(a) DL Detection limit.

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

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

TABLE M.14. Phenol and Substituted Phenol Analysis, (phenol - 2-chlorophenol), Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g}/\text{kg}$ dry weight)				
				Phenol	2,4-di-methyl-phenol	2,4,6-tri-chloro-phenol	Para-chloro-meta-cresol	2-chloro-phenol
PC-1	1	2	14.15	1948.42 J ^(a)	622.58 J	659.46 J	752.37 J	267.84 J
PC-1	2	1	14.03	1857.03 U ^(b)	1857.03 U	1857.03 U	1857.03 U	1857.03 U
PC-1	3	2	12.32	741.40 J	3880.19 U	3880.19 U	3880.19 U	3880.19 U
PC-1	4	1	14.15	2007.35 U	2007.35 U	2007.35 U	2007.35 U	2007.35 U
PC-1	5	2	14.17	531.40 J	2659.19 U	2659.19 U	2659.19 U	2659.19 U
PC-1A	1	2	12.85	632.17 J	2583.15 U	2583.15 U	2583.15 U	2583.15 U
PC-1A	2	1	14.13	1962.29 U	1962.29 U	1962.29 U	1962.29 U	1962.29 U
PC-1A	3	2	13.54	643.26 J	2569.78 U	2569.78 U	2569.78 U	2569.78 U
PC-1A	4	2	14.00	231.08 J	3005.14 U	3005.14 U	3005.14 U	3005.14 U
PC-1A	5	1	13.39	401.07 J	1961.79 U	1961.79 U	1961.79 U	1961.79 U
PC-2	1	3	14.28	592.30 J	6377.17 U	6377.17 U	6377.17 U	6377.17 U
PC-2	2	2	13.47	344.10 J	3034.74 U	3034.74 U	3034.74 U	3034.74 U
PC-2	3	1	14.07	96.72 J	2147.03 U	2147.03 U	2147.03 U	2147.03 U
PC-2	4	1	13.98	1959.02 U	1959.02 U	1959.02 U	1959.02 U	18.31 J
PC-2	5	1	14.45	3117.87 U	3117.87 U	3117.87 U	3117.87 U	26.36 J
PC-4	1	1	14.33	2174.60 U	2174.60 U	2174.60 U	2174.60 U	2174.60 U
PC-4 Rep 1	2	2	14.75	749.76 J	6746.78 U	6746.78 U	6746.78 U	6746.78 U
PC-4 Rep 2	2	2	14.75	658.19 J	6768.33 U	6768.33 U	6768.33 U	6768.33 U
PC-4 Rep 3	2	2	14.75	425.85 J	5156.57 U	5156.57 U	5156.57 U	5156.57 U
PC-4	3	1	14.21	49.24 J	2092.42 U	2092.42 U	4.22 J	2092.42 U
PC-4 Rep 1	4	2	14.22	427.01 J	6895.51 U	6895.51 U	6895.51 U	6895.51 U
PC-4 Rep 2	4	2	14.22	1020.25 J	6960.34 U	6960.34 U	6960.34 U	6960.34 U
PC-4 Rep 3	4	2	14.22	692.94 J	6.05 J	5711.01 U	5711.01 U	5711.01 U
PC-4	5	3	13.57	277.66 J	4870.12 U	4870.12 U	4870.12 U	4870.12 U
PC-5	1	2	13.62	1257.98 J	2605.33 U	59.87 J	2605.33 U	2605.33 U
PC-5	2	2	13.47	451.58 J	4941.08 U	4941.08 U	4941.08 U	4941.08 U
PC-5	3	1	13.83	285.10 J	1945.55 U	1945.55 U	1945.55 U	1945.55 U
PC-5	4	3	14.84	329.61 J	4451.40 U	4451.40 U	4451.40 U	4451.40 U
PC-5	5	1	14.17	503.35 J	45.86 J	2309.91 U	2309.91 U	2309.91 U
Reference	1	3	12.70	227.93 J	4781.36 U	4781.36 U	4781.36 U	4781.36 U
Reference	2	2	14.22	2519.54 U	2519.54 U	2519.54 U	2519.54 U	2519.54 U
Reference	3	2	13.74	523.06 J	2525.10 U	2525.10 U	2525.10 U	2525.10 U
Reference	4	1	14.50	3444.06 U	3444.06 U	3444.06 U	3444.06 U	3444.06 U
Reference	5	3	14.72	419.47 J	4493.92 U	4493.92 U	4493.92 U	4493.92 U
<i>N. virens</i> Background Rep 1	1	3	14.39	2031.32 J	4912.56 U	18.13 J	4912.56 U	4912.56 U
<i>N. virens</i> Background Rep 2	2	3	14.39	1641.78 J	4824.22 U	4824.22 U	4824.22 U	4824.22 U
<i>N. virens</i> Background Rep 3	3	3	14.39	1632.96 J	4558.51 U	4558.51 U	4558.51 U	4558.51 U

TABLE M.14. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g}/\text{kg}$ dry weight)				
				Phenol	2,4-di- methyl- phenol	2,4,6- tri- chloro- phenol	Para- chloro- meta- cresol	2- chloro- phenol
<i>N. virens</i> Control	1	2	14.32	455.90 J	2680.96 U	2680.96 U	2680.96 U	2680.96 U
<i>N. virens</i> Control	2	3	14.82	348.89 J	4470.09 U	4470.09 U	4470.09 U	4470.09 U
<i>N. virens</i> Control	3	1	13.20	1317.03 J	3363.75 U	3363.75 U	16.28 J	3363.75 U
<i>N. virens</i> Control	4	1	14.60	3020.47 U	3020.47 U	3020.47 U	3020.47 U	33.75 J
<i>N. virens</i> Control Rep 1	5	1	14.16	5267.78 U	5267.78 U	5267.78 U	5267.78 U	5267.78 U
<i>N. virens</i> Control Rep 2	5	1	14.16	367.98 J	5141.44 U	5141.44 U	5141.44 U	5141.44 U
<i>N. virens</i> Control Rep 3	5	1	14.16	4021.75 U	4021.75 U	4021.75 U	4021.75 U	4021.75 U

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) U Analyte was not present above the associated value.

TABLE M.15. Phenol and Substituted Phenol Analysis (2,4-dichlorophenol - Pentachlorophenol), Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g}/\text{kg}$ dry weight)					
				2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
PC-1	1	2	14.15	423.77 J(a)	137.56 J	3144.69 U(b)	3144.69 U	3144.69 U	3144.69 U
PC-1	2	1	14.03	1857.03 U	1857.03 U	1857.03 U	1857.03 U	1857.03 U	1857.03 U
PC-1	3	2	12.32	3880.19 U	3880.19 U	3880.19 U	3880.19 U	3880.19 U	3880.19 U
PC-1	4	1	14.15	2007.35 U	2007.35 U	2007.35 U	2007.35 U	2007.35 U	2007.35 U
PC-1	5	2	14.17	2659.19 U	2659.19 U	2659.19 U	2659.19 U	2659.19 U	2659.19 U
PC-1A	1	2	12.85	2583.15 U	2583.15 U	2583.15 U	2583.15 U	2583.15 U	2583.15 U
PC-1A	2	1	14.13	1962.29 U	1962.29 U	1962.29 U	1962.29 U	1962.29 U	1962.29 U
PC-1A	3	2	13.54	2569.78 U	2569.78 U	2569.78 U	2569.78 U	2569.78 U	2569.78 U
PC-1A	4	2	14.00	3005.14 U	3005.14 U	3005.14 U	3005.14 U	3005.14 U	3005.14 U
PC-1A	5	1	13.39	1961.79 U	1961.79 U	1961.79 U	1961.79 U	1961.79 U	1961.79 U
PC-2	1	3	14.28	6377.17 U	6377.17 U	6377.17 U	6377.17 U	6377.17 U	6377.17 U
PC-2	2	2	13.47	3034.74 U	3034.74 U	3034.74 U	3034.74 U	3034.74 U	3034.74 U
PC-2	3	1	14.07	2147.03 U	2147.03 U	2147.03 U	2147.03 U	2147.03 U	2147.03 U
PC-2	4	1	13.98	1959.02 U	1959.02 U	1959.02 U	1959.02 U	1959.02 U	1959.02 U
PC-2	5	1	14.45	3117.87 U	3117.87 U	3117.87 U	3117.87 U	3117.87 U	3117.87 U
PC-4	1	1	14.33	2174.60 U	2174.60 U	2174.60 U	2174.60 U	2174.60 U	2174.60 U
PC-4 Rep 1	2	2	14.75	6746.78 U	6746.78 U	6746.78 U	6746.78 U	6746.78 U	6746.78 U
PC-4 Rep 2	2	2	14.75	6768.33 U	6768.33 U	6768.33 U	6768.33 U	6768.33 U	6768.33 U
PC-4 Rep 3	2	2	14.75	5156.57 U	5156.57 U	5156.57 U	5156.57 U	5156.57 U	5156.57 U
PC-4	3	1	14.21	27.85 J	2092.42 U	2092.42 U	2092.42 U	2092.42 U	2092.42 U
PC-4 Rep 1	4	2	14.22	6895.51 U	6895.51 U	6895.51 U	6895.51 U	6895.51 U	6895.51 U
PC-4 Rep 2	4	2	14.22	6960.34 U	6960.34 U	6960.34 U	6960.34 U	6960.34 U	6960.34 U
PC-4 Rep 3	4	2	14.22	5711.01 U	5711.01 U	5711.01 U	5711.01 U	5711.01 U	5711.01 U
PC-4	5	3	13.57	4870.12 U	4870.12 U	4870.12 U	4870.12 U	4870.12 U	4870.12 U
PC-5	1	2	13.62	2605.33 U	2605.33 U	2605.33 U	2605.33 U	2605.33 U	2605.33 U
PC-5	2	2	13.47	4941.08 U	4941.08 U	4941.08 U	4941.08 U	4941.08 U	4941.08 U
PC-5	3	1	13.83	1945.55 U	1945.55 U	1945.55 U	1945.55 U	1945.55 U	1945.55 U
PC-5	4	3	14.84	4451.40 U	4451.40 U	4451.40 U	4451.40 U	4451.40 U	4451.40 U
PC-5	5	1	14.17	2309.91 U	2309.91 U	2309.91 U	2309.91 U	2309.91 U	2309.91 U
Reference	1	3	12.70	4781.36 U	4781.36 U	4781.36 U	4781.36 U	4781.36 U	4781.36 U
Reference	2	2	14.22	2519.54 U	2519.54 U	2519.54 U	2519.54 U	2519.54 U	2519.54 U
Reference	3	2	13.74	2525.10 U	2525.10 U	2525.10 U	2525.10 U	2525.10 U	2525.10 U
Reference	4	1	14.50	3444.06 U	3444.06 U	3444.06 U	3444.06 U	3444.06 U	3444.06 U
Reference	5	3	14.72	4493.92 U	4493.92 U	4493.92 U	4493.92 U	4493.92 U	4493.92 U

TABLE M. 15. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g}/\text{kg}$ dry weight)					
				2,4-di- chloro- phenol	2-nitro- phenol	4-nitro- phenol	2,4-di- nitro- phenol	4,6-di- nitro- o-cresol	Penta- chloro- phenol
<i>N. virens</i> Background Rep 1	1	3	14.39	4912.56 U	4912.56 U	4912.56 U	4912.56 U	4912.56 U	4912.56 U
<i>N. virens</i> Background Rep 2	2	3	14.39	4824.22 U	4824.22 U	4824.22 U	4824.22 U	4824.22 U	4824.22 U
<i>N. virens</i> Background Rep 3	3	3	14.39	4558.51 U	4558.51 U	4558.51 U	4558.51 U	4558.51 U	4558.51 U
<i>N. virens</i> Control	1	2	14.32	2680.96 U	2680.96 U	2680.96 U	2680.96 U	2680.96 U	2680.96 U
<i>N. virens</i> Control	2	3	14.82	4470.09 U	4470.09 U	4470.09 U	4470.09 U	4470.09 U	4470.09 U
<i>N. virens</i> Control	3	1	13.20	3363.75 U	3363.75 U	3363.75 U	39.38 J	3363.75 U	3363.75 U
<i>N. virens</i> Control	4	1	14.60	3020.47 U	3020.47 U	3020.47 U	3020.47 U	3020.47 U	3020.47 U
<i>N. virens</i> Control Rep 1	5	1	14.16	5267.78 U	5267.78 U	5267.78 U	5267.78 U	5267.78 U	5267.78 U
<i>N. virens</i> Control Rep 2	5	1	14.16	5141.44 U	5141.44 U	5141.44 U	5141.44 U	5141.44 U	5141.44 U
<i>N. virens</i> Control Rep 3	5	1	14.16	4021.75 U	4021.75 U	4021.75 U	4021.75 U	4021.75 U	4021.75 U

(a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) U Analyte was not present above the associated value.

TABLE M.16. Quality Control Data for Phenol and Substituted Phenol Analysis, (Phenol - 2-chlorophenol), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

			<i>N. virens</i>				
			Phenol and Substituted Phenols ($\mu\text{g/kg}$ wet weight)				
Sediment Treatment	Replicate	Batch	Phenol	2,4-di-methyl phenol	2,4,6-tri-chloro phenol	Para-chloro-meta-cresol	2-chloro-phenol
<u>Method Blanks</u>							
Blank		1	57.99 J ^(a)	2.71 J	7.03 J	8.35 J	9.05 J
Blank		2	488.14 U ^(b)	488.14 U	488.14 U	488.14 U	488.14 U
Blank		3	59.04 J	659.89 U	659.89 U	659.89 U	659.89 U
<u>Matrix Spikes</u>							
PC-2	1	3	84.58 J	910.66 U	910.66 U	910.66 U	910.66 U
PC-2 MS	1	3	5643.73	4996.88	5013.01	3402.78	6070.32
Concentration Recovered			5559.15	4996.88	5013.01	3402.78	6070.32
Amount Spiked			4344.10	4344.10	4476.71	4344.10	4344.10
Percent Recovery			128% ^(c)	115%	112%	78%	140% ^(c)
PC-5	2	2	60.86 J	665.91 U	665.91 U	665.91 U	665.91 U
PC-5 MS	2	2	5787.30	52.84	1440.53	1436.74	6536.46
Concentration Recovered			5726.44	52.84	1440.53	1436.74	6536.46
Amount Spiked			2889.55	2889.55	2977.76	2889.55	2889.55
Percent Recovery			198% ^(c)	2% ^(c)	48%	50%	226% ^(c)
Reference	4	1	499.63 U	499.63 U	499.63 U	499.63 U	499.63 U
Reference MS	4	1	1952.94	136.19	3085.79	3129.72	3804.87
Concentration Recovered			1952.94	136.19	3085.79	3129.72	3804.87
Amount Spiked			2919.71	2919.71	3008.84	2919.71	2919.71
Percent Recovery			67%	5% ^(c)	103%	107%	130% ^(c)
<i>N. virens</i> Control	4	1	441.23 U	441.23 U	441.23 U	441.23 U	4.93 J
<i>N. virens</i> Control MS	4	1	3826.68	259.31	3669.92	3499.18	3791.46
Concentration Recovered			3826.68	259.31	3669.92	3499.18	3786.53
Amount Spiked			3204.27	3204.27	3302.09	3204.27	3204.27
Percent Recovery			119%	8% ^(c)	111%	109%	118%
<u>Analytical Replicates</u>							
PC-4 Rep 1	2	2	110.62 J	995.42 U	995.42 U	995.42 U	995.42 U
PC-4 Rep 2	2	2	97.11 J	998.60 U	998.60 U	998.60 U	998.60 U
PC-4 Rep 3	2	2	62.83 J	760.80 U ^(d)	760.80 U	760.80 U	760.80 U
RSD			27%	NA	NA	NA	NA
PC-4 Rep 1	4	2	60.73 J	980.68 U	980.68 U	980.68 U	980.68 U
PC-4 Rep 2	4	2	145.10 J	989.90 U	989.90 U	989.90 U	989.90 U
PC-4 Rep 3	4	2	98.55 J	0.86 J	812.22 U	812.22 U	812.22 U
RSD			42% ^(e)	NA	NA	NA	NA
<i>N. virens</i> Background Rep 1	1	3	292.49 J	707.36 U	2.61 J	707.36 U	707.36 U
<i>N. virens</i> Background Rep 2	2	3	236.40 J	694.64 U	694.64 U	694.64 U	694.64 U
<i>N. virens</i> Background Rep 3	3	3	235.13 J	656.38 U	656.38 U	656.38 U	656.38 U
RSD			13%	NA	NA	NA	NA

TABLE M.15. (contd)

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g}/\text{kg}$ wet weight)				
			Phenol	2,4-di- methyl phenol	2,4,6- tri- chloro phenol	Para- chloro- meta- cresol	2-chloro- phenol
<i>N. virens</i> Control Rep 1	5	1	745.97 U	745.97 U	745.97 U	745.97 U	745.97 U
<i>N. virens</i> Control Rep 2	5	1	52.11 J	728.08 U	728.08 U	728.08 U	728.08 U
<i>N. virens</i> Control Rep 3	5	1	569.52 U	569.52 U	569.52 U	569.52 U	569.52 U
RSD			NA	NA	NA	NA	NA

- (a) J Analyte detected below method detection limit (MDL), but above instrument detection limit (IDL).
 (b) U Analyte was not present above the associated value.
 (c) Recovery outside quality control range (40%-120%).
 (d) NA Not applicable.
 (e) Value exceeds relative precision goal of $\leq 30\%$.

TABLE M.17.

Quality Control Data for Phenol and Substituted Phenol (2,4-dichlorophenol-Pentachlorophenol), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

<i>N. virens</i> Phenol and Substituted Phenols (µg/kg wet weight)								
Sediment Treatment	Replicate	Batch	2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
<u>Method Blanks</u>								
Blank		1	6.37 J(a)	352.15 U(b)	73.01 J	352.15 U	352.15 U	24.70 J
Blank		2	488.14 U	488.14 U	488.14 U	488.14 U	488.14 U	488.14 U
Blank		3	659.89 U	659.89 U	659.89 U	659.89 U	659.89 U	659.89 U
<u>Matrix Spikes</u>								
PC-2								
PC-2 MS	1	3	910.66 U	910.66 U	910.66 U(c)	910.66 U	910.66 U	910.66 U
Concentration Recovered	1	3	4646.01	4347.71	NA	NA	1321.43	NA
Amount Spiked			4646.01	4347.71	NA	NA	1321.43	NA
Percent Recovery			4344.10	4344.10	4344.10	4435.27	4344.10	4344.10
			107%	100%	NA	NA	30%	NA
PC-5								
PC-5 MS	2	2	665.91 U	665.91 U	665.91 U	665.91 U	665.91 U	665.91 U
Concentration Recovered	2	2	2575.58	2976.38	NA	NA	NA	NA
Amount Spiked			2575.58	2976.38	NA	NA	NA	NA
Percent Recovery			2889.55	2889.55	2889.55	2950.19	2889.55	2889.55
			89%	103%	NA	NA	NA	NA
Reference								
Reference MS	4	1	499.63 U	499.63 U	499.63 U	499.63 U	499.63 U	499.63 U
Concentration Recovered	4	1	3295.76	1927.69	471.67	11.06	13.13	445.78
Amount Spiked			3295.76	1927.69	471.67	11.06	13.13	445.78
Percent Recovery			2919.71	2919.71	2919.71 (d)	2980.98	2919.71 (d)	2919.71
			113%	66%	16%	0%	0%	15%
<i>N. virens</i> Control								
<i>N. virens</i> Control MS	4	1	441.23 U	441.23 U	441.23 U	441.23 U	441.23 U	441.23 U
Concentration Recovered	4	1	3810.77	1679.69	1346.92	24.04	15.94	2825.04
Amount Spiked			3810.77	1679.69	1346.92	24.04	15.94	2825.04
Percent Recovery			3204.27	3204.27	3204.27	3271.52	3204.27	3204.27
			119%	52%	42%	1%	0%	88%
<u>Analytical Replicates</u>								
PC-4 Rep 1	2	2	995.42 U	995.42 U	995.42 U	995.42 U	995.42 U	995.42 U
PC-4 Rep 2	2	2	998.60 U	998.60 U	998.60 U	998.60 U	998.60 U	998.60 U
PC-4 Rep 3	2	2	760.80 U	760.80 U	760.80 U	760.80 U	760.80 U	760.80 U
RSD			NA	NA	NA	NA	NA	NA

TABLE M.17. (contd)

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Phenol and Substituted Phenols ($\mu\text{g}/\text{kg}$ wet weight)					
			2,4-di-chloro-phenol	2-nitro-phenol	4-nitro-phenol	2,4-di-nitro-phenol	4,6-di-nitro-o-cresol	Penta-chloro-phenol
PC-4 Rep 1	4	2	980.68 U	980.68 U	980.68 U	980.68 U	980.68 U	980.68 U
PC-4 Rep 2	4	2	989.90 U	989.90 U	989.90 U	989.90 U	989.90 U	989.90 U
PC-4 Rep 3	4	2	812.22 U	812.22 U	812.22 U	812.22 U	812.22 U	812.22 U
RSD			NA	NA	NA	NA	NA	NA
<i>N. virens</i> Background Rep 1	1	3	707.36 U	707.36 U	707.36 U	707.36 U	707.36 U	707.36 U
<i>N. virens</i> Background Rep 2	2	3	694.64 U	694.64 U	694.64 U	694.64 U	694.64 U	694.64 U
<i>N. virens</i> Background Rep 3	3	3	656.38 U	656.38 U	656.38 U	656.38 U	656.38 U	656.38 U
RSD			NA	NA	NA	NA	NA	NA
<i>N. virens</i> Control Rep 1	5	1	745.97 U	745.97 U	745.97 U	745.97 U	745.97 U	745.97 U
<i>N. virens</i> Control Rep 2	5	1	728.08 U	728.08 U	728.08 U	728.08 U	728.08 U	728.08 U
<i>N. virens</i> Control Rep 3	5	1	569.52 U	569.52 U	569.52 U	569.52 U	569.52 U	569.52 U
RSD			NA	NA	NA	NA	NA	NA

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

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

(c) NA Not applicable.

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

TABLE M.18. Phthalate Ester Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phthalate Esters ($\mu\text{g}/\text{kg}$ wet weight)					
				Bis(2-ethyl- (hexyl) Phthalate	Butyl- benzyl- Phthalate	Di-n-butyl Phthalate	Di-n-octyl Phthalate	Diethyl Phthalate	Dimethyl Phthalate
Target DL (a)				100	100	100	100	100	100
Achieved DL High				199.72	199.72	199.72	199.72	199.72	199.72
Achieved DL Low				66.39	66.39	66.39	66.39	66.39	66.39
PC-1	1	2	14.15	89.02 U ^(b)	89.02 U	89.02 U ^(c)	89.02 U	89.02 U	89.02 U
PC-1	2	1	14.03	52.14 U	52.14 U	3.84 J	52.14 U	4.60 J	3.46 J
PC-1	3	2	12.32	18.04 J	95.67 U	95.67 U	95.67 U	95.67 U	95.67 U
PC-1	4	1	14.15	13.82 J	56.81 U	4.70 J	56.81 U	3.68 J	1.84 J
PC-1	5	2	14.17	26.67 J	75.37 U	75.37 U	75.37 U	75.37 U	75.37 U
PC-1A	1	2	12.85	66.39 U	66.39 U	62.50 J	66.39 U	66.39 U	66.39 U
PC-1A	2	1	14.13	55.47 U	55.47 U	55.47 U	55.47 U	3.40 J	1.14 J
PC-1A	3	2	13.54	69.60 U	69.60 U	69.60 U	69.60 U	69.60 U	69.60 U
PC-1A	4	2	14.00	84.19 U	84.19 U	53.09 J	84.19 U	84.19 U	84.19 U
PC-1A	5	1	13.39	16.44 J	52.57 U	8.01 J	52.57 U	52.57 U	52.57 U
PC-2	1	3	14.28	182.13 U	182.13 U	11.27 J	182.13 U	182.13 U	182.13 U
PC-2	2	2	13.47	81.76 U	81.76 U	72.47 J	81.76 U	81.76 U	81.76 U
PC-2	3	1	14.07	60.43 U	60.43 U	5.15 J	60.43 U	3.56 J	1.44 J
PC-2	4	1	13.98	54.78 U	54.78 U	54.78 U	54.78 U	1.72 J	1.25 J
PC-2	5	1	14.45	90.14 U	90.14 U	10.11 J	90.14 U	5.10 J	2.21 J
PC-4	1	1	14.33	62.32 U	62.32 U	62.32 U	62.32 U	62.32 U	62.32 U
PC-4 Rep 1	2	2	14.75	199.08 U	199.08 U	136.80 J	199.08 U	199.08 U	199.08 U
PC-4 Rep 2	2	2	14.75	199.72 U	199.72 U	105.93 J	199.72 U	199.72 U	199.72 U
PC-4 Rep 3	2	2	14.75	152.16 U	152.16 U	69.98 J	152.16 U	152.16 U	152.16 U
PC-4	3	1	14.21	5.16 J	3.79 J	49.86 J	4.18 J	8.88 J	5.01 J
PC-4 Rep 1	4	2	14.22	196.14 U	196.14 U	196.14 U	196.14 U	196.14 U	196.14 U
PC-4 Rep 2	4	2	14.22	197.98 U	197.98 U	197.98 U	197.98 U	197.98 U	197.98 U
PC-4 Rep 3	4	2	14.22	162.44 U	162.44 U	162.44 U	162.44 U	162.44 U	162.44 U
PC-4	5	3	13.57	132.21 U	132.21 U	132.21 U	132.21 U	132.21 U	132.21 U
PC-5	1	2	13.62	71.02 U	71.02 U	13.19 J	71.02 U	71.02 U	71.02 U
PC-5	2	2	13.47	30.87 J	133.18 U	128.75 J	133.18 U	133.18 U	133.18 U
PC-5	3	1	13.83	53.81 U	53.81 U	4.67 J	53.81 U	2.55 J	53.81 U
PC-5	4	3	14.84	132.16 U	132.16 U	132.16 U	132.16 U	132.16 U	132.16 U
PC-5	5	1	14.17	65.49 U	65.49 U	65.49 U	65.49 U	2.91 J	1.20 J

TABLE M.18. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. viridis</i> Phthalate Esters ($\mu\text{g}/\text{kg}$ wet weight)				
				Bis(2-ethyl- (hexyl) Phthalate	Butyl- benzyl Phthalate	Di-n-butyl Phthalate	Di-n-octyl Phthalate	Diethyl Phthalate
Reference	1	3	12.70	121.46 U	138.97	13.63 J	121.46 U	121.46 U
Reference	2	2	14.22	71.68 U	71.68 U	71.68 U	71.68 U	71.68 U
Reference	3	2	13.74	69.41 U	69.41 U	78.47	69.41 U	69.41 U
Reference	4	1	14.50	99.93 U	99.93 U	11.72 J	99.93 U	99.93 U
Reference	5	3	14.72	132.31 U	132.31 U	17.96 J	132.31 U	132.31 U
<i>N. viridis</i> Background Rep 1	1	3	14.39	141.47 U	141.47 U	29.85 J	141.47 U	14.21 J
<i>N. viridis</i> Background Rep 2	2	3	14.39	138.93 U	138.93 U	33.20 J	138.93 U	28.23 J
<i>N. viridis</i> Background Rep 3	3	3	14.39	131.28 U	131.28 U	22.16 J	131.28 U	4.49 J
<i>N. viridis</i> Control	1	2	14.32	76.79 U	76.79 U	76.79 U	76.79 U	76.79 U
<i>N. viridis</i> Control	2	3	14.82	132.56 U	132.56 U	132.56 U	132.56 U	132.56 U
<i>N. viridis</i> Control	3	1	13.20	7.16 J	0.98 J	4.80 J	2.00 J	1.99 J
<i>N. viridis</i> Control	4	1	14.60	88.25 U	88.25 U	88.25 U	88.25 U	6.29 J
<i>N. viridis</i> Control Rep 1	5	1	14.16	35.10 J	149.19 U	149.19 U	149.19 U	11.12 J
<i>N. viridis</i> Control Rep 2	5	1	14.16	17.22 J	145.62 U	18.72 J	145.62 U	19.70 J
<i>N. viridis</i> Control Rep 3	5	1	14.16	113.90 U	113.90 U	113.90 U	113.90 U	113.90 U

(a) DL Detection limit.

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

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

TABLE M.19. Phthalate Ester Analysis, Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phthalate Esters ($\mu\text{g}/\text{kg}$ dry weight)				
				Bis(2-ethyl-hexyl) Phthalate	Butyl-benzyl Phthalate	Di-n-butyl Phthalate	Di-n-octyl Phthalate	Diethyl Phthalate
PC-1	1	2	14.15	628.94 U ^(a)	628.94 U	628.94 U	628.94 U	628.94 U
PC-1	2	1	14.03	371.42 U	371.42 U	27.35 J ^(b)	371.42 U	32.77 J
PC-1	3	2	12.32	146.33 J	776.04 U	776.04 U	776.04 U	776.04 U
PC-1	4	1	14.15	97.66 J	401.46 U	33.21 J	401.46 U	26.01 J
PC-1	5	2	14.17	188.19 J	531.82 U	531.82 U	531.82 U	531.82 U
PC-1A	1	2	12.85	516.61 U	516.61 U	486.34 J	516.61 U	516.61 U
PC-1A	2	1	14.13	392.46 U	392.46 U	392.46 U	392.46 U	24.06 J
PC-1A	3	2	13.54	513.96 U	513.96 U	513.96 U	513.96 U	513.96 U
PC-1A	4	2	14.00	601.01 U	601.01 U	379.00 J	601.01 U	601.01 U
PC-1A	5	1	13.39	122.70 J	392.34 U	59.78 J	392.34 U	392.34 U
PC-2	1	3	14.28	1275.42 U	1275.42 U	78.92 J	1275.42 U	1275.42 U
PC-2	2	2	13.47	606.98 U	606.98 U	538.01 J	606.98 U	606.98 U
PC-2	3	1	14.07	429.43 U	429.43 U	36.60 J	429.43 U	25.30 J
PC-2	4	1	13.98	391.82 U	391.82 U	391.82 U	391.82 U	12.30 J
PC-2	5	1	14.45	623.55 U	623.55 U	69.94 J	623.55 U	35.28 J
PC-4	1	1	14.33	434.89 U	434.89 U	434.89 U	434.89 U	434.89 U
PC-4 Rep 1	2	2	14.75	1349.33 U	1349.33 U	927.21 J	1349.33 U	1349.33 U
PC-4 Rep 2	2	2	14.75	1353.67 U	1353.67 U	717.97 J	1353.67 U	1353.67 U
PC-4 Rep 3	2	2	14.75	1031.31 U	1031.31 U	474.31 J	1031.31 U	1031.31 U
PC-4	3	1	14.21	36.29 J	26.66 J	350.71 J	29.40 J	62.46 J
PC-4 Rep 1	4	2	14.22	1379.13 U	1379.13 U	1379.13 U	1379.13 U	1379.13 U
PC-4 Rep 2	4	2	14.22	1392.07 U	1392.07 U	1392.07 U	1392.07 U	1392.07 U
PC-4 Rep 3	4	2	14.22	1142.17 U	1142.17 U	1142.17 U	1142.17 U	1142.17 U
PC-4	5	3	13.57	973.99 U	973.99 U	973.99 U	973.99 U	973.99 U
PC-5	1	2	13.62	521.09 U	521.09 U	96.78 J	521.09 U	521.09 U
PC-5	2	2	13.47	229.06 J	988.20 U	955.33 J	988.20 U	988.20 U
PC-5	3	1	13.83	389.08 U	389.08 U	33.77 J	389.08 U	18.44 J
PC-5	4	3	14.84	890.27 U	890.27 U	890.27 U	890.27 U	890.27 U
PC-5	5	1	14.17	462.01 U	462.01 U	462.01 U	462.01 U	20.53 J
Reference	1	3	12.70	956.30 U	1094.17	107.31 J	956.30 U	956.30 U
Reference	2	2	14.22	503.94 U	503.94 U	503.94 U	503.94 U	503.94 U
Reference	3	2	13.74	505.02 U	505.02 U	570.94	505.02 U	505.02 U
Reference	4	1	14.50	688.84 U	688.84 U	80.79 J	688.84 U	34.95 J
Reference	5	3	14.72	898.78 U	898.78 U	122.00 J	898.78 U	898.78 U

TABLE M.19. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Phthalate Esters ($\mu\text{g}/\text{kg}$ dry weight)					
				Bis(2-ethyl- hexyl) Phthalate	Butyl- benzyl Phthalate	Di-n-butyl Phthalate	Di-n-octyl Phthalate	Diethyl Phthalate	Dimethyl Phthalate
<i>N. virens</i> Background Rep	1	3	14.39	982.50 U	982.50 U	207.31 J	982.50 U	98.69 J	8.33 J
<i>N. virens</i> Background Rep	2	3	14.39	964.86 U	964.86 U	230.57 J	964.86 U	196.06 J	16.11 J
<i>N. virens</i> Background Rep	3	3	14.39	911.73 U	911.73 U	153.90 J	911.73 U	31.18 J	8.82 J
<i>N. virens</i> Control	1	2	14.32	536.21 U	536.21 U	536.21 U	536.21 U	536.21 U	536.21 U
<i>N. virens</i> Control	2	3	14.82	894.04 U	894.04 U	894.04 U	894.04 U	894.04 U	894.04 U
<i>N. virens</i> Control	3	1	13.20	54.23 J	7.42 J	36.35 J	15.15 J	40.22 J	15.07 J
<i>N. virens</i> Control	4	1	14.60	604.12 U	604.12 U	604.12 U	604.12 U	43.06 J	14.17 J
<i>N. virens</i> Control Rep 1	5	1	14.16	247.86 J	1053.53 U	1053.53 U	1053.53 U	78.53 J	27.61 J
<i>N. virens</i> Control Rep 2	5	1	14.16	121.60 J	1028.32 U	132.19 J	1028.32 U	139.11 J	45.90 J
<i>N. virens</i> Control Rep 3	5	1	14.16	804.32 U	804.32 U	804.32 U	804.32 U	804.32 U	804.32 U

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

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

TABLE M.20.

Quality Control Data for Phthalate Ester Analysis, Wet Weight, in Tissue of
N. virens, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Phthalate Esters ($\mu\text{g/kg}$ wet weight)				
			Bis (2-ethyl)-hexyl Phthalate	Butyl-benzyl Phthalate	Di-n-butyl Phthalate	Di-n-octyl Phthalate	Diethyl Phthalate
Method Blanks							
Blank		1	30.32 J(a)	21.56 J	38.41 J	2.90 J	4.39 J
Blank		2	93.40 J	97.63 U(b)	6.41 J	97.63 U	97.63 U
Blank		3	131.98 U	131.98 U	131.98 U	131.98 U	131.98 U
Matrix Spikes							
PC-2	1	3	182.13 U	182.13 U	11.27 J	182.13 U	182.13 U
PC-2 MS	1	3	1573.66	1636.47	2115.73	1828.16	2465.85
Concentration Recovered			1573.66	1636.47	2104.46	1828.16	2465.85
Amount Spiked			2000.57	2000.57	2000.57	2000.57	2051.73
Percent Recovery			79%	82%	105%	91%	120%
PC-5	2	2	30.87 J	133.18 U	128.75 J	133.18 U	133.18 U
PC-5 MS	2	2	1029.95	733.13	988.87	887.30	1700.24
Concentration Recovered			999.08	733.13	860.12	887.30	1700.24
Amount Spiked			1330.71	1330.71	1330.71	1330.71	1364.74
Percent Recovery			75%	55%	65%	67%	125% (c)
Reference	4	1	99.93 U	99.93 U	11.72 J	99.93 U	5.07 J
Reference MS	4	1	995.06	526.66	1060.87	1231.92	1406.95
Concentration Recovered			995.06	526.66	1049.15	1231.92	1401.88
Amount Spiked			1344.60	1344.60	1344.60	1344.60	1378.99
Percent Recovery			74%	39%	78%	92%	102%
<i>N. virens</i> Control	4	1	88.25 U	88.25 U	88.25 U	88.25 U	6.29 J
<i>N. virens</i> Control MS	4	1	1192.47	692.2	1214.61	1452.39	1583.7
Concentration Recovered			1192.47	692.2	1214.61	1452.39	1577.41
Amount Spiked			1475.65	1475.65	1475.65	1475.65	1513.39
Percent Recovery			81%	47%	82%	98%	104%
Analytical Replicates							
PC-4 Rep 1	2	2	199.08 U	199.08 U	136.80 J	199.08 U	199.08 U
PC-4 Rep 2	2	2	199.72 U	199.72 U	105.93 J	199.72 U	199.72 U
PC-4 Rep 3	2	2	152.16 U	152.16 U	69.98 J	152.16 U	152.16 U
RSD			NA	NA	32% (e)	NA	NA

TABLE 20. (contd)

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Phthalate Esters ($\mu\text{g}/\text{kg}$ wet weight)					
			Bis (2-ethyl-hexyl) Phthalate	Butyl-benzyl Phthalate	Di-n-butyl Phthalate	Di-n-octyl Phthalate	Diethyl Phthalate	Dimethyl Phthalate
PC-4 Rep 1	4	2	196.14 U	196.14 U	196.14 U	196.14 U	196.14 U	196.14 U
PC-4 Rep 2	4	2	197.98 U	197.98 U	197.98 U	197.98 U	197.98 U	197.98 U
PC-4 Rep 3	4	2	162.44 U	162.44 U	162.44 U	162.44 U	162.44 U	162.44 U
RSD			NA	NA	11%	NA	NA	NA
<i>N. virens</i> Background Rep 1	1	3	141.47 U	141.47 U	29.85 J	141.47 U	14.21 J	1.20 J
<i>N. virens</i> Background Rep 2	2	3	138.93 U	138.93 U	33.20 J	138.93 U	28.23 J	2.32 J
<i>N. virens</i> Background Rep 3	3	3	131.28 U	131.28 U	22.16 J	131.28 U	4.49 J	1.27 J
RSD			NA	NA	20%	NA	76% (e)	39% (e)
<i>N. virens</i> Control Rep 1	5	1	35.10 J	149.19 U	149.19 U	149.19 U	11.12 J	3.91 J
<i>N. virens</i> Control Rep 2	5	1	17.22 J	145.62 U	18.72 J	145.62 U	19.70 J	6.50 J
<i>N. virens</i> Control Rep 3	5	1	113.90 U	113.90 U	113.90 U	113.90 U	113.90 U	113.90 U
RSD			NA	NA	NA	NA	NA	NA

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

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

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

(d) NA Not applicable.

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

TABLE M.21. Surrogate Percent Recoveries and Quality Control Data for Polynuclear Aromatic Hydrocarbon (PAH), Phenol and Substituted Phenol Analysis, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Surrogate Percent Recovery			
			2-fluoro-phenol	Naph-thalene-d8	Acenaph-thene-d10	Benzo[a]pyrene-d12
PC-1	1	2	66	71	86	94
PC-1	2	1	58	80	208 ^(a)	71
PC-1	3	2	41	57	135 ^(a)	84
PC-1	4	1	47	65	137 ^(a)	51
PC-1	5	2	36 ^(a)	53	122 ^(a)	54
PC-1A	1	2	37 ^(a)	64	105	67
PC-1A	2	1	59	61	83	0 ^(a)
PC-1A	3	2	34 ^(a)	53	132 ^(a)	63
PC-1A	4	2	57	79	215 ^(a)	95
PC-1A	5	1	44	69	94	0 ^(a)
PC-2	1	3	105	69	58	76
PC-2	2	2	54	69	114	79
PC-2	3	1	58	81	174 ^(a)	75
PC-2	4	1	45	64	88	0 ^(a)
PC-2	5	1	49	66	83	0 ^(a)
PC-4	1	1	108	68	94	0 ^(a)
PC-4 Rep 1	2	2	70	76	138 ^(a)	71
PC-4 Rep 2	2	2	67	78	166 ^(a)	74
PC-4 Rep 3	2	2	69	80	178 ^(a)	66
PC-4	3	1	45	73	111	67
PC-4 Rep 1	4	2	42	49	88	57
PC-4 Rep 2	4	2	30 ^(a)	38 ^(a)	78 ^(a)	34 ^(a)
PC-4 Rep 3	4	2	69	86	211 ^(a)	96
PC-4	5	3	133 ^(a)	92	64	64
PC-5	1	2	45	59	68	61
PC-5	2	2	54	75	112	88
PC-5	3	1	46	60	146 ^(a)	61
PC-5	4	3	126 ^(a)	93	67	96
PC-5	5	1	45	67	103	0 ^(a)
Reference	1	3	114	85	67	80
Reference	2	2	50	71	150 ^(a)	77
Reference	3	2	54	70	161 ^(a)	72
Reference	4	1	518 ^(a)	68	91	0 ^(a)
Reference	5	3	98	45	40	66
<i>N. virens</i> Background Rep 1	1	3	53	67	81	76
<i>N. virens</i> Background Rep 2	2	3	50	65	86	83
<i>N. virens</i> Background Rep 3	3	3	51	70	86	68
<i>N. virens</i> Control	1	2	54	68	136 ^(a)	21
<i>N. virens</i> Control	2	3	145 ^(a)	89	65	80
<i>N. virens</i> Control	3	1	21 ^(a)	69	145 ^(a)	29 ^(a)
<i>N. virens</i> Control	4	1	62	71	89	132 ^(a)
<i>N. virens</i> Control Rep 1	5	1	53	42	114	63
<i>N. virens</i> Control Rep 2	5	1	106	70	110	60
<i>N. virens</i> Control Rep 3	5	1	57	77	142 ^(a)	56

TABLE M.21. (contd)

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Surrogate Percent Recovery			
			2-fluoro-phenol	Naph-thalene-d8	Acenaph-thene-d10	Benzo[a]pyrene-d12
<u>Quality Control Data</u>						
<u>Method Blanks</u>						
Blank		1	21 ^(a)	49	58	50
Blank		2	32 ^(a)	54	54	49
Blank		3	75	64	65	85
<u>Matrix Spikes</u>						
PC-2 MS		3	78	53	87	73
PC-5 MS		2	31 ^(a)	62	100	74
Reference MS		1	87	67	88	0 ^(a)
<i>N. virens</i> Control MS		1	51	65	85	105

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

(b) NA Not applicable.

TABLE M.22. Chlorinated Pesticide Analysis (alphabetical, Aldrin - Dieldrin), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Pesticides ($\mu\text{g/kg}$ wet weight)									
				Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Chlordane	DDD	DDT	4,4'-DDT	4,4'-DDT	Dieldrin
Target DL (a)				10	10	10	10	30	10.00	10	10	10	10
				0.16	0.25	0.25	0.25	4.96	0.25	0.56	0.52	0.20	
Achieved High DL				0.05	0.08	0.08	0.08	1.65	0.08	0.19	0.17	0.07	
Achieved Low DL													
PC-1	1	2	14.15	0.07 U ^(b)	0.22	0.04 J ^(c)	0.11 U	2.21 U	0.31	0.08 J	0.23 U	0.12	
PC-1	2	1	14.04	0.06 U	1.09	0.06 J	0.09 U	1.73 U	0.94	0.19 U	0.05 J	0.22	
PC-1	3	2	12.33	0.08 U	0.13	0.04 J	0.12 U	2.38 U	0.15	0.27 U	0.25 U	0.12	
PC-1	4	1	14.15	0.06 U	0.33	0.04 J	0.10 U	1.88 U	0.58	0.09 J	0.05 J	0.14	
PC-1	5	2	14.17	0.06 U	0.06 J	0.01 J	0.10 U	1.87 U	0.14	0.21 U	0.20 U	0.04 J	
PC-1A	1	2	12.85	0.06 U	0.08 J	0.02 J	0.08 U	1.65 U	0.08 J	0.19 U	0.17 U	0.07 J	
PC-1A	2	1	14.13	0.06 U	0.30	0.09 J	0.09 U	1.84 U	0.87	0.13 J	0.19 U	0.16	
PC-1A	3	2	13.54	0.06 U	0.12	0.03 J	0.09 U	1.73 U	0.10	0.19 U	0.18 U	0.10	
PC-1A	4	2	14.01	0.07 U	0.12	0.03 J	0.11 U	2.09 U	0.30	0.08 J	0.22 U	0.14	
PC-1A	5	1	13.40	0.06 U	0.25	0.04 J	0.09 U	1.74 U	0.27	0.05 J	0.04 J	0.14	
PC-2	1	3	14.28	0.15 U	0.20 J	0.23 U	0.23 U	4.52 U	0.23 U	0.51 U	0.47 U	0.19 U	
PC-2	2	2	13.47	0.07 U	0.13	0.02 J	0.10 U	2.03 U	0.13	0.23 U	0.21 U	0.08 U	
PC-2	3	1	14.07	0.07 U	0.48	0.06 J	0.10 U	2.00 U	0.69	0.12 J	0.14 J	0.18	
PC-2	4	1	13.98	0.06 U	0.34	0.06 J	0.09 U	1.81 U	0.47	0.08 J	0.05 J	0.15	
PC-2	5	1	14.46	0.10 U	0.30	0.06 J	0.15 U	2.98 U	0.67	0.18 J	0.31 U	0.18	
PC-4	1	1	14.33	0.07 U	0.32	0.06 J	0.11 U	2.06 U	0.46	0.06 J	0.05 J	0.19	
PC-4 Rep 1	2	2	14.75	0.16 U	0.17 J	0.04 J	0.25 U	4.94 U	0.19 J	0.56 U	0.52 U	0.18 J	
PC-4 Rep 2	2	2	14.75	0.16 U	0.11 J	0.25 U	0.25 U	4.96 U	0.25 U	0.56 U	0.52 U	0.22	
PC-4 Rep 3	2	2	14.75	0.13 U	0.19 J	0.05 J	0.19 U	3.78 U	0.24	0.43 U	0.40 U	0.30	
PC-4	3	1	14.22	0.07 U	0.24	0.05 J	0.10 U	1.97 U	0.25	0.05 J	0.04 J	0.11	
PC-4 Rep 1	4	2	14.22	0.16 U	0.18 J	0.09 J	0.25 U	4.87 U	0.42	0.09 J	0.51 U	0.42	
PC-4 Rep 2	4	2	14.22	0.16 U	0.16 J	0.04 J	0.25 U	4.92 U	0.17 J	0.06 J	0.52 U	0.14 J	
PC-4 Rep 3	4	2	14.22	0.13 U	0.20 J	0.05 J	0.21 U	4.03 U	0.28	0.07 J	0.42 U	0.22	
PC-4	5	3	13.57	0.11 U	0.16 J	0.17 U	0.17 U	3.28 U	0.17 U	0.37 U	0.34 U	0.13 U	
PC-5	1	2	13.63	0.06 U	0.09 U	0.02 J	0.09 U	1.76 U	0.15	0.20 U	0.19 U	0.11	
PC-5	2	2	13.48	0.11 U	0.17 J	0.05 J	0.17 U	3.31 U	0.24	0.37 U	0.35 U	0.16	
PC-5	3	1	13.83	0.06 U	0.27	0.04 J	0.09 U	1.78 U	0.55	0.11 J	0.19 U	0.17	
PC-5	4	3	14.85	0.11 U	0.21	0.17 U	0.17 U	3.28 U	0.17 U	0.37 U	0.34 U	0.10 J	
PC-5	5	1	14.17	0.07 U	0.31	0.05 J	0.11 U	2.17 U	0.25	0.05 J	0.23 U	0.15	

TABLE M.22. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)							
				Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT
Reference	1	3	12.70	0.10 U	0.21	0.15 U	0.15 U	3.02 U	0.15 U	0.34 U	0.32 U
Reference	2	2	14.22	0.06 U	0.11	0.03 J	0.09 U	1.78 U	0.20 U	0.20 U	0.19 U
Reference	3	2	13.74	0.06 U	0.13	0.09 U	0.09 U	1.72 U	0.15	0.19 U	0.18 U
Reference	4	1	14.51	0.11 U	0.31	0.05 J	0.17 U	3.31 U	0.45	0.07 J	0.41
Reference	5	3	14.72	0.11 U	0.18	0.17 U	0.17 U	3.29 U	0.17 U	0.37 U	0.34 U
<i>N. virens</i> Background Rep 1	1	3	14.40	0.12 U	0.16 J	0.18 U	0.18 U	3.51 U	0.18 U	0.40 U	0.37 U
<i>N. virens</i> Background Rep 2	2	3	14.40	0.11 U	0.96	0.18 U	0.18 U	3.45 U	0.18 U	0.39 U	0.36 U
<i>N. virens</i> Background Rep 3	3	3	14.40	0.11 U	0.19	0.17 U	0.17 U	3.26 U	0.17 U	0.37 U	0.34 U
<i>N. virens</i> Control	1	2	14.32	0.06 U	0.14	0.03 J	0.10 U	1.91 U	0.34	0.21 U	0.20 U
<i>N. virens</i> Control	2	3	14.83	0.11 U	0.20	0.17 U	0.17 U	3.29 U	0.17 U	0.37 U	0.35 U
<i>N. virens</i> Control	3	1	13.20	0.10 U	0.32	0.03 J	0.15 U	2.94 U	0.26	0.08 J	0.15 J
<i>N. virens</i> Control	4	1	14.61	0.10 U	0.28	0.06 J	0.15 U	2.92 U	0.29	0.33 U	0.31 U
<i>N. virens</i> Control Rep 1	5	1	14.16	0.16 U	0.99	0.37	0.25 U	4.94 U	0.45	0.56 U	0.52 U
<i>N. virens</i> Control Rep 2	5	1	14.16	0.16 U	1.16	2.81	0.25 U	4.82 U	0.44	0.54 U	0.51 U
<i>N. virens</i> Control Rep 3	5	1	14.16	0.13 U	0.61	0.05 J	0.19 U	3.77 U	0.50	0.11 J	0.08 J

(a) DL Detection limit.

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

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

TABLE M.23. Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)									
				Endo-sulfan I	Endo-sulfan II	Endo-sulfan Sulfate	Endrin Aldehyde	Hepta-chlor Epoxide	Hepta-chlor Lindane	Methoxy-chlor	Toxaphene		
Target DL (a)				20	20	20	10	20	10	20	30		
Achieved High DL				0.50	0.50	0.50	0.21	0.27	0.25	4.96	4.96		
Achieved Low DL				0.17	0.17	0.17	0.07	0.09	0.08	1.65	1.65		
PC-1	1	2	14.15	0.22 U ^(b)	0.22 U	0.22 U	0.06 J ^(c)	0.22 U	0.11 U	0.03 J	2.21 U	2.21 U	
PC-1	2	1	14.04	0.17 U	0.17 U	0.05 J	0.07 U	0.17 U	0.08 U	0.02 J	1.73 U	1.73 U	
PC-1	3	2	12.33	0.24 U	0.24 U	0.24 U	0.10 U	0.24 U	0.13 U	0.03 J	2.38 U	2.38 U	
PC-1	4	1	14.15	0.19 U	0.19 U	0.06 J	0.08 U	0.19 U	0.10 U	0.09 U	1.88 U	1.88 U	
PC-1	5	2	14.17	0.19 U	0.19 U	0.19 U	0.08 U	0.19 U	0.10 U	0.09 U	1.87 U	1.87 U	
PC-1A	1	2	12.85	0.17 U	0.17 U	0.17 U	0.07 U	0.17 U	0.09 U	0.02 J	1.65 U	1.65 U	
PC-1A	2	1	14.13	0.18 U	0.18 U	0.06 J	0.08 U	0.18 U	0.10 U	0.04 J	1.84 U	1.84 U	
PC-1A	3	2	13.54	0.17 U	0.17 U	0.17 U	0.07 U	0.17 U	0.09 U	0.03 J	1.73 U	1.73 U	
PC-1A	4	2	14.01	0.21 U	0.21 U	0.21 U	0.09 U	0.21 U	0.11 U	0.03 J	2.09 U	2.09 U	
PC-1A	5	1	13.40	0.17 U	0.17 U	0.06 J	0.07 U	0.17 U	0.09 U	0.03 J	1.74 U	1.74 U	
PC-2	1	3	14.28	0.45 U	0.45 U	0.45 U	0.19 U	0.45 U	0.25 U	0.23 U	4.52 U	4.52 U	
PC-2	2	2	13.47	0.20 U	0.20 U	0.20 U	0.09 U	0.20 U	0.11 U	0.02 J	2.03 U	2.03 U	
PC-2	3	1	14.07	0.20 U	0.20 U	0.06 J	0.08 U	0.20 U	0.11 U	0.03 J	2.00 U	2.00 U	
PC-2	4	1	13.98	0.18 U	0.18 U	0.07 J	0.08 U	0.18 U	0.10 U	0.03 J	1.81 U	1.81 U	
PC-2	5	1	14.46	0.30 U	0.30 U	0.10 J	0.13 U	0.30 U	0.16 U	0.03 J	2.98 U	2.98 U	
PC-4	1	1	14.33	0.21 U	0.21 U	0.06 J	0.09 U	0.21 U	0.11 U	0.02 J	2.06 U	2.06 U	
PC-4 Rep 1	2	2	14.75	0.49 U	0.49 U	0.49 U	0.21 U	0.49 U	0.27 U	0.03 J	4.94 U	4.94 U	
PC-4 Rep 2	2	2	14.75	0.50 U	0.50 U	0.50 U	0.21 U	0.50 U	0.27 U	0.25 U	4.96 U	4.96 U	
PC-4 Rep 3	2	2	14.75	0.38 U	0.38 U	0.38 U	0.16 U	0.38 U	0.21 U	0.04 J	3.78 U	3.78 U	
PC-4	3	1	14.22	0.20 U	0.20 U	0.05 J	0.08 U	0.20 U	0.11 U	0.02 J	1.97 U	1.97 U	
PC-4 Rep 1	4	2	14.22	0.49 U	0.49 U	0.49 U	0.20 U	0.49 U	0.26 U	0.03 J	4.87 U	4.87 U	
PC-4 Rep 2	4	2	14.22	0.49 U	0.49 U	0.49 U	0.21 U	0.49 U	0.27 U	0.03 J	4.92 U	4.92 U	
PC-4 Rep 3	4	2	14.22	0.40 U	0.40 U	0.40 U	0.17 U	0.40 U	0.22 U	0.03 J	4.03 U	4.03 U	
PC-4	5	3	13.57	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.17 U	3.28 U	3.28 U	
PC-5	1	2	13.63	0.18 U	0.18 U	0.18 U	0.07 U	0.18 U	0.10 U	0.02 J	1.76 U	1.76 U	
PC-5	2	2	13.48	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.05 J	3.31 U	3.31 U	
PC-5	3	1	13.83	0.18 U	0.18 U	0.04 J	0.08 U	0.18 U	0.10 U	0.03 J	1.78 U	1.78 U	
PC-5	4	3	14.85	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.17 U	3.28 U	3.28 U	
PC-5	5	1	14.17	0.22 U	0.22 U	0.08 J	0.09 U	0.22 U	0.12 U	0.03 J	2.17 U	2.17 U	

TABLE M.23. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Pesticides ($\mu\text{g/kg}$ wet weight)									
				Endo-sulfan I	Endo-sulfan II	Endo-sulfate	Endrin	Aldehyde	Hepta-chlor	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxaphene
Reference	1	3	12.70	0.30 U	0.30 U	0.30 U	0.13 U	0.30 U	0.16 U	0.15 U	0.15 U	3.02 U	3.02 U
Reference	2	2	14.22	0.18 U	0.18 U	0.18 U	0.08 U	0.18 U	0.10 U	0.09 U	0.02 J	1.78 U	1.78 U
Reference	3	2	13.74	0.17 U	0.17 U	0.17 U	0.07 U	0.17 U	0.09 U	0.08 U	0.09 U	1.72 U	1.72 U
Reference	4	1	14.51	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.01 J	3.31 U	3.31 U
Reference	5	3	14.72	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U	3.29 U	3.29 U
<i>N. virens</i> Background Rep 1	1	3	14.40	0.35 U	0.35 U	0.35 U	0.15 U	0.35 U	0.19 U	0.17 U	0.18 U	3.51 U	3.51 U
<i>N. virens</i> Background Rep 2	2	3	14.40	0.35 U	0.35 U	0.35 U	0.15 U	0.35 U	0.19 U	0.17 U	0.18 U	3.45 U	3.45 U
<i>N. virens</i> Background Rep 3	3	3	14.40	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U	3.26 U	3.26 U
<i>N. virens</i> Control	1	2	14.32	0.19 U	0.19 U	0.19 U	0.08 U	0.19 U	0.10 U	0.09 U	0.02 J	1.91 U	1.91 U
<i>N. virens</i> Control	2	3	14.83	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U	3.29 U	3.29 U
<i>N. virens</i> Control	3	1	13.20	0.29 U	0.29 U	0.29 U	0.12 U	0.29 U	0.16 U	0.14 U	0.01 J	2.94 U	2.94 U
<i>N. virens</i> Control	4	1	14.61	0.29 U	0.29 U	0.29 U	0.12 U	0.29 U	0.16 U	0.14 U	0.03 J	2.92 U	2.92 U
<i>N. virens</i> Control Rep 1	5	1	14.16	0.49 U	0.22 J	0.16 J	0.21 U	0.49 U	0.44	0.24 U	0.35	4.94 U	4.94 U
<i>N. virens</i> Control Rep 2	5	1	14.16	0.48 U	0.13 J	0.14 J	0.20 U	0.48 U	0.40	0.23 U	1.93	4.82 U	4.82 U
<i>N. virens</i> Control Rep 3	5	1	14.16	0.38 U	0.38 U	0.07 J	0.16 U	0.38 U	0.21 U	0.18 U	0.01 J	3.77 U	3.77 U

(a) DL Detection limit.

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

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

TABLE M.24. Chlorinated Pesticide Analysis (alphabetical, Aldrin - Dieldrin), Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Dry Weight	Percent Dry	<i>N. virens</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)											
					Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Chlordane	DDD	DDE	DDT	Dieldrin			
PC-1	1	2	14.15	0.49 U ^(a)	1.55	0.28 J ^(b)	0.78 U	15.61 U	2.19	0.57 J	1.62 U	0.85				
PC-1	2	1	14.04	0.43 U	7.76	0.43 J	0.64 U	12.32 U	6.70	1.35 U	0.36 J	1.57				
PC-1	3	2	12.33	0.65 U	1.05	0.32 J	0.97 U	19.31 U	1.22	2.19 U	2.03 U	0.97				
PC-1	4	1	14.15	0.42 U	2.33	0.28 J	0.71 U	13.29 U	4.10	0.64 J	0.35 J	0.99				
PC-1	5	2	14.17	0.42 U	0.42 J	0.07 J	0.71 U	13.20 U	0.99	1.48 U	1.41 U	0.28 J				
PC-1A	1	2	12.85	0.47 U	0.62 J	0.16 J	0.62 U	12.84 U	0.62 J	1.48 U	1.32 U	0.54 J				
PC-1A	2	1	14.13	0.42 U	2.12	0.64 J	0.64 U	13.02 U	6.16	0.92 J	1.34 U	1.13				
PC-1A	3	2	13.54	0.44 U	0.89	0.22 J	0.66 U	14.76 U	0.74	1.40 U	1.33 U	0.74				
PC-1A	4	2	14.01	0.50 U	0.86	0.21 J	0.79 U	14.92 U	2.14	0.57 J	1.57 U	1.00				
PC-1A	5	1	13.40	0.45 U	1.87	0.30 J	0.67 U	12.99 U	2.02	0.37 J	0.30 J	1.04				
PC-2	1	3	14.28	1.05 U	1.40 J	1.61 U	1.61 U	31.65 U	1.61 U	3.57 U	3.29 U	1.33 U				
PC-2	2	2	13.47	0.52 U	0.97	0.15 J	0.74 U	15.07 U	0.97	1.71 U	1.56 U	0.59 U				
PC-2	3	1	14.07	0.50 U	3.41	0.43 J	0.71 U	14.21 U	4.90	0.85 J	0.99 J	1.28				
PC-2	4	1	13.98	0.43 U	2.43	0.43 J	0.64 U	12.95 U	3.36	0.57 J	0.36 J	1.07				
PC-2	5	1	14.46	0.69 U	2.08	0.42 J	1.04 U	20.61 U	4.63	1.25 J	2.14 U	1.25				
PC-4	1	1	14.33	0.49 U	2.23	0.42 J	0.77 U	14.38 U	3.21	0.42 J	0.35 J	1.33				
PC-4 Rep 1	2	2	14.75	1.08 U	1.15 J	0.27 J	1.69 U	33.48 U	1.29 J	3.80 U	3.52 U	1.22 J				
PC-4 Rep 2	2	2	14.75	1.08 U	0.75 J	1.69 U	1.69 U	33.62 U	1.69 U	3.80 U	3.52 U	1.49				
PC-4 Rep 3	2	2	14.75	0.88 U	1.29 J	0.34 J	1.29 U	25.62 U	1.63	2.91 U	2.71 U	2.03				
PC-4	3	1	14.22	0.49 U	1.69	0.35 J	0.70 U	13.86 U	1.76	0.35 J	0.28 J	0.77				
PC-4 Rep 1	4	2	14.22	1.13 U	1.27 J	0.63 J	1.76 U	34.24 U	2.95	0.63 J	3.59 U	2.95				
PC-4 Rep 2	4	2	14.22	1.13 U	1.13 J	0.28 J	1.76 U	34.59 U	1.20 J	0.42 J	3.66 U	0.98 J				
PC-4 Rep 3	4	2	14.22	0.91 U	1.41 J	0.35 J	1.48 U	28.34 U	1.97	0.49 J	2.95 U	1.55				
PC-4	5	3	13.57	0.81 U	1.18 J	1.25 U	1.25 U	24.16 U	1.25 U	2.73 U	2.50 U	0.96 U				
PC-5	1	2	13.63	0.44 U	0.66 U	0.15 J	0.66 U	12.91 U	1.10	1.47 U	1.39 U	0.81				
PC-5	2	2	13.48	0.82 U	1.26 J	0.37 J	1.26 U	24.56 U	1.78	2.75 U	2.60 U	1.19				
PC-5	3	1	13.83	0.43 U	1.95	0.29 J	0.65 U	12.87 U	3.98	0.80 J	1.37 U	1.23				
PC-5	4	3	14.85	0.74 U	1.41	1.15 U	1.15 U	22.09 U	1.15 U	2.49 U	2.29 U	0.67 J				
PC-5	5	1	14.17	0.49 U	2.19	0.35 J	0.78 U	15.31 U	1.76	0.35 J	1.62 U	1.06				
Reference	1	3	12.70	0.79 U	1.65	1.18 U	1.18 U	23.78 U	1.18 U	2.68 U	2.52 U	1.18				
Reference	2	2	14.22	0.42 U	0.77	0.21 J	0.63 U	12.51 U	1.41	1.41 U	1.34 U	0.84				
Reference	3	2	13.74	0.44 U	0.95	0.65 U	0.65 U	12.51 U	1.09	1.38 U	1.31 U	0.87				
Reference	4	1	14.51	0.76 U	2.14	0.34 J	1.17 U	22.82 U	3.10	0.48 J	2.83	1.72				
Reference	5	3	14.72	0.75 U	1.22	1.15 U	1.15 U	22.35 U	1.15 U	2.51 U	2.31 U	0.88 U				

TABLE M.24. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
				Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Chlordane	DDD	4,4'-DDE	4,4'-DDT	Dieldrin
<i>N. virens</i> Background Rep 1	1	3	14.40	0.83 U	1.11 J	1.25 U	1.25 U	24.38 U	1.25 U	2.78 U	2.57 U	1.18
<i>N. virens</i> Background Rep 2	2	3	14.40	0.76 U	6.67	1.25 U	1.25 U	23.96 U	1.25 U	2.71 U	2.50 U	0.97 U
<i>N. virens</i> Background Rep 3	3	3	14.40	0.76 U	1.32	1.18 U	1.18 U	22.64 U	1.18 U	2.57 U	2.36 U	1.11
<i>N. virens</i> Control	1	2	14.32	0.42 U	0.98	0.21 J	0.70 U	13.34 U	2.37	1.47 U	1.40 U	0.77
<i>N. virens</i> Control	2	3	14.83	0.74 U	1.35	1.15 U	1.15 U	22.19 U	1.15 U	2.50 U	2.36 U	1.48
<i>N. virens</i> Control	3	1	13.20	0.76 U	2.42	0.23 J	1.14 U	22.27 U	1.97	0.61 J	1.14 J	1.44
<i>N. virens</i> Control	4	1	14.61	0.68 U	1.92	0.41 J	1.03 U	19.99 U	1.99	2.26 U	2.12 U	1.30
<i>N. virens</i> Control Rep 1	5	1	14.16	1.13 U	6.99	2.61	1.77 U	34.88 U	3.18	3.95 U	3.67 U	0.92 J
<i>N. virens</i> Control Rep 2	5	1	14.16	1.13 U	8.19	19.84	1.77 U	34.04 U	3.11	3.81 U	3.60 U	1.48
<i>N. virens</i> Control Rep 3	5	1	14.16	0.92 U	4.31	0.35 J	1.34 U	26.62 U	3.53	0.78 J	0.56 J	1.41

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

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

TABLE M.25. Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene), Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Percent Dry Weight			<i>N. virens</i> Pesticides ($\mu\text{g/kg}$ dry weight)								
	Replicate	Batch	Weight	Endo-sulfan I	Endo-sulfan II	Endo-sulfate	Endrin Aldehyde	Hepta-chlor Epoxide	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxaphene
PC-1	1	2	14.15	1.55 U ^(a)	1.55 U	1.55 U	0.42 J ^(b)	0.85 U	0.78 U	0.21 J	15.61 U	15.61 U
	2	1	14.04	1.21 U	1.21 U	0.36 J	0.50 U	0.64 U	0.57 U	0.14 J	12.32 U	12.32 U
	3	2	12.33	1.95 U	1.95 U	1.95 U	0.81 U	1.05 U	0.89 U	0.24 J	19.31 U	19.31 U
	4	1	14.15	1.34 U	1.34 U	0.42 J	0.57 U	0.71 U	0.64 U	0.71 U	13.29 U	13.29 U
	5	2	14.17	1.34 U	1.34 U	1.34 U	0.56 U	0.71 U	0.64 U	0.14 J	13.20 U	13.20 U
PC-1A	1	2	12.85	1.32 U	1.32 U	1.32 U	0.54 U	0.70 U	0.62 U	0.16 J	12.84 U	12.84 U
	2	1	14.13	1.27 U	1.27 U	0.42 J	0.57 U	0.71 U	0.64 U	0.28 J	13.02 U	13.02 U
	3	2	13.54	1.26 U	1.26 U	1.26 U	0.52 U	0.66 U	0.59 U	0.22 J	12.78 U	12.78 U
	4	2	14.01	1.50 U	1.50 U	1.50 U	0.64 U	0.79 U	0.71 U	0.21 J	14.92 U	14.92 U
	5	1	13.40	1.27 U	1.27 U	0.45 J	0.52 U	0.67 U	0.60 U	0.22 J	12.99 U	12.99 U
PC-2	1	3	14.28	3.15 U	3.15 U	3.15 U	1.33 U	1.75 U	1.54 U	1.61 U	31.65 U	31.65 U
	2	2	13.47	1.48 U	1.48 U	1.48 U	0.67 U	0.82 U	0.74 U	0.15 J	15.07 U	15.07 U
	3	1	14.07	1.42 U	1.42 U	0.43 J	0.57 U	0.78 U	0.71 U	0.21 J	14.21 U	14.21 U
	4	1	13.98	1.29 U	1.29 U	0.50 J	0.57 U	0.72 U	0.64 U	0.21 J	12.95 U	12.95 U
	5	1	14.46	2.08 U	2.08 U	0.69 J	0.90 U	1.11 U	0.97 U	0.21 J	20.61 U	20.61 U
PC-4	1	1	14.33	1.47 U	1.47 U	0.42 J	0.63 U	0.77 U	0.70 U	0.14 J	14.38 U	14.38 U
	2	2	14.75	3.32 U	3.32 U	3.32 U	1.42 U	1.83 U	1.63 U	0.20 J	33.48 U	33.48 U
	2	2	14.75	3.39 U	3.39 U	3.39 U	1.42 U	1.83 U	1.63 U	1.69 U	33.62 U	33.62 U
	2	2	14.75	2.58 U	2.58 U	2.58 U	1.08 U	1.42 U	1.22 U	0.27 J	25.62 U	25.62 U
	3	1	14.22	1.41 U	1.41 U	0.35 J	0.56 U	0.77 U	0.70 U	0.14 J	13.86 U	13.86 U
PC-4 Rep 1	4	2	14.22	3.45 U	3.45 U	3.45 U	1.41 U	1.83 U	1.62 U	0.21 J	34.24 U	34.24 U
	4	2	14.22	3.45 U	3.45 U	3.45 U	1.48 U	1.90 U	1.69 U	0.21 J	34.59 U	34.59 U
	4	2	14.22	2.81 U	2.81 U	2.81 U	1.20 U	1.55 U	1.34 U	0.21 J	28.34 U	28.34 U
	4	2	14.22	2.81 U	2.81 U	2.81 U	1.20 U	1.55 U	1.34 U	0.21 J	28.34 U	28.34 U
	5	3	13.57	2.43 U	2.43 U	2.43 U	1.03 U	1.33 U	1.18 U	1.25 U	24.16 U	24.16 U
PC-5	1	2	13.63	1.32 U	1.32 U	1.32 U	0.51 U	0.73 U	0.66 U	0.15 J	12.91 U	12.91 U
	2	2	13.48	2.45 U	2.45 U	2.45 U	1.04 U	1.34 U	1.19 U	0.37 J	24.56 U	24.56 U
	3	1	13.83	1.30 U	1.30 U	0.29 J	0.58 U	0.72 U	0.65 U	0.22 J	12.87 U	12.87 U
	4	3	14.85	2.22 U	2.22 U	2.22 U	0.94 U	1.21 U	1.08 U	1.15 U	22.09 U	22.09 U
	5	1	14.17	1.55 U	1.55 U	0.56 J	0.63 U	0.85 U	0.71 U	0.21 J	15.31 U	15.31 U
Reference	1	3	12.70	2.36 U	2.36 U	2.36 U	1.02 U	1.26 U	1.18 U	1.18 U	23.78 U	23.78 U
	2	2	14.22	1.27 U	1.27 U	1.27 U	0.56 U	0.70 U	0.63 U	0.14 J	12.51 U	12.51 U
	3	2	13.74	1.24 U	1.24 U	1.24 U	0.51 U	0.65 U	0.58 U	0.65 U	12.51 U	12.51 U
	4	1	14.51	2.27 U	2.27 U	0.48 J	0.97 U	1.24 U	1.10 U	0.07 J	22.82 U	22.82 U
	5	3	14.72	2.24 U	2.24 U	2.24 U	0.95 U	1.22 U	1.09 U	1.15 U	22.35 U	22.35 U

TABLE M.25. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> Pesticides ($\mu\text{g}/\text{kg}$ dry weight)									
				Endo- sulfan I	Endo- sulfan II	Endo- sulfate	Endrin	Endrin Aldehyde	Hepta- chlor	Hepta- chlor Epoxide	Lindane	Methoxy- chlor	Toxaphene
<i>N. virens</i> Background Rep 1	1	3	14.40	2.43 U	2.43 U	2.43 U	1.04 U	2.43 U	1.32 U	1.18 U	1.25 U	24.38 U	24.38 U
<i>N. virens</i> Background Rep 2	2	3	14.40	2.43 U	2.43 U	2.43 U	1.04 U	2.43 U	1.32 U	1.18 U	1.25 U	23.96 U	23.96 U
<i>N. virens</i> Background Rep 3	3	3	14.40	2.29 U	2.29 U	2.29 U	0.97 U	2.29 U	1.25 U	1.11 U	1.18 U	22.64 U	22.64 U
<i>N. virens</i> Control	1	2	14.32	1.33 U	1.33 U	1.33 U	0.56 U	1.33 U	0.70 U	0.63 U	0.14 J	13.34 U	13.34 U
<i>N. virens</i> Control	2	3	14.83	2.23 U	2.23 U	2.23 U	0.94 U	2.23 U	1.21 U	1.08 U	1.15 U	22.19 U	22.19 U
<i>N. virens</i> Control	3	1	13.20	2.20 U	2.20 U	0.76 J	0.91 U	2.20 U	1.21 U	1.06 U	0.08 J	22.27 U	22.27 U
<i>N. virens</i> Control	4	1	14.61	1.99 U	1.99 U	0.75 J	0.82 U	1.99 U	1.10 U	0.96 U	0.21 J	19.99 U	19.99 U
<i>N. virens</i> Control Rep 1	5	1	14.16	3.46 U	1.55 J	1.13 J	1.48 U	3.46 U	3.11	1.69 U	2.47	34.88 U	34.88 U
<i>N. virens</i> Control Rep 2	5	1	14.16	3.39 U	0.92 J	0.99 J	1.41 U	3.39 U	2.82	1.62 U	13.63	34.04 U	34.04 U
<i>N. virens</i> Control Rep 3	5	1	14.16	2.68 U	2.68 U	0.49 J	1.13 U	2.68 U	1.48 U	1.27 U	0.07 J	26.62 U	26.62 U

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

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

TABLE M.26. Quality Control Data for Chlorinated Pesticide Analysis (alphabetical, Aldrin - Dieldrin), Wet Weight, in Tissue of *N. Virens*, Panama City Harbor Project

Sediment Treatment	<i>N. virens</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)										
	Replicate	Batch	Aldrin	Alpha- BHC	Beta- BHC	Delta- BHC	Chlordane	4,4'- DDD	4,4'- DDE	4,4'- DDT	Dieldrin
Method Blanks											
Blank		1	0.08 U(a)	0.12 U	0.12 U	0.12 U	2.33 U	0.12 U	0.26 U	0.24 U	0.10 U
Blank		2	0.08 U	0.12 U	0.12 U	0.12 U	2.42 U	0.12 U	0.27 U	0.25 U	0.10 U
Blank		3	0.11 U	0.17 U	0.17 U	0.17 U	3.28 U	0.17 U	0.37 U	0.34 U	0.13 U
Matrix Spikes											
PC-2	1	3	0.15 U	0.20 J(b)	0.23 U	0.23 U	4.52 U	0.23 U	0.51 U	0.47 U	0.19 U
PC-2 MS	1	3	4.20	3.60	4.33	3.13	NA (c)	3.40	3.34	3.62	3.11
Concentration Recovered			4.20	3.40	4.33	3.13	NA	3.40	3.34	3.62	3.11
Amount Spiked			4.76	5.01	4.76	4.77	NS (d)	4.76	4.76	4.77	4.76
Percent Recovery			88%	68%	91%	66%	NA	71%	70%	76%	65%
PC-5	2	2	0.11 U	0.17 J	0.05 J	0.17 U	3.31 U	0.24	0.37 U	0.35 U	0.16
PC-5 MS	2	2	12.72	7.97	8.96	7.77	NA	10.98	9.67	9.07	9.33
Concentration Recovered			12.72	7.80	8.91	7.77	NA	10.74	9.67	9.07	9.17
Amount Spiked			9.51	10.00	9.51	9.51	NS	9.51	9.51	9.51	9.51
Percent Recovery			134% (e)	78%	94%	82%	NA	113%	102%	95%	96%
Reference	4	1	0.11 U	0.31	0.05 J	0.17 U	3.31 U	0.45	0.07 J	0.41	0.25
Reference MS	4	1	12.22	11.77	11.36	17.59	NA	22.71	16.60	15.26	13.06
Concentration Recovered			12.22	11.46	11.31	17.59	NA	22.26	16.53	14.85	12.81
Amount Spiked			9.60	10.11	9.60	9.60	NS	9.60	9.60	9.61	9.60
Percent Recovery			127% (e)	113%	118%	183% (e)	NA	232% (e)	172% (e)	155% (e)	133% (e)
<i>N. virens</i> Control	4	1	0.10 U	0.28	0.06 J(b)	0.15 U	2.92 U	0.29	0.33 U	0.31 U	0.19
<i>N. virens</i> Control MS	4	1	10.55	10.45	10.57	14.06	NA	14.57	11.89	11.26	10.01
Concentration Recovered			10.55	10.17	10.51	14.06	NA	14.28	11.89	11.26	9.82
Amount Spiked			10.54	11.09	10.54	10.54	NS	10.54	10.54	10.55	10.54
Percent Recovery			100%	92%	100%	133% (e)	NA	135% (e)	113%	107%	93%

TABLE M.26. (contd)

Sediment Treatment	<i>N. virens</i> Pesticides ($\mu\text{g}/\text{kg}$ wet weight)										
	Replicate	Batch	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin
Analytical Replicates											
PC-4 Rep 1	2	2	0.16 U	0.17 J	0.04 J	0.25 U	4.94 U	0.19 J	0.56 U	0.52 U	0.18 J
PC-4 Rep 2	2	2	0.16 U	0.11 J	0.25 U	0.25 U	4.96 U	0.25 U	0.56 U	0.52 U	0.22
PC-4 Rep 3	2	2	0.13 U	0.19 J	0.05 J	0.19 U	3.78 U	0.24	0.43 U	0.40 U	0.30
RSD			NA	27%	NA	NA	NA	NA	NA	NA	26%
PC-4 Rep 1	4	2	0.16 U	0.18 J	0.09 J	0.25 U	4.87 U	0.42	0.09 J	0.51 U	0.42
PC-4 Rep 2	4	2	0.16 U	0.16 J	0.04 J	0.25 U	4.92 U	0.17 J	0.06 J	0.52 U	0.14 J
PC-4 Rep 3	4	2	0.13 U	0.20 J	0.05 J	0.21 U	4.03 U	0.28	0.07 J	0.42 U	0.22
RSD			NA	11%	44% (f)	NA	NA	43% (f)	21%	NA	55% (f)
<i>N. virens</i> Background Rep 1	1	3	0.12 U	0.16 J	0.18 U	0.18 U	3.51 U	0.18 U	0.40 U	0.37 U	0.17
<i>N. virens</i> Background Rep 2	2	3	0.11 U	0.96	0.18 U	0.18 U	3.45 U	0.18 U	0.39 U	0.36 U	0.14 U
<i>N. virens</i> Background Rep 3	3	3	0.11 U	0.19	0.17 U	0.17 U	3.26 U	0.17 U	0.37 U	0.34 U	0.16
RSD			NA	104% (f)	NA	NA	NA	NA	NA	NA	NA
<i>N. virens</i> Control Rep 1	5	1	0.16 U	0.99	0.37	0.25 U	4.94 U	0.45	0.56 U	0.52 U	0.13 J
<i>N. virens</i> Control Rep 2	5	1	0.16 U	1.16	2.81	0.25 U	4.82 U	0.44	0.54 U	0.51 U	0.21
<i>N. virens</i> Control Rep 3	5	1	0.13 U	0.61	0.05 J	0.19 U	3.77 U	0.50	0.11 J	0.08 J	0.20
RSD			NA	31% (f)	140% (f)	NA	NA	7%	NA	NA	24%

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

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

(c) NA Not applicable.

(d) NS Not spiked.

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

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

TABLE M.27. Quality Control Data for Chlorinated Pesticide Analysis (alphabetical, Endosulfan I - Toxaphene), Wet Weight, in Tissue of *N. virans*, Panama City Harbor Project

Sediment Treatment	<i>N. virans</i> Pesticides ($\mu\text{g/kg}$ wet weight)											
	Replicate	Batch	Endo-sulfan I	Endo-sulfan II	Endo-sulfan Sulfate	Endrin	Endrin Aldehyde	Hepta-chlor	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxaphene
Method Blanks												
Blank		1	0.23 U(a)	0.23 U	0.23 U	0.10 U	0.23 U	0.13 U	0.11 U	0.12 U	2.33 U	2.33 U
Blank		2	0.24 U	0.24 U	0.24 U	0.10 U	0.24 U	0.13 U	0.12 U	0.12 U	2.42 U	2.42 U
Blank		3	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U	3.28 U	3.28 U
Matrix Spikes												
PC-2	1	3	0.45 U	0.45 U	0.45 U	0.19 U	0.45 U	0.25 U	0.22 U	0.23 U	4.52 U	4.52 U
PC-2 MS	1	3	2.10	3.43	2.22	3.11	0.47	5.90	3.33	3.41	4.73	NA(b)
Concentration Recovered			2.10	3.43	2.22	3.11	0.47	5.90	3.33	3.41	4.73	NA
Amount Spiked			4.76	4.76	4.76	4.88	4.76	4.76	4.77	4.76	4.76	NS(c)
Percent Recovery			44%	72%	47%	64%	10%	124%(d)	70%	72%	99%	NA
PC-5	2	2	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.05 J(e)	3.31 U	3.31 U
PC-5 MS	2	2	6.34	9.51	5.42	9.56	0.14	9.14	9.28	9.63	6.40	NA
Concentration Recovered			6.34	9.51	5.42	9.56	0.14	9.14	9.28	9.58	6.40	NA
Amount Spiked			9.51	9.51	9.51	9.73	9.50	9.51	9.51	9.51	9.51	NS
Percent Recovery			67%	100%	57%	98%	1%(d)	96%	98%	101%	67%	NA
Reference	4	1	0.33 U	0.33 U	0.07 J	0.14 U	0.33 U	0.18 U	0.16 U	0.01 J	3.31 U	3.31 U
Reference MS	4	1	9.55	11.51	8.16	13.98	NA	12.01	10.34	13.87	6.46	NA
Concentration Recovered			9.55	11.51	8.09	13.98	NA	12.01	10.34	13.86	6.46	NA
Amount Spiked			9.60	9.60	9.60	9.83	9.60	9.60	9.61	9.60	9.60	NS
Percent Recovery			99%	120%	84%	142%(d)	NA	125%(d)	108%	144%(d)	67%	NA
<i>N. virans</i> Control	4	1	0.29 U	0.29 U	0.11 J	0.12 U	0.29 U	0.16 U	0.14 U	0.03 J	2.92 U	2.92 U
<i>N. virans</i> Control MS	4	1	7.96	10.18	6.54	11.39	6.81	10.27	8.76	11.98	4.94	NA
Concentration Recovered			7.96	10.18	6.43	11.39	6.81	10.27	8.76	11.95	4.94	NA
Amount Spiked			10.54	10.54	10.54	10.79	10.54	10.54	10.55	10.54	10.54	NS
Percent Recovery			76%	97%	61%	106%	65%	97%	83%	113%	47%	NA

TABLE M.27. (contd)

Sediment Treatment	<i>N. virens</i> Pesticides ($\mu\text{g/kg}$ wet weight)										
	Replicate	Batch	Endo-sulfan I	Endo-sulfan II	Endo-sulfan Sulfate	Endrin Aldehyde	Hepta-chlor	Hepta-chlor Epoxide	Lindane	Methoxy-chlor	Toxaphene
Analytical Replicates											
PC-4 Rep 1	2	2	0.49 U	0.49 U	0.49 U	0.21 U	0.49 U	0.27 U	0.24 U	0.03 J	4.94 U
PC-4 Rep 2	2	2	0.50 U	0.50 U	0.50 U	0.21 U	0.50 U	0.27 U	0.24 U	0.25 U	4.96 U
PC-4 Rep 3	2	2	0.38 U	0.38 U	0.38 U	0.16 U	0.38 U	0.21 U	0.18 U	0.04 J	3.78 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
PC-4 Rep 1	4	2	0.49 U	0.49 U	0.49 U	0.20 U	0.49 U	0.26 U	0.23 U	0.03 J	4.87 U
PC-4 Rep 2	4	2	0.49 U	0.49 U	0.49 U	0.21 U	0.49 U	0.27 U	0.24 U	0.03 J	4.92 U
PC-4 Rep 3	4	2	0.40 U	0.40 U	0.40 U	0.17 U	0.40 U	0.22 U	0.19 U	0.03 J	4.03 U
RSD			NA	NA	NA	NA	NA	NA	NA	0%	NA
<i>N. virens</i> Background Rep 1	1	3	0.35 U	0.35 U	0.35 U	0.15 U	0.35 U	0.19 U	0.17 U	0.18 U	3.51 U
<i>N. virens</i> Background Rep 2	2	3	0.35 U	0.35 U	0.35 U	0.15 U	0.35 U	0.19 U	0.17 U	0.18 U	3.45 U
<i>N. virens</i> Background Rep 3	3	3	0.33 U	0.33 U	0.33 U	0.14 U	0.33 U	0.18 U	0.16 U	0.17 U	3.26 U
RSD			NA	NA	NA	NA	NA	NA	NA	NA	NA
<i>N. virens</i> Control Rep 1	5	1	0.49 U	0.22 J	0.16 J	0.21 U	0.49 U	0.44	0.24 U	0.35	4.94 U
<i>N. virens</i> Control Rep 2	5	1	0.48 U	0.13 J	0.14 J	0.20 U	0.48 U	0.40	0.23 U	1.93	4.82 U
<i>N. virens</i> Control Rep 3	5	1	0.38 U	0.38 U	0.07 J	0.16 U	0.38 U	0.21 U	0.18 U	0.01 J	3.77 U
RSD			NA	NA	38%(f)	NA	NA	NA	NA	134%(f)	NA

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

(b) NA Not applicable.

(c) NS Not spiked.

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

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

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

TABLE M.28. Polychlorinated Biphenyl (PCB) Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> PCBs ($\mu\text{g}/\text{kg}$ wet weight)					
				Aroclor 1221	Aroclor 1232	Aroclor 1242/1016	Aroclor 1248	Aroclor 1254	Aroclor 1260
Target DL (a)				20	20	20	20	20	20
Achieved High DL				4.96	4.96	4.96	4.96	4.96	4.96
Achieved Low DL				1.65	1.65	1.65	1.65	1.65	1.65
PC-1	1	2	14.15	2.21 U ^(b)	2.21 U	2.21 U	2.21 U	2.21 U	13.86
PC-1	2	1	14.04	1.73 U	1.73 U	1.73 U	1.73 U	1.73 U	29.53
PC-1	3	2	12.33	2.38 U	2.38 U	2.38 U	2.38 U	2.38 U	13.88
PC-1	4	1	14.15	1.88 U	1.88 U	1.88 U	1.88 U	1.88 U	22.44
PC-1	5	2	14.17	1.87 U	1.87 U	1.87 U	1.87 U	1.87 U	7.47
PC-1A	1	2	12.85	1.65 U	1.65 U	1.65 U	1.65 U	1.65 U	7.20
PC-1A	2	1	14.13	1.84 U	1.84 U	1.84 U	1.84 U	1.84 U	27.30
PC-1A	3	2	13.54	1.73 U	1.73 U	1.73 U	1.73 U	1.73 U	9.83
PC-1A	4	2	14.01	2.09 U	2.09 U	2.09 U	2.09 U	2.09 U	12.38
PC-1A	5	1	13.40	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	25.15
PC-2	1	3	14.28	4.52 U	4.52 U	4.52 U	4.52 U	4.52 U	8.93
PC-2	2	2	13.47	2.03 U	2.03 U	2.03 U	2.03 U	2.03 U	9.78
PC-2	3	1	14.07	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	31.13
PC-2	4	1	13.98	1.81 U	1.81 U	1.81 U	1.81 U	1.81 U	28.18
PC-2	5	1	14.46	2.98 U	2.98 U	2.98 U	2.98 U	2.98 U	30.41
PC-4	1	1	14.33	2.06 U	2.06 U	2.06 U	2.06 U	2.06 U	27.92
PC-4 Rep 1	2	2	14.75	4.94 U	4.94 U	4.94 U	4.94 U	4.94 U	14.29
PC-4 Rep 2	2	2	14.75	4.96 U	4.96 U	4.96 U	4.96 U	4.96 U	30.34
PC-4 Rep 3	2	2	14.75	3.78 U	3.78 U	3.78 U	3.78 U	3.78 U	18.03
PC-4	3	1	14.22	1.97 U	1.97 U	1.97 U	1.97 U	1.97 U	25.26
PC-4 Rep 1	4	2	14.22	4.87 U	4.87 U	4.87 U	4.87 U	4.87 U	18.89
PC-4 Rep 2	4	2	14.22	4.92 U	4.92 U	4.92 U	4.92 U	4.92 U	14.48
PC-4 Rep 3	4	2	14.22	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	18.69
PC-4	5	3	13.57	3.28 U	3.28 U	3.28 U	3.28 U	3.28 U	17.21
PC-5	1	2	13.63	1.76 U	1.76 U	1.76 U	1.76 U	1.76 U	8.94
PC-5	2	2	13.48	3.31 U	3.31 U	3.31 U	3.31 U	3.31 U	15.37
PC-5	3	1	13.83	1.78 U	1.78 U	1.78 U	1.78 U	1.78 U	22.61
PC-5	4	3	14.85	3.28 U	3.28 U	3.28 U	3.28 U	3.28 U	19.06
PC-5	5	1	14.17	2.17 U	2.17 U	2.17 U	2.17 U	2.17 U	22.49
Reference	1	3	12.70	3.02 U	3.02 U	3.02 U	3.02 U	3.02 U	20.15
Reference	2	2	14.22	1.78 U	1.78 U	1.78 U	1.78 U	1.78 U	10.33
Reference	3	2	13.74	1.72 U	1.72 U	1.72 U	1.72 U	1.72 U	11.60
Reference	4	1	14.51	3.31 U	3.31 U	3.31 U	3.31 U	3.31 U	39.38
Reference	5	3	14.72	3.29 U	3.29 U	3.29 U	3.29 U	3.29 U	13.42
<i>N. virens</i> Background Rep 1	1	3	14.40	3.51 U	3.51 U	3.51 U	3.51 U	3.51 U	21.44
<i>N. virens</i> Background Rep 2	2	3	14.40	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	19.50
<i>N. virens</i> Background Rep 3	3	3	14.40	3.26 U	3.26 U	3.26 U	3.26 U	3.26 U	22.05

TABLE M.28. (contd)

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> PCBs ($\mu\text{g/kg}$ wet weight)					
				Aroclor 1221	Aroclor 1232	Aroclor 1242/1016	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>N. virens</i> Control	1	2	14.32	1.91 U	1.91 U	1.91 U	1.91 U	1.91 U	33.47
<i>N. virens</i> Control	2	3	14.83	3.29 U	3.29 U	3.29 U	3.29 U	3.29 U	25.02
<i>N. virens</i> Control	3	1	13.20	2.94 U	2.94 U	2.94 U	2.94 U	2.94 U	23.56
<i>N. virens</i> Control	4	1	14.61	2.92 U	2.92 U	2.92 U	2.92 U	2.92 U	27.91
<i>N. virens</i> Control Rep 1	5	1	14.16	4.94 U	4.94 U	4.94 U	4.94 U	4.94 U	27.84
<i>N. virens</i> Control Rep 2	5	1	14.16	4.82 U	4.82 U	4.82 U	4.82 U	4.82 U	28.75
<i>N. virens</i> Control Rep 3	5	1	14.16	3.77 U	3.77 U	3.77 U	3.77 U	3.77 U	28.26

(a) DL Detection limit.

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

TABLE M.29. Polychlorinated Biphenyl (PCB) Analysis, Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	Percent Dry Weight	<i>N. virens</i> PCBs ($\mu\text{g/kg}$ dry Weight)					
				Aroclor 1221	Aroclor 1232	Aroclor 1242/1016	Aroclor 1248	Aroclor 1254	Aroclor 1260
PC-1	1	2	14.15	15.61 U ^(a)	15.61 U	15.61 U	15.61 U	15.61 U	97.92
PC-1	2	1	14.04	12.32 U	12.32 U	12.32 U	12.32 U	12.32 U	210.36
PC-1	3	2	12.33	19.31 U	19.31 U	19.31 U	19.31 U	19.31 U	112.59
PC-1	4	1	14.15	13.29 U	13.29 U	13.29 U	13.29 U	13.29 U	158.58
PC-1	5	2	14.17	13.20 U	13.20 U	13.20 U	13.20 U	13.20 U	52.71
PC-1A	1	2	12.85	12.84 U	12.84 U	12.84 U	12.84 U	12.84 U	56.03
PC-1A	2	1	14.13	13.02 U	13.02 U	13.02 U	13.02 U	13.02 U	193.15
PC-1A	3	2	13.54	12.78 U	12.78 U	12.78 U	12.78 U	12.78 U	72.59
PC-1A	4	2	14.31	14.92 U	14.92 U	14.92 U	14.92 U	14.92 U	88.38
PC-1A	5	1	13.40	12.99 U	12.99 U	12.99 U	12.99 U	12.99 U	187.70
PC-2	1	3	14.28	31.65 U	31.65 U	31.65 U	31.65 U	31.65 U	62.54
PC-2	2	2	13.47	15.07 U	15.07 U	15.07 U	15.07 U	15.07 U	72.61
PC-2	3	1	14.07	14.21 U	14.21 U	14.21 U	14.21 U	14.21 U	221.22
PC-2	4	1	13.98	12.95 U	12.95 U	12.95 U	12.95 U	12.95 U	201.56
PC-2	5	1	14.46	20.61 U	20.61 U	20.61 U	20.61 U	20.61 U	210.36
PC-4	1	1	14.33	14.38 U	14.38 U	14.38 U	14.38 U	14.38 U	194.84
PC-4 Rep 1	2	2	14.75	33.48 U	33.48 U	33.48 U	33.48 U	33.48 U	96.86
PC-4 Rep 2	2	2	14.75	33.62 U	33.62 U	33.62 U	33.62 U	33.62 U	205.64
PC-4 Rep 3	2	2	14.75	25.62 U	25.62 U	25.62 U	25.62 U	25.62 U	122.20
PC-4	3	1	14.22	13.86 U	13.86 U	13.86 U	13.86 U	13.86 U	177.67
PC-4 Rep 1	4	2	14.22	34.24 U	34.24 U	34.24 U	34.24 U	34.24 U	132.82
PC-4 Rep 2	4	2	14.22	34.59 U	34.59 U	34.59 U	34.59 U	34.59 U	101.81
PC-4 Rep 3	4	2	14.22	28.34 U	28.34 U	28.34 U	28.34 U	28.34 U	131.42
PC-4	5	3	13.57	24.16 U	24.16 U	24.16 U	24.16 U	24.16 U	126.79
PC-5	1	2	13.63	12.91 U	12.91 U	12.91 U	12.91 U	12.91 U	65.60
PC-5	2	2	13.48	24.56 U	24.56 U	24.56 U	24.56 U	24.56 U	114.05
PC-5	3	1	13.83	12.87 U	12.87 U	12.87 U	12.87 U	12.87 U	163.49
PC-5	4	3	14.85	22.09 U	22.09 U	22.09 U	22.09 U	22.09 U	128.39
PC-5	5	1	14.17	15.31 U	15.31 U	15.31 U	15.31 U	15.31 U	158.66
Reference	1	3	12.70	23.78 U	23.78 U	23.78 U	23.78 U	23.78 U	158.65
Reference	2	2	14.22	12.51 U	12.51 U	12.51 U	12.51 U	12.51 U	72.62
Reference	3	2	13.74	12.51 U	12.51 U	12.51 U	12.51 U	12.51 U	84.40
Reference	4	1	14.51	22.82 U	22.82 U	22.82 U	22.82 U	22.82 U	271.46
Reference	5	3	14.72	22.35 U	22.35 U	22.35 U	22.35 U	22.35 U	91.16
<i>N. virens</i> Background Rep 1	1	3	14.40	24.38 U	24.38 U	24.38 U	24.38 U	24.38 U	148.90
<i>N. virens</i> Background Rep 2	2	3	14.40	23.96 U	23.96 U	23.96 U	23.96 U	23.96 U	135.43
<i>N. virens</i> Background Rep 3	3	3	14.40	22.64 U	22.64 U	22.64 U	22.64 U	22.64 U	153.14
<i>N. virens</i> Control	1	2	14.32	13.34 U	13.34 U	13.34 U	13.34 U	13.34 U	233.71
<i>N. virens</i> Control	2	3	14.83	22.19 U	22.19 U	22.19 U	22.19 U	22.19 U	168.75
<i>N. virens</i> Control	3	1	13.20	22.27 U	22.27 U	22.27 U	22.27 U	22.27 U	178.43
<i>N. virens</i> Control	4	1	14.61	19.99 U	19.99 U	19.99 U	19.99 U	19.99 U	191.06
<i>N. virens</i> Control Rep 1	5	1	14.16	34.88 U	34.88 U	34.88 U	34.88 U	34.88 U	196.60
<i>N. virens</i> Control Rep 2	5	1	14.16	34.04 U	34.04 U	34.04 U	34.04 U	34.04 U	203.02
<i>N. virens</i> Control Rep 3	5	1	14.16	26.62 U	26.62 U	26.62 U	26.62 U	26.62 U	199.56

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

TABLE M.30. Quality Control Data for Polychlorinated Biphenyl (PCB) Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

			<i>N. virens</i> PCBs ($\mu\text{g}/\text{kg}$ wet weight)					
<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Aroclor 1221</u>	<u>Aroclor 1232</u>	<u>Aroclor 1242/1016</u>	<u>Aroclor 1248</u>	<u>Aroclor 1254</u>	<u>Aroclor 1260</u>
<u>Method Blanks</u>								
Blank		1	2.33 U ^(a)	2.33 U	2.33 U	2.33 U	2.33 U	2.33 U
Blank		2	2.42 U	2.42 U	2.42 U	2.42 U	2.42 U	2.42 U
Blank		3	3.28 U	3.28 U	3.28 U	3.28 U	3.28 U	3.28 U
<u>Matrix Spikes</u>								
PC-2	1	3	4.52 U ^(b)	4.52 U	4.52 U	4.52 U	4.52 U	8.93
PC-2 MS	1	3	NA ^(b)	NA	NA	NA	75.86	NA
Concentration Recovered			NA	NA	NA	NA	75.86	NA
Amount Spiked			NS ^(c)	NS	NS	NS	53.59	NS
Percent Recovery			NA	NA	NA	NA	142% ^(d)	NA
PC-5	2	2	3.31 U	3.31 U	3.31 U	3.31 U	3.31 U	15.37
PC-5 MS	2	2	NA	NA	NA	NA	33.52	NA
Concentration Recovered			NA	NA	NA	NA	33.52	NA
Amount Spiked			NS	NS	NS	NS	43.57	NS
Percent Recovery			NA	NA	NA	NA	77%	NA
Reference	4	1	3.31 U	3.31 U	3.31 U	3.31 U	3.31 U	39.38
Reference MS	4	1	NA	NA	NA	NA	139.4	NA
Concentration Recovered			NA	NA	NA	NA	139.4	NA
Amount Spiked			NS	NS	NS	NS	44.02	NS
Percent Recovery			NA	NA	NA	NA	317% ^(d)	NA
<i>N. virens</i> Control	4	1	2.92 U	2.92 U	2.92 U	2.92 U	2.92 U	27.91
<i>N. virens</i> Control MS	4	1	NA	NA	NA	NA	73.88	NA
Concentration Recovered			NA	NA	NA	NA	73.88	NA
Amount Spiked			NS	NS	NS	NS	48.31	NS
Percent Recovery			NA	NA	NA	NA	153% ^(d)	NA
<u>Analytical Replicates</u>								
PC-4 Rep 1	2	2	4.94 U	4.94 U	4.94 U	4.94 U	4.94 U	14.29
PC-4 Rep 2	2	2	4.96 U	4.96 U	4.96 U	4.96 U	4.96 U	30.34
PC-4 Rep 3	2	2	3.78 U	3.78 U	3.78 U	3.78 U	3.78 U	18.03
RSD			NA	NA	NA	NA	NA	40% ^(e)
PC-4 Rep 1	4	2	4.87 U	4.87 U	4.87 U	4.87 U	4.87 U	18.89
PC-4 Rep 2	4	2	4.92 U	4.92 U	4.92 U	4.92 U	4.92 U	14.48
PC-4 Rep 3	4	2	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	18.69
RSD			NA	NA	NA	NA	NA	14%

TABLE M.30. (contd)

Sediment Treatment	Replicate	Batch	<i>N. virens</i> PCBs ($\mu\text{g}/\text{kg}$ wet weight)					
			Aroclor 1221	Aroclor 1232	Aroclor 1242/1016	Aroclor 1248	Aroclor 1254	Aroclor 1260
<i>N. virens</i> Background Rep 1	1	3	3.51 U	3.51 U	3.51 U	3.51 U	3.51 U	21.44
<i>N. virens</i> Background Rep 2	2	3	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	19.50
<i>N. virens</i> Background Rep 3	3	3	3.26 U	3.26 U	3.26 U	3.26 U	3.26 U	22.05
RSD			NA	NA	NA	NA	NA	6%
<i>N. virens</i> Control Rep 1	5	1	4.94 U	4.94 U	4.94 U	4.94 U	4.94 U	27.84
<i>N. virens</i> Control Rep 2	5	1	4.82 U	4.82 U	4.82 U	4.82 U	4.82 U	28.75
<i>N. virens</i> Control Rep 3	5	1	3.77 U	3.77 U	3.77 U	3.77 U	3.77 U	28.26
RSD			NA	NA	NA	NA	NA	2%

- (a) U Analyte was not present above the associated value.
 (b) NA Not applicable.
 (c) NS Not spiked.
 (d) Recovery outside quality control range (40%-120%).
 (e) Value exceeds relative precision goal of $\leq 30\%$.

TABLE M.31. Surrogate Recoveries and Quality Control Data for Polychlorinated Biphenyl (PCB) and Chlorinated Pesticide Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Batch	<i>N. virens</i> Surrogate Percent Recovery	
			DBOFB	CL5(112)
PC-1	1	2	93	44
PC-1	2	1	111	75
PC-1	3	2	54	31 ^(a)
PC-1	4	1	71	50
PC-1	5	2	43	22 ^(a)
PC-1A	1	2	49	28 ^(a)
PC-1A	2	1	125 ^(a)	67
PC-1A	3	2	66	40
PC-1A	4	2	82	37 ^(a)
PC-1A	5	1	103	67
PC-2	1	3	87	32 ^(a)
PC-2	2	2	72	35 ^(a)
PC-2	3	1	106	70
PC-2	4	1	90	66
PC-2	5	1	86	60
PC-4	1	1	104	73
PC-4 Rep 1	2	2	142 ^(a)	32 ^(a)
PC-4 Rep 2	2	2	56	20 ^(a)
PC-4 Rep 3	2	2	97	38 ^(a)
PC-4	3	1	91	60
PC-4 Rep 1	4	2	110	46
PC-4 Rep 2	4	2	77	26 ^(a)
PC-4 Rep 3	4	2	100	40
PC-4	5	3	88	33 ^(a)
PC-5	1	2	64	40
PC-5	2	2	142 ^(a)	37 ^(a)
PC-5	3	1	96	63
PC-5	4	3	105	36 ^(a)
PC-5	5	1	84	53
Reference	1	3	96	36 ^(a)
Reference	2	2	63	40
Reference	3	2	86	44
Reference	4	1	101	67
Reference	5	3	55	22 ^(a)
<i>N. virens</i> Background Rep 1	1	3	84	31 ^(a)
<i>N. virens</i> Background Rep 2	2	3	61	14 ^(a)
<i>N. virens</i> Background Rep 3	3	3	78	30 ^(a)

TABLE M.31. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<i>N. virens</i> <u>Surrogate Percent Recovery</u>	
			<u>DBQFB</u>	<u>CL5(112)</u>
<i>N. virens</i> Control	1	2	51	30 ^(a)
<i>N. virens</i> Control	2	3	100	35 ^(a)
<i>N. virens</i> Control	3	1	95	61
<i>N. virens</i> Control	4	1	96	66
<i>N. virens</i> Control Rep 1	5	1	78	56
<i>N. virens</i> Control Rep 2	5	1	109	59
<i>N. virens</i> Control Rep 3	5	1	107	67

Quality Control DataMethod Blanks

Blank	1	92	53
Blank	2	69	55
Blank	3	121 ^(a)	79

Matrix Spikes

PC-2 MS	3	84	22 ^(a)
PC-5 MS	2	55	34 ^(a)
Reference MS	1	98	71
<i>N. virens</i> Control MS	1	71	60

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

TABLE M.32. Percent Lipid Results, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Percent Lipid</u>
Target DL ^(a)			0.1
Achieved DL			NA ^(b)
PC-1	1	2	3.01
PC-1	2	1	3.53
PC-1	3	2	5.32
PC-1	4	1	7.88
PC-1	5	2	4.25
PC-1A	1	2	2.37
PC-1A	2	1	5.86
PC-1A	3	2	3.23
PC-1A	4	2	9.06
PC-1A	5	1	10.45
PC-2	1	3	5.19
PC-2	2	2	4.08
PC-2	3	1	5.74
PC-2	4	1	13.73
PC-2	5	1	5.13
PC-4	1	1	6.18
PC-4 Rep 1	2	2	6.58
PC-4 Rep 2	2	2	7.11
PC-4 Rep 3	2	2	5.16
PC-4	3	1	3.82
PC-4 Rep 1	4	2	5.89
PC-4 Rep 2	4	2	6.10
PC-4 Rep 3	4	2	5.00
PC-4	5	3	2.86
PC-5	1	2	2.53
PC-5	2	2	6.06
PC-5	3	1	3.05
PC-5	4	3	2.87
PC-5	5	1	5.06
Reference	1	3	2.62
Reference	2	2	2.54
Reference	3	2	3.27
Reference	4	1	4.59
Reference	5	3	2.71
<i>N. virens</i> Background Rep 1	1	3	3.91
<i>N. virens</i> Background Rep 2	2	3	3.74
<i>N. virens</i> Background Rep 3	3	3	2.84

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TABLE M.32. (contd)

<u>Sediment Treatment</u>	<u>Replicate</u>	<u>Batch</u>	<u>Percent Lipid</u>
<i>N. virens</i> Control	1	2	3.85
<i>N. virens</i> Control	2	3	4.00
<i>N. virens</i> Control	3	1	4.25
<i>N. virens</i> Control	4	1	5.11
<i>N. virens</i> Control Rep 1	5	1	4.43
<i>N. virens</i> Control Rep 2	5	1	NA
<i>N. virens</i> Control Rep 3	5	1	3.22

(a) DL Detection limit.

(b) NA Not applicable.

TABLE M.33.

Metals Analysis by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS),
X-Ray Fluorescence (XRF), and Cold Vapor Atomic Absorption (CVAA), Dry Weight, in
Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Percent Dry Weight	N. virens Metals (mg/kg dry weight)														Zn ICP/MS	XRF
			Ag ICP/MS	As XRF	Be ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Sb ICP/MS	Se XRF	Tl ICP/MS				
Target DL (a) Achieved High DL Achieved Low DL		0.1	0.1	0.2	0.1	0.6	0.1	0.01	1.0	0.1	0.1	0.3	0.1	0.3	0.1	0.3		
		0.03	1.2	0.080	0.04	0.01	0.05	0.014	0.05	0.04	0.02	0.56	0.020	0.56	0.020	27		
		0.01	1.2	0.010	0.01	0.01	0.02	0.003	0.02	0.04	0.01	0.54	0.005	0.54	0.005	27		
PC-1 Rep 1	1	14.17	0.176	16.6	0.080 U(b)	0.272	0.889	6.23	0.134	0.481	0.502	0.046	0.86	0.020	0.86	0.020	62.3	
	1	14.17	0.173	17.5	0.080 U	0.258	0.901	6.19	0.136	0.375	0.505	0.048	1.11	0.020	0.505	0.020	60.6	
	1	14.17	0.179	16.0	0.080 U	0.262	0.882	6.14	0.130	0.368	0.571	0.049	1.23	0.020	0.571	0.020	114	
	2	15.76	0.175	13.0	0.080 U	0.249	1.10	5.55	0.132	0.227	0.535	0.044	1.12	0.020	0.535	0.020	57.5	
	3	14.43	0.165	14.3	0.080 U	0.243	0.822	6.04	0.114	0.354	0.485	0.055	0.77	0.020	0.485	0.020	124	
PC-1	4	15.93	0.190	15.8	0.080 U	0.307	0.837	6.89	0.149	0.321	0.603	0.049	1.69	0.020	0.603	0.020	75.7	
	5	13.89	0.184	15.4	0.080 U	0.298	0.835	5.77	0.132	0.570	0.643	0.056	0.64	0.020	0.643	0.020	151	
	1	14.82	0.181	14.1	0.080 U	0.255	0.987	5.96	0.141	0.544	0.600	0.050	1.37	0.020	0.600	0.020	59.4	
	2	14.60	0.194	18.4	0.080 U	0.323	1.21	6.51	0.149	0.878	0.853	0.055	1.03	0.020	0.853	0.020	83.5	
	3	14.24	0.218	18.5	0.080 U	0.347	1.00	6.30	0.180	0.745	0.623	0.066	1.02	0.020	0.623	0.020	57.9	
PC-1A	4	16.09	0.178	14.9	0.080 U	0.256	0.745	5.68	0.113	0.174	0.560	0.045	1.51	0.020	0.560	0.020	52.4	
	5	15.34	0.206	17.8	0.080 U	0.297	1.28	7.07	0.123	0.910	0.743	0.051	1.34	0.020	0.743	0.020	115	
	1	15.18	0.152	12.2	0.080 U	0.269	0.754	6.69	0.113	0.544	0.543	0.055	1.02	0.020	0.543	0.020	54.1	
	2	13.92	0.173	13.8	0.080 U	0.295	0.968	6.44	0.126	0.326	0.604	0.048	0.84	0.020	0.604	0.020	89.9	
	3	14.77	0.169	12.9	0.080 U	0.291	1.16	7.14	0.144	0.672	0.591	0.047	1.14	0.020	0.591	0.020	73.4	
PC-2	4	15.84	0.194	15.1	0.080 U	0.293	0.768	7.22	0.125	0.188	0.594	0.050	1.50	0.020	0.594	0.020	50.3	
	5	13.67	0.164	13.7	0.080 U	0.262	0.744	6.00	0.132	0.182	0.541	0.044	1.27	0.020	0.541	0.020	94.5	
	1	15.07	0.191	16.3	0.080 U	0.336	1.27	7.55	0.127	0.989	0.762	0.053	1.23	0.020	0.762	0.020	62.1	
	2	15.05	0.197	14.7	0.080 U	0.322	1.22	6.54	0.122	1.518	0.766	0.056	1.65	0.020	0.766	0.020	54.4	
	3	15.80	0.169	16.3	0.080 U	0.255	0.907	6.25	0.138	0.602	0.551	0.046	1.43	0.020	0.551	0.020	95.1	
PC-4	4	15.07	0.190	13.7	0.080 U	0.246	0.758	6.48	0.126	0.127	0.492	0.072	1.21	0.020	0.492	0.020	54.1	
	5	13.30	0.189	15.4	0.080 U	0.278	1.22	6.20	0.134	0.986	0.589	0.052	1.46	0.020	0.589	0.020	52.7	
	1	15.00	0.179	14.0	0.080 U	0.264	0.923	5.98	0.131	0.391	0.626	0.046	1.13	0.020	0.626	0.020	50.7	
	2	15.57	0.172	14.2	0.080 U	0.258	0.839	5.70	0.129	0.395	0.713	0.051	1.47	0.020	0.713	0.020	53.1	
	3	13.81	0.150	14.2	0.080 U	0.267	1.78	7.15	0.123	1.161	0.733	0.050	1.02	0.020	0.733	0.020	81.2	
PC-5	4	14.36	0.174	13.8	0.080 U	0.239	0.739	5.98	0.110	0.305	0.552	0.045	0.56	0.020	0.552	0.020	194	
	5	15.10	0.173	14.1	0.080 U	0.247	0.678	6.42	0.135	0.469	0.597	0.052	1.41	0.020	0.597	0.020	121	
	5	15.10	0.191	14.4	0.080 U	0.265	0.738	6.31	0.131	0.380	0.632	0.052	1.13	0.020	0.632	0.020	72.9	
	5	15.10	0.179	14.4	0.080 U	0.257	0.728	6.58	0.135	0.449	0.591	0.049	0.53	0.020	0.591	0.020	780	

TABLE M.33. (contd)

Sediment Treatment	Replicate	Percent Dry Weight	N. virens Metals (mg/kg dry weight)											
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Zn
			ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVA	ICP/MS	ICP/MS	ICP/MS	XRF	XRF
Reference	1	15.36	0.217	14.6	0.080 U	0.291	0.847	5.96	0.152	0.376	0.431	0.049	0.69	0.020 U 198
Reference	2	14.42	0.252	16.2	0.080 U	0.280	0.878	7.29	0.154	0.570	0.524	0.050	1.32	0.020 U 57.9
Reference	3	15.07	0.230	14.5	0.080 U	0.276	0.892	6.55	0.134	0.369	0.572	0.042	0.54 U	0.020 U 291
Reference	4	15.00	0.229	19.7	0.080 U	0.346	1.17	6.91	0.147	0.859	0.653	0.052	0.87	0.020 U 88.3
Reference	5	16.19	0.221	14.4	0.080 U	0.284	1.18	6.23	0.161	0.503	0.609	0.054	1.33	0.020 U 60.3
N. virens Background Rep 1	1	15.28	0.156	15.3	0.080 U	0.317	0.860	7.43	0.135	0.742	0.528	0.050	1.52	0.020 U 56.7
N. virens Background Rep 2	2	15.28	0.152	15.3	0.080 U	0.281	0.748	6.91	0.137	0.773	0.429	0.043	1.65	0.020 U 57.3
N. virens Background Rep 3	3	15.28	0.156	15.8	0.080 U	0.308	0.759	7.31	0.140	0.761	0.487	0.052	1.43	0.020 U 56.2
N. virens Control	1	15.40	0.201	17.2	0.080 U	0.326	1.09	7.02	0.146	0.728	1.10	0.056	1.33	0.020 U 126
N. virens Control	2	14.41	0.211	16.5	0.080 U	0.305	0.648	7.08	0.163	0.495	0.663	0.044	1.14	0.020 U 53.4
N. virens Control Rep 1	3	15.12	0.192	15.2	0.080 U	0.244	0.937	6.53	0.150	0.229	0.616	0.046	1.52	0.020 U 87.3
N. virens Control Rep 2	3	15.12	0.197	14.5	0.080 U	0.252	0.962	6.66	0.155	0.259	0.662	0.045	1.16	0.020 U 259
N. virens Control Rep 3	3	15.12	0.194	14.7	0.080 U	0.284	0.909	6.68	0.151	0.187	0.609	0.045	1.03	0.020 U 58.3
N. virens Control	4	16.00	0.172	15.1	0.080 U	0.269	0.868	8.02	0.162	0.528	0.874	0.043	1.35	0.020 U 186
N. virens Control	5	16.01	0.192	15.3	0.080 U	0.274	0.944	7.52	0.138	0.467	0.772	0.051	1.36	0.020 U 62.0

(a) DL Detection limit.

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

TABLE M.34.

Metals Analysis by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS), X-Ray Fluorescence (XRF), and Cold Vapor Atomic Absorption (CVAA), Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Percent Dry Weight	N. virens Metals (mg/kg wet weight)													
			Ag	As	Be	Cd	Cr	Cu	Hg	Mn	Pb	Sb	Se	Tl	Zn	
			ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVAA	ICP/MS	ICP/MS	ICP/MS	ICP/MS	XRF	ICP/MS	XRF
PC-1 Rep 1 PC-1 Rep 2 PC-1 Rep 3 PC-1 PC-1	1	14.17	0.025	2.4	0.011 U ^(a)	0.038	0.126	0.88	0.018	0.068	0.071	0.006	0.12	0.002 U	8.8	
	1	14.17	0.025	2.5	0.011 U	0.036	0.127	0.88	0.019	0.053	0.071	0.006	0.16	0.002 U	8.6	
	1	14.17	0.025	2.3	0.011 U	0.037	0.125	0.87	0.018	0.052	0.080	0.006	0.17	0.002 U	16	
	2	15.76	0.028	2.0	0.013 U	0.039	0.17	1.03	0.020	0.035	0.084	0.006	0.18	0.003 U	9.1	
	3	14.43	0.024	2.1	0.012 U	0.035	0.118	0.87	0.016	0.051	0.069	0.007	0.11	0.002 U	18	
PC-1 PC-1 PC-1	4	15.93	0.030	2.5	0.013 U	0.048	0.133	1.10	0.023	0.051	0.096	0.007	0.27	0.003 U	12.1	
	5	13.89	0.026	2.1	0.011 U	0.041	0.115	0.80	0.018	0.079	0.089	0.007	0.09	0.002 U	21	
	PC-1A PC-1A PC-1A PC-1A PC-1A	1	14.82	0.027	2.1	0.012 U	0.037	0.146	0.88	0.020	0.080	0.088	0.007	0.20	0.002 U	8.8
		2	14.60	0.028	2.7	0.012 U	0.047	0.18	0.95	0.021	0.128	0.124	0.008	0.15	0.002 U	12.2
		3	14.24	0.031	2.6	0.011 U	0.049	0.14	0.90	0.025	0.106	0.088	0.009	0.15	0.002 U	8.2
4		16.09	0.029	2.4	0.013 U	0.041	0.119	0.91	0.018	0.027	0.090	0.007	0.24	0.003 U	8.4	
5		15.34	0.032	2.7	0.012 U	0.045	0.20	1.08	0.018	0.139	0.113	0.007	0.21	0.003 U	18	
PC-2 PC-2 PC-2 PC-2 PC-2	1	15.18	0.023	1.9	0.012 U	0.040	0.114	1.02	0.017	0.082	0.082	0.008	0.15	0.003 U	8.2	
	2	13.92	0.024	1.9	0.011 U	0.041	0.134	0.90	0.017	0.045	0.084	0.006	0.12	0.002 U	12.5	
	3	14.77	0.025	1.9	0.012 U	0.042	0.17	1.05	0.021	0.099	0.087	0.006	0.17	0.002 U	10.8	
	4	15.84	0.031	2.4	0.013 U	0.046	0.121	1.14	0.019	0.029	0.094	0.007	0.24	0.003 U	8.0	
	5	13.67	0.022	1.9	0.011 U	0.035	0.101	0.82	0.018	0.024	0.073	0.006	0.17	0.002 U	12.9	
PC-4 PC-4 PC-4 PC-4 PC-4	1	15.07	0.029	2.5	0.012 U	0.050	0.19	1.14	0.019	0.149	0.114	0.007	0.19	0.003 U	9.4	
	2	15.05	0.030	2.2	0.012 U	0.048	0.18	0.98	0.018	0.228	0.115	0.008	0.25	0.003 U	8.2	
	3	15.80	0.027	2.6	0.013 U	0.040	0.143	0.99	0.021	0.095	0.086	0.007	0.23	0.003 U	15.0	
	4	15.07	0.029	2.1	0.012 U	0.036	0.114	0.98	0.018	0.019	0.074	0.010	0.18	0.003 U	8.2	
	5	13.30	0.025	2.0	0.011 U	0.036	0.16	0.82	0.017	0.131	0.078	0.006	0.19	0.002 U	7.0	
PC-5 PC-5 PC-5 PC-5 PC-5	1	15.00	0.027	2.1	0.012 U	0.039	0.138	0.90	0.019	0.058	0.093	0.006	0.17	0.003 U	7.6	
	2	15.57	0.027	2.2	0.012 U	0.040	0.130	0.89	0.020	0.061	0.110	0.007	0.23	0.003 U	8.3	
	3	13.81	0.021	2.0	0.011 U	0.036	0.25	0.99	0.016	0.160	0.101	0.006	0.14	0.002 U	11.2	
	4	14.36	0.025	2.0	0.011 U	0.034	0.106	0.86	0.015	0.043	0.079	0.006	0.08 U	0.002 U	28	
	5	15.10	0.026	2.1	0.012 U	0.037	0.102	0.97	0.020	0.070	0.090	0.007	0.21	0.003 U	18	
PC-5 Rep 1 PC-5 Rep 2 PC-5 Rep 3 Reference Reference	5	15.10	0.029	2.2	0.012 U	0.040	0.111	0.95	0.019	0.057	0.095	0.007	0.17	0.003 U	11.0	
	5	15.10	0.027	2.2	0.012 U	0.038	0.109	0.99	0.020	0.067	0.089	0.007	0.08	0.003 U	42	
	1	15.36	0.033	2.2	0.012 U	0.044	0.130	0.92	0.023	0.057	0.066	0.007	0.11	0.003 U	30	
	2	14.42	0.036	2.3	0.012 U	0.040	0.126	1.05	0.022	0.082	0.075	0.007	0.19	0.002 U	8.3	
	3	15.07	0.035	2.2	0.012 U	0.041	0.134	0.99	0.020	0.055	0.086	0.006	0.08 U	0.003 U	44	
Reference Reference Reference Reference Reference	4	15.00	0.034	3.0	0.012 U	0.051	0.18	1.04	0.022	0.128	0.097	0.007	0.13	0.003 U	13.2	
	5	16.19	0.036	2.3	0.013 U	0.045	0.19	1.01	0.026	0.081	0.098	0.008	0.22	0.003 U	9.8	

TABLE M.34. (contd)

Sediment Treatment	Replicate	Percent Dry Weight	<i>N. virans</i> Metals (mg/kg wet weight)													
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn	
			ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	CMA	ICP/MS	ICP/MS	ICP/MS	ICP/MS	XRF	ICP/MS	XRF	
<i>N. virans</i> Background Rep 1	1	15.28	0.024	2.3	0.012 U	0.048	0.131	1.14	0.020	0.113	0.080	0.007	0.23	0.003 U	8.7	
<i>N. virans</i> Background Rep 2	2	15.28	0.023	2.3	0.012 U	0.042	0.114	1.06	0.020	0.118	0.065	0.006	0.25	0.003 U	8.8	
<i>N. virans</i> Background Rep 3	3	15.28	0.024	2.4	0.012 U	0.047	0.115	1.12	0.021	0.116	0.074	0.007	0.22	0.003 U	8.6	
<i>N. virans</i> Control	1	15.40	0.031	2.7	0.012 U	0.050	0.17	1.08	0.022	0.112	0.170	0.008	0.20	0.003 U	19	
<i>N. virans</i> Control	2	14.41	0.030	2.4	0.012 U	0.043	0.093	1.02	0.023	0.071	0.095	0.006	0.16	0.002 U	7.7	
<i>N. virans</i> Control Rep 1	3	15.12	0.029	2.3	0.012 U	0.036	0.141	0.99	0.027	0.034	0.093	0.007	0.23	0.003 U	13.2	
<i>N. virans</i> Control Rep 2	3	15.12	0.030	2.2	0.012 U	0.038	0.145	1.01	0.023	0.039	0.100	0.006	0.18	0.003 U	39	
<i>N. virans</i> Control Rep 3	3	15.12	0.029	2.2	0.012 U	0.042	0.137	1.01	0.022	0.028	0.092	0.006	0.16	0.003 U	8.8	
<i>N. virans</i> Control	4	16.00	0.028	2.4	0.013 U	0.043	0.138	1.28	0.025	0.084	0.139	0.006	0.22	0.003 U	30	
<i>N. virans</i> Control	5	16.01	0.031	2.4	0.013 U	0.043	0.151	1.20	0.022	0.074	0.123	0.008	0.22	0.003 U	9.9	

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

TABLE M.35.

Quality Control Data for Metals Analyzed by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS), X-Ray Fluorescence (XRF), and Cold Vapor Atomic Absorption (CVAA), Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	<i>N. virens</i> Metals (mg/kg dry weight)											
		Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Zn
		ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVAA	ICP/MS	ICP/MS	ICP/MS	XRF	XRF
Method Blanks													
Blank	1	0.093	NA ^(a)	0.080 U ^(b)	0.051	0.369	0.050 U	0.003 U	0.020 U	0.022	0.040	NA	0.020 U
Blank	2	0.083	NA	0.080 U	0.051	0.449	0.121	0.003 U	0.020 U	0.022	0.034	NA	0.020 U
Blank	3	0.021	NA	0.020 U	0.010	0.369	0.020 U	0.004	0.020 U	0.023	0.020 U	NA	0.005 U
Blank	4	0.024	NA	0.020 U	0.018	0.449	0.020 U	0.003 U	0.020 U	0.003	0.020 U	NA	0.005 U
Blank	5	0.031	NA	0.010 U	0.027	0.644	0.005 U	NA	0.050 U	0.040 U	0.010 U	NA	0.006 U
Blank	6	0.018	NA	0.010 U	0.019	0.523	0.005 U	NA	0.050 U	0.040 U	0.010 U	NA	0.006 U
Matrix Spikes													
PC-1	4	0.190	15.8	0.080 U	0.307	0.837	6.89	0.149	0.321	0.603	0.049	1.69	0.020 U 75.7
PC-1	4	2.19	NA	1.036	2.68	5.52	15.0	0.924	4.58	3.24	1.02	NA	0.890
Concentration Recovered		2.00	NA ^(c)	1.036	2.37	4.69	8.16	0.775	4.25	2.63	0.971	NA	0.890
Amount Spiked		2.00	NS ^(c)	0.800	2.00	4.00	8.00	0.799	4.00	2.00	0.800	NS	0.800
Percent Recovery		100%	NA	129%(d)	119%	117%	102%	97%	106%	132%(d)	121%	NA	111%
PC-2	1	0.152	12.2	0.080 U	0.269	0.754	6.69	0.113	0.544	0.543	0.055	1.02	0.020 U 54.1
PC-2	1	2.13	NA	1.106	2.61	5.48	16.2	0.82	4.72	2.91	0.984	NA	0.848
Concentration Recovered		1.98	NA	1.106	2.34	4.72	9.48	0.714	4.18	2.36	0.929	NA	0.848
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.798	4.00	2.00	0.800	NS	0.800
Percent Recovery		99%	NA	138%(d)	117%	118%	119%	89%	104%	118%	116%	NA	106%
<i>N. virens</i> Control	4	0.172	15.1	0.08 U	0.269	0.868	8.02	0.162	0.528	0.874	0.043	1.35	0.020 U 186
<i>N. virens</i> Control	4	1.16	NA	0.914	2.55	5.53	16.5	0.956	4.63	3.26	0.981	NA	0.874
Concentration Recovered		0.989	NA	0.914	2.28	4.66	8.44	0.794	4.11	2.38	0.938	NA	0.854
Amount Spiked		2.00	NS	0.800	2.00	4.00	8.00	0.799	4.00	2.00	0.800	NS	0.800
Percent Recovery		49%(d)	NA	114%	114%	116%	105%	99%	103%	119%	117%	NA	107%

TABLE M.35. (contd)

Sediment Treatment	Replicate	N. virens Metals (mg/kg dry weight)											
		Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Zn
		ICP/MS	XRF	ICP/MS	ICP/MS	ICP/MS	ICP/MS	CVA	ICP/MS	ICP/MS	ICP/MS	XRF	XRF
<u>Standard Reference Material</u>													
Certified Value range		1.68 ±0.15	14.0 ±1.2	NC ^(e)	4.15 ±0.38	1.43 ±0.46	66.3 ±4.3	0.064 ±0.0067	2.25 ±0.44	0.371 ±0.014	NC	2.21 ±0.24	830 ±57
1566a	1	1.74	15.1	0.080 U	4.59	1.30	71.2	0.064	2.77	0.410	0.044	2.21	0.020 U 855
1566a	2	1.78	14.9	0.080 U	4.69	1.44	65.0	0.066	1.77	0.376	0.040	2.53	0.020 U 839
1566a	3	1.66	14.6	0.020 U	4.54	1.24	71.0	0.063	2.39	0.400	0.020 U	2.14	0.005 U 852
1566a	4	1.73	15.0	0.020 U	4.77	1.28	74.2	0.067	1.72	0.481	0.020 U	2.08	0.005 U 849
1566a	5	1.74	NA	0.010 U	4.35	1.37	68.0	NA	1.79	0.370	0.010 U	NA	0.006 U NA
1566a	6	1.84	NA	0.010 U	4.55	1.56	72.5	NA	1.84	0.390	0.010 U	NA	0.006 U NA
<u>Analytical Replicates</u>													
PC-1 Rep 1	1	0.176	16.6	0.080 U	0.272	0.889	6.23	0.134	0.481	0.502	0.046	0.86	0.020 U 62.3
PC-1 Rep 2	1	0.173	17.5	0.080 U	0.258	0.901	6.19	0.136	0.375	0.505	0.048	1.11	0.020 U 60.6
PC-1 Rep 3	1	0.179	16.0	0.080 U	0.262	0.882	6.14	0.130	0.368	0.571	0.049	1.23	0.020 U 114
RSD		2%	4%	NA	3%	1%	1%	2%	16%	7%	4%	18%	39% ^(f)
PC-5 Rep 1	5	0.173	14.1	0.080 U	0.247	0.678	6.42	0.135	0.469	0.597	0.052	1.41	0.020 U 121
PC-5 Rep 2	5	0.191	14.4	0.080 U	0.265	0.738	6.31	0.131	0.380	0.632	0.052	1.13	0.020 U 72.9
PC-5 Rep 3	5	0.179	14.4	0.080 U	0.257	0.728	6.58	0.135	0.449	0.591	0.049	0.53	0.020 U 280
RSD		5%	1%	NA	4%	4%	2%	2%	11%	4%	3%	44% ^(f)	69% ^(f)
N. virens Background Rep 1	1	0.156	15.3	0.080 U	0.317	0.860	7.43	0.135	0.742	0.528	0.050	1.52	0.020 U 56.7
N. virens Background Rep 2	2	0.152	15.3	0.080 U	0.281	0.748	6.91	0.137	0.773	0.429	0.043	1.65	0.020 U 57.3
N. virens Background Rep 3	3	0.156	15.8	0.080 U	0.308	0.759	7.31	0.140	0.761	0.487	0.052	1.43	0.020 U 56.2
RSD		1%	2%	NA	6%	8%	4%	2%	2%	10%	9%	7%	1%
N. virens Control Rep 1	3	0.192	15.2	0.080 U	0.244	0.937	6.53	0.150	0.229	0.616	0.046	1.52	0.020 U 87.3
N. virens Control Rep 2	3	0.197	14.5	0.080 U	0.252	0.962	6.66	0.155	0.259	0.662	0.045	1.16	0.020 U 259
N. virens Control Rep 3	3	0.194	14.7	0.080 U	0.284	0.909	6.68	0.151	0.187	0.609	0.045	1.03	0.020 U 58.3
RSD		1%	2%	NA	8%	3%	1%	2%	16%	5%	2%	21% ^(f)	80% ^(f)

- (a) NA Not applicable.
 (b) U Analyte was not present above the associated value.
 (c) NS Not spiked.
 (d) Recovery outside quality control range (75%-125%).
 (e) NC Not certified.
 (f) Value exceeds relative precision goal of $\leq 20\%$.

TABLE M.36. Butyltin Analysis, Wet and Dry Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Target DL (a) Achieved DL	Surrogate		<i>N. virens</i>				<i>N. virens</i>			
		Replicate	Percent Recovery Iripenyltin	Butyltin ($\mu\text{g}/\text{kg}$ wet weight)		Percent Dry Weight	Butyltins ($\mu\text{g}/\text{kg}$ dry weight)		Tri- butyltin	Di- butyltin	Mono- butyltin
				Tri- butyltin	Di- butyltin		Tri- butyltin	Di- butyltin			
				10	10						
				5	5						
PC-1		1	55	5.0 U ^(b)	5.0 U		33.4 U	33.4 U			53.4 U
PC-1		2	95	5.0 U	5.0 U	14.98	37.7 U	37.7 U			60.3 U
PC-1		3	51	5.0 U	5.0 U	13.54	36.9 U	36.9 U			59.1 U
PC-1 Rep 1		4	93	5.0 U	5.0 U	15.09	33.1 U	33.1 U			53.0 U
PC-1 Rep 2		4	103	5.0 U	5.0 U	15.09	33.1 U	33.1 U			53.0 U
PC-1 Rep 3		4	96	5.0 U	5.0 U	15.09	33.1 U	33.1 U			53.0 U
PC-1		5	105	5.0 U	5.0 U	14.90	33.6 U	33.6 U			53.7 U
PC-1A		1	56	5.0 U	5.0 U	14.94	33.5 U	33.5 U			53.5 U
PC-1A		2	74	5.0 U	5.0 U	14.02	35.7 U	35.7 U			57.1 U
PC-1A		3	71	5.0 U	5.0 U	14.37	34.8 U	34.8 U			55.7 U
PC-1A		4	55	5.0 U	5.0 U	14.11	35.4 U	35.4 U			56.7 U
PC-1A Rep 1		5	103	5.0 U	5.0 U	14.46	34.6 U	34.6 U			55.3 U
PC-1A Rep 2		5	88	5.0 U	10.3	14.46	34.6 U	71.2			55.3 U
PC-1A Rep 3		5	36 ^(c)	5.0 U	5.0 U	14.46	34.6 U	34.6 U			55.3 U
PC-2		1	57	5.0 U	5.0 U	13.28	37.7 U	37.7 U			60.2 U
PC-2 Rep 1		2	30 ^(c)	5.0 U	5.0 U	13.31	37.6 U	37.6 U			60.1 U
PC-2 Rep 2		2	27 ^(c)	5.0 U	5.0 U	13.31	37.6 U	37.6 U			60.1 U
PC-2 Rep 3		2	45	5.0 U	5.0 U	13.31	37.6 U	37.6 U			60.1 U
PC-2		3	39 ^(c)	5.0 U	5.0 U	13.93	35.9 U	35.9 U			57.4 U
PC-2		4	52	5.0 U	5.0 U	13.54	36.9 U	36.9 U			59.1 U
PC-2		5	47	5.0 U	5.0 U	13.77	36.3 U	36.3 U			58.1 U
PC-4		1	101	5.0 U	5.0 U	14.77	33.9 U	33.9 U			54.2 U
PC-4		2	59	5.0 U	5.0 U	15.38	32.5 U	32.5 U			52.0 U
PC-4		3	86	5.0 U	5.0 U	14.29	35.0 U	35.0 U			56.0 U
PC-4		4	55	5.0 U	5.0 U	14.29	35.0 U	35.0 U			56.0 U
PC-4		5	40	5.0 U	5.0 U	12.38	40.4 U	40.4 U			64.6 U
PC-5		1	56	5.0 U	5.0 U	12.99	38.5 U	38.5 U			61.6 U
PC-5		2	53	5.0 U	5.0 U	14.97	33.4 U	33.4 U			53.4 U
PC-5		3	62	5.0 U	5.0 U	13.76	36.3 U	36.3 U			58.1 U
PC-5		4	44	5.0 U	5.4	12.58	39.7 U	43.0			63.6 U
PC-5		5	55	5.0 U	5.0 U	14.33	34.9 U	34.9 U			55.8 U

TABLE M.36. (contd)

Sediment Treatment	Replicate	Surrogate Percent Recovery	<i>N. virens</i>				<i>N. virens</i>			
			Tri- butyltin	Di- butyltin	Butyltin ($\mu\text{g/kg}$ wet weight)	Mono- butyltin	Tri- butyltin	Di- butyltin	Butyltin ($\mu\text{g/kg}$ dry weight)	Mono- butyltin
Reference	1	49	5.0 U	5.0 U	8.0 U	8.0 U	34.5 U	34.5 U	55.1 U	55.1 U
Reference	2	96	5.0 U	5.0 U	8.0 U	8.0 U	34.6 U	34.6 U	55.3 U	55.3 U
Reference	3	58	5.0 U	7.2	8.0 U	8.0 U	32.6 U	46.9	52.2 U	52.2 U
Reference	4	97	5.0 U	5.0 U	8.0 U	8.0 U	34.2 U	34.2 U	54.8 U	54.8 U
Reference	5	64	5.0 U	5.0 U	8.0 U	8.0 U	35.5 U	35.5 U	56.7 U	56.7 U
<i>N. virens</i> Background Rep 1	1	43	5.0 U	7.3	8.0 U	8.0 U	36.0 U	52.5	57.6 U	57.6 U
<i>N. virens</i> Background Rep 2	2	33 (c)	5.0 U	5.9	8.0 U	8.0 U	36.0 U	42.7	57.6 U	57.6 U
<i>N. virens</i> Background Rep 3	3	41	5.0 U	5.0 U	8.0 U	8.0 U	36.0 U	36.0 U	57.6 U	57.6 U
<i>N. virens</i> Control	1	64	5.0 U	5.0 U	8.0 U	8.0 U	36.1 U	36.1 U	57.8 U	57.8 U
<i>N. virens</i> Control	2	28 (c)	5.0 U	5.0 U	8.0 U	8.0 U	37.7 U	37.7 U	60.4 U	60.4 U
<i>N. virens</i> Control	3	79	5.0 U	5.0 U	8.0 U	8.0 U	38.0 U	38.0 U	60.8 U	60.8 U
<i>N. virens</i> Control	4	80	5.0 U	5.0 U	8.0 U	8.0 U	37.5 U	37.5 U	59.9 U	59.9 U
<i>N. virens</i> Control	5	48	5.0 U	5.0 U	8.0 U	8.0 U	35.4 U	35.4 U	56.7 U	56.7 U

(a) DL Detection limit.

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

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

TABLE M.37. Quality Control Data for Butyltin Analysis, Wet Weight, in Tissue of *N. virens*, Panama City Harbor Project

Sediment Treatment	Replicate	Surrogate Percent Recovery Tri-pentyltin	N. virens Butyltins (µg/kg wet weight)		
			Tri-butyltin	Di-butyltin	Mono-butyltin
Method Blanks					
Blank	1	44	5.0 U ^(a)	5.0 U	8.0 U
Blank	2	45	5.0 U	5.0 U	5.0 U
Blank	3	96	5.0 U	5.0 U	8.0 U
Blank	4	101	5.0 U	5.0 U	8.0 U
Matrix Spikes					
PC-1	5	105	5.0 U	5.0 U	8.0 U
PC-1 MS	5	78 ^(b)	50.6	45.0	5.4
Concentration Recovered		NA	50.6	45.0	5.4
Amount Spiked		NA	48.7	48.7	48.7
Percent Recovery		NA	104%	92%	11% ^(c)
PC-1	5	105	5.0 U	5.0 U	8.0 U
PC-1 MSD	5	86	46.9	41.9	5.6
Concentration Recovered		NA	46.9	41.9	5.6
Amount Spiked		NA	46.6	46.6	46.6
Percent Recovery		NA	101%	90%	12% ^(c)
RPD		NA	3%	2%	9%
I-Stat		NA	0.02	0.01	0.04
PC-5	1	56	5.0 U	5.0 U	8.0 U
PC-5 MS	1	53	51.6	48.1	7.5
Concentration Recovered		NA	51.6	48.1	7.5
Amount Spiked		NA	47.9	47.9	47.9
Percent Recovery		NA	108%	100%	16% ^(b)
PC-5	1	56	5.0 U	5.0 U	8.0 U
PC-5 MSD	1	56	55.2	48.9	7.2
Concentration Recovered		NA	55.2	48.9	7.2
Amount Spiked		NA	50.0	50.0	50.0
Percent Recovery		NA	110%	98%	14% ^(c)
RPD		NA	2%	2%	13%
I-Stat		NA	0.01	0.01	0.07
Reference	4	97	5.0 U	5.0 U	8.0 U
Reference MS	4	97	51.8	49.6	11.9
Concentration Recovered		NA	51.8	49.6	11.9
Amount Spiked		NA	49.4	49.4	49.4
Percent Recovery		NA	105%	100%	24% ^(c)
Reference	4	97	5.0 U	5.0 U	8.0 U
Reference MSD	4	105	53.1	49.3	11.5
Concentration Recovered		NA	53.1	49.3	11.5
Amount Spiked		NA	48.4	48.4	48.4
Percent Recovery		NA	110%	102%	24% ^(c)
RPD		NA	5%	2%	0%
I-Stat		NA	0.02	0.01	0.01

TABLE M.37. (contd)

Sediment Treatment	Replicate	Surrogate Percent Recovery Triphenyltin	<i>N. virens</i> Butyltins ($\mu\text{g/kg}$ wet weight)		
			Tri- butyltin	Di- butyltin	Mono- butyltin
<u>Analytical Replicates</u>					
PC-1A Rep 1	5	103	5.0 U	5.0 U	8.0 U
PC-1A Rep 2	5	88	5.0 U	10.3	8.0 U
PC-1A Rep 3	5	36 ^(c)	5.0 U	5.0 U	8.0 U
RSD		NA	NA	NA	NA
PC-1 Rep 1	4	93	5.0 U	5.0 U	8.0 U
PC-1 Rep 2	4	103	5.0 U	5.0 U	8.0 U
PC-1 Rep 3	4	96	5.0 U	5.0 U	8.0 U
RSD		NA	NA	NA	NA
PC-2 Rep 1	2	30 ^(c)	5.0 U	5.0 U	8.0 U
PC-2 Rep 2	2	27 ^(c)	5.0 U	5.0 U	8.0 U
PC-2 Rep 3	2	45	5.0 U	5.0 U	8.0 U
RSD		NA	NA	NA	NA
<i>N. virens</i> Background Rep 1	1	43	5.0 U	7.3	8.0 U
<i>N. virens</i> Background Rep 2	2	33 ^(c)	5.0 U	5.9	8.0 U
<i>N. virens</i> Background Rep 3	3	41	5.0 U	5.0 U	8.0 U
RSD		NA	NA	NA	NA

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

(b) NA Not applicable.

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

APPENDIX N

ORGANIZATION CHART

FIGURE N.1. Organizational Chart of Technical Staff, Panama City Harbor Project

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