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Evaluation of Dredged Material Proposed for Ocean Disposal from Red Hook / Bay Ridge Project Areas, New York

M. R. Pinza
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Battelle Marine Sciences Laboratory
Sequim, Washington

September 1996

Prepared for the
U.S. Army Corps of Engineers - New York District
under a Related Services Agreement
with the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
Operated for the U.S. Department of Energy
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Summary

The objective of the Red Hook/Bay Ridge project was to evaluate proposed dredged material from these two areas to determine its suitability for unconfined ocean disposal at the Mud Dump Site. Red Hook and Bay Ridge were two of four waterways that the U. S. Army Corps of Engineers-New York District (USACE-NYD) requested the Battelle/Marine Sciences Laboratory (MSL) to sample and evaluate for dredging and disposal in March 1995. Sediment samples were collected from the Red Hook/Bay Ridge project areas, as well as from Port Jersey and Claremont. Combining sample collection and evaluation of multiple dredged material projects was more cost-effective for the USACE-NYD, because the expense of reference site testing and quality control analyses could be shared among projects.

Tests and analyses were conducted according to the manual developed by the USACE and the U.S. Environmental Protection Agency (EPA), *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual)*, commonly referred to as the "Green Book," and the regional manual developed by the USACE-NYD and EPA Region II, *Guidance for Performing Tests on Dredged Material to be Disposed of in Ocean Waters.*

The evaluation of proposed dredged material from the Red Hook/Bay Ridge project areas consisted of bulk sediment chemical analyses, chemical analyses of dredging site water and elutriate, water-column and benthic acute toxicity tests. Twenty-four individual sediment core samples were collected from these two areas and analyzed for grain size, moisture content, and total organic carbon (TOC). Three composite sediment samples, representing Red Hook Channel (RH COMP) and the two Bay Ridge Reaches (BR-A COMP and BR-B COMP) to be dredged, were analyzed for bulk density, specific gravity, metals, chlorinated pesticides, polychlorinated biphenyl (PCB) congeners, polynuclear aromatic hydrocarbons (PAH), and 1,4-dichlorobenzene. Dredging site water and elutriate water, which is prepared from the suspended-particulate phase (SPP) of the three Red Hook/Bay Ridge sediment composites, were analyzed for metals, pesticides, and PCBs. Benthic acute toxicity tests were performed with the amphipod *Ampelisca abdita* and the mysid *Mysidopsis bahia*. The amphipod and mysid benthic toxicity test procedures followed EPA guidance for reduction of total ammonia concentrations in test systems prior to test initiation. Water-column or SPP toxicity tests were performed with three species, the mysid *Mysidopsis bahia*, the juvenile silverside *Menidia beryllina*, and larvae of the mussel *Mytilus galloprovincialis*. Bioaccumulation tests were conducted with the surface detrital-feeding, bent-nose clam *Macoma nasuta* and the burrowing polychaete worm *Nereis virens*.

Red Hook/Bay Ridge sediment core samples were generally black or gray-black, silty-clayey material. Eighteen of the 24 stations were predominantly silt and clay. The Red Hook/Bay Ridge sediment composite samples contained elevated levels of metals, pesticides

(particularly the DDD/DDE/DDT group of compounds), PCBs, PAHs, and 1,4-dichlorobenzene.

Statistically significant acute toxicity and a greater than 20% increase in mortality over the reference sediment was found in the static-renewal test with *A. abdita* for test sediments from RH COMP and BR-B COMP. All three test sediment composites were acutely toxic and had greater than 10% mortality from the Mud Dump Reference Site for the *M. bahia* test. In water-column toxicity tests, all three test sediment composites were acutely toxic to all three species tested. The LC_{50}s for the *M. beryllina* test ranged from 19% to 60% of SPP. The range of LC_{50}s for the *M. bahia* test were from 60% to >100% of SPP. The EC_{50}s (a more sensitive indicator of toxicity) for the *M. galloprovincialis* test were from 21% to 23% of SPP.

Following 28-day bioaccumulation tests, concentrations of contaminants were elevated in *M. nasuta* and *N. virens* tissues relative to levels in organisms exposed to the Mud Dump Reference Site. Tissues of both species exposed to each Red Hook/Bay Ridge sediment composite had tissue body burdens that were lower than the U.S. Food and Drug Administration (FDA) action levels for poisonous or deleterious substances in fish and shellfish for human consumption for selected pesticides, and FDA levels of concern for chronic shellfish consumption for selected metals.

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1.0 Introduction

1.1 Project Objectives

The objective of the Red Hook/Bay Ridge project was to evaluate proposed dredged material from the Red Hook Channel and the Bay Ridge Channel Reaches A and B to determine its suitability for unconfined ocean disposal at the Mud Dump Site. Tests and analyses for Mud Dump disposal were conducted on sediment core samples from these areas according to the manual developed by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (EPA), *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual)* (EPA/USACE 1991), commonly referred to as the "Green Book," and the regional manual developed by the USACE-New York District (USACE-NYD) and EPA Region II, *Guidance for Performing Tests on Dredged Material to be Disposed of in Ocean Waters* (USACE-NYD/EPA Region II 1992), hereinafter referred to as the "Regional Guidance Manual." The Regional Guidance Manual provides specifications for the use of local or appropriate test species in biological tests and identifies chemical contaminants of concern.

As required by the Regional Guidance Manual, the evaluation of proposed dredged material from the Red Hook/Bay Ridge project areas consisted of bulk sediment chemical analyses, chemical analyses of dredging site water and elutriate, water-column and benthic acute toxicity tests, and benthic bioaccumulation studies. Individual sediment core samples collected from the Red Hook/Bay Ridge project area were analyzed for grain size, moisture content, and total organic carbon (TOC). One composite sediment sample from Red Hook, and two composite sediment samples from Bay Ridge representing each reach proposed for dredging, were analyzed for bulk density, specific gravity, metals, chlorinated pesticides, polychlorinated biphenyl (PCB) congeners, polynuclear aromatic hydrocarbons (PAHs), and 1,4-dichlorobenzene. Site water and elutriate water, which is prepared from the suspended-particulate phase (SPP) of the one Red Hook sediment composite and the two Bay Ridge sediment composites, were analyzed for metals, pesticides, and PCBs. Water-column or SPP toxicity tests were performed with three species, the mysid *Mysidopsis bahia*, the juvenile silverside *Menidia beryllina*, and larvae of the mussel *Mytilus galloprovincialis*. Benthic acute toxicity tests were performed with the amphipod, *Ampelisca abdita* and the mysid *M. bahia*. Bioaccumulation tests were conducted with the burrowing worm *Nereis virens* and the surface-detrital-feeding clam *Macoma nasuta*.

1.2 Project Background

The Red Hook project area is located in Gowanus Bay (Figure 1.1) and requires dredging and disposal of an estimated 50,000 cu yd of sediment. The project depth of the channel is 40 ft mean lower water (MLW) plus 2 ft of overdepth. Stations RH-1 through RH-6 were combined to form the Red Hook composite. The Bay Ridge project area is also located in Gowanus Bay and adjacent to Brooklyn in New York. Stations BR-A-1 through BR-A-12 were combined to form BR-A COMP, and stations BR-B-13 through BR-B-18 were combined to form BR-B COMP. The Bay Ridge project requires dredging and disposal of an estimated 960,000 cu yd of sediment. Project depth of the channel is 40 ft MLW plus 2 ft of overdepth. Red Hook and Bay Ridge Channels were two of four waterways that the USACE-NYD requested the Battelle/Marine Sciences Laboratory (MSL) to evaluate in a series of dredged material projects that became known as the New York/New Jersey Federal Projects 4 program. The other projects evaluated under the Federal Projects 4 program were the Port Jersey and Claremont Projects. Sediment samples from one reach in the Red Hook waterway and two reaches in Bay Ridge waterway were collected during a survey that took place from March 21, 1995 to March 30, 1995. Combining sample collection and evaluation of multiple dredged material projects was more cost-effective for the USACE-NYD, because the expense of reference site testing and quality control analyses could be shared among projects.

1.3 Organization of this Report

Following this introduction, Section 2 presents the methods and materials used for sample collection, sample processing, sediment sample analysis of physical and chemical parameters, and quality assurance. Results of all physical/chemical analyses and bioassays are presented in Section 3. A discussion of the results and conclusions is provided in Section 4. Section 5 lists the literature cited in this report. Appendix A contains tabulated quality control data for all physical and chemical sediment analyses. Appendix B contains results of replicate sample analyses and quality control data for site water and elutriate chemical parameters. Appendix C contains raw data associated with benthic toxicity tests: water quality measurements, test animal survival data, and reference toxicant test results. Similar data for water-column acute toxicity tests are provided in Appendix D. Appendix E contains water quality measurements, test animal survival data, and reference toxicant test results for the bioaccumulation tests. Appendix F contains replicate sample results and quality control data for chemical analyses of *M. nasuta* tissue samples generated from the bioaccumulation tests, and Appendix G contains replicate sample results and quality control data for chemical analyses of *N. virens* tissue samples.

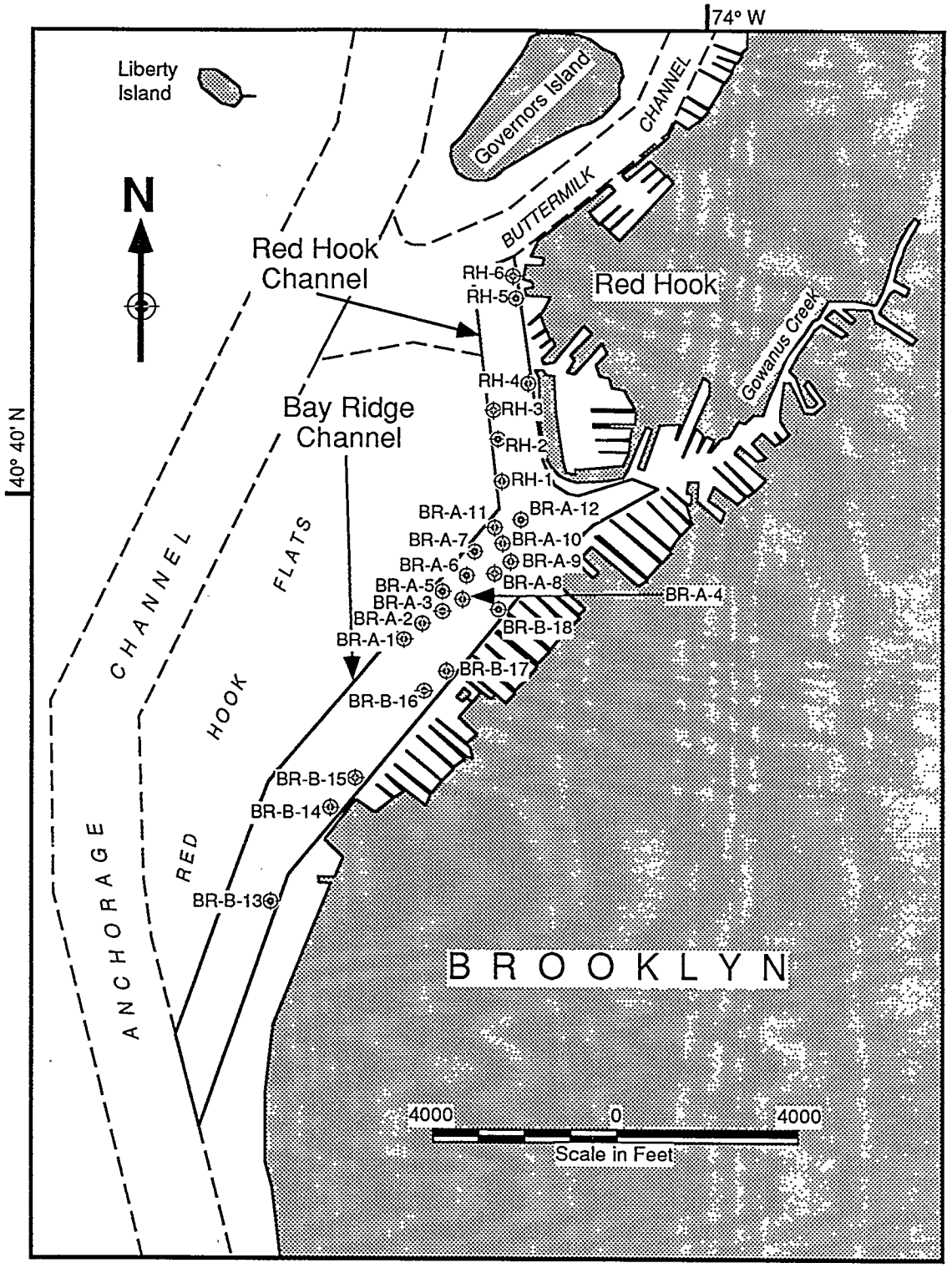

FIGURE 1.1. Location of Red Hook/Bay Ridge Project Area and Sample Collection Stations

2.0 Methods

2.1 Sediment and Water Collection

Sediment samples were collected from 6 stations within the Red Hook project area and 18 stations within the Bay Ridge project area. Sampling locations were selected by the USACE-NYD based on recent bathymetric surveys. The locations, their coordinates, and water and core sampling depths are presented with the sampling results in Section 3.0. Water samples were collected at a representative location in Red Hook Channel and two locations in the Bay Ridge Channel, and in the Mud Dump Site. Reference sediment was collected from the Mud Dump Reference Site. All samples were collected aboard the M/V *Hayward*, which is owned and operated by USACE-NYD at Caven Point, New Jersey.

2.1.1 Test Sediment and Site Water Sampling

The approximate core sampling locations were first determined with the aid of reference to landmarks, such as shoreline features or buoys, as well as by water depth. Then, a hand-held Magellan differential Global Positioning System (dGPS) was used to identify and record (within 30 m) the approximate location of each sampling station. The vessel's dGPS was used to establish the final location. Water depth at the time of sampling was measured by a fathometer on the ship. The actual water depth was corrected to MLW depth by correcting to the tide height at the time the depth was recorded. The difference between the MLW depth and the project depth, plus 2 ft overdepth, yields the amount of core required. At some sites, more than one core replicate was required to collect a sufficient volume of sediment for conducting all tests.

Core samples were collected aboard the *Hayward* using a vibracore sampler owned and operated by Alpine Ocean Seismic Survey, Inc, Norwood, New Jersey. The vibracore sampler consisted of a 4-in. outer diameter (OD), steel core barrel attached to a pneumatic vibratory hammer. The vibratory hammer could be fitted to steel core barrels of various lengths, depending on the length of core needed. To collect a core sample, the core barrel was fitted with a 3.125-in. interior diameter (ID), steam-cleaned, Lexan polycarbonate tube. The vibracore was then suspended by the ship's crane. Once the coring apparatus was directly above the sampling station, the core was lowered through the water to the sediment surface. At this point, the station coordinates were recorded from the vessels dGPS, and water depth was recorded from the ship's fathometer. The vibratory hammer was switched on until the corer penetrated through the sediment to the desired project depth. Adequate penetration was determined relative to marks on the outside of the core barrel and on the cable suspending the vibracore from the crane. The vibracore apparatus was then pulled out of the sediment and lowered onto the ship's deck. A

cutter-head and core-catcher assembly prevented loss of the sediment through the bottom of the core liner. After each core was brought on board, the liner was pulled from the barrel and the length of cored sediment was measured from the mudline to determine whether the project depth plus 2 ft overdepth had been reached. If not, the liner was replaced and a second core sample was attempted. If the sediment core length was at least project depth plus 2 ft overdepth, it was capped, sealed with tape, and labeled. While on board the sampling vessel, cores were kept cool (~4°C) in a walk-in freezer on the deck of the ship.

Surface-water samples for dredging site water chemical analysis were collected at one station (RH-3) in the Red Hook project area, and two stations(BR-A-8 and BR-B-15) in the Bay Ridge project area. Site water was also collected from the Mud Dump Site for chemical analysis and used as dilution water in water-column toxicity tests. Water samples were collected using a peristaltic pump, which collected water several feet below the surface. Water was then transferred to precleaned, 20-L polypropylene carboys which were previously rinsed with site water three times before filling. Water samples were labeled and stored in the walk-in freezer while on board the ship. (Prior to the sampling survey, carboys were washed with hot water and detergent, acid-rinsed with dilute hydrochloric acid, then rinsed with distilled water, followed by acetone).

A log book was maintained containing records of each sample collected, including station designation, coordinates, replicate number, date, sampling time, water depth, core length, and number of core sections per core. At the end of each sampling day, when the *Hayward* returned to Caven Point, all sediment cores and water samples were loaded into a refrigerated van, thermostatically controlled to maintain temperature at approximately 4°C. Sample identification numbers were logged on chain-of-custody forms daily.

At the conclusion of the sample collection survey, sediment cores and water samples were shipped by refrigerated van from Caven Point, New Jersey, to the MSL in Sequim, Washington. The shipment departed from Caven Point on March 30, 1995, and arrived at the MSL on April 6, 1995.

2.1.2 Reference and Control Sediment Sampling

Reference sediments for toxicity and bioaccumulation tests were collected from the Mud Dump Reference Site. Four 5-gal containers of surficial sediment were collected using a modified van Veen grab sampler. After recovery, water was drained from the sampler, and the sediments were transferred to epoxy-coated steel buckets. The buckets were covered, labeled, and stored in the walk-in freezer (4°C) while aboard the ship. Records of reference sediment collection included navigational coordinates, replicate number, date, sampling time, and water depth.

Reference sediment samples were loaded into the refrigerated van at the staging area upon return to port, and sample identification numbers were logged on chain-of-custody forms.

Control sediments were used in each toxicity and bioaccumulation test to validate test procedures. Control sediment used in *M. nasuta* and *M. bahia* tests was collected from Sequim Bay, Washington, using a van Veen sampler deployed from an MSL research vessel. Native control sediment for *A. abdita* and *N. virens* were supplied with the test organisms by their respective suppliers.

2.2 Test Organism Collection

Seven species of test organisms were used to evaluate sediment samples from the Red Hook/Bay Ridge project area:

- *Ampelisca abdita*, a tube-dwelling, surface detrital-feeding amphipod
- *Mysidopsis bahia*, a juvenile mysid shrimp
- *Menidia beryllina*, a juvenile silverside fish
- *Mytilus galloprovincialis*, the larval zooplankton stage of the mussel
- *Macoma nasuta*, the bent-nose clam, a burrowing, surface detrital-feeder
- *Nereis virens*, a burrowing, deposit-feeding polychaete.

All test organisms except mysids, and silversides were wild-captured animals, collected either by a commercial supplier or by MSL personnel. Silversides were supplied by Aquatic Research Organisms in Hampton, New Hampshire, and were shipped via overnight delivery in plastic bags containing oxygen-supersaturated seawater maintained at approximately 22°C with gel refrigerant packs. Mussels used for obtaining *M. galloprovincialis* larvae were purchased from the commercial supplier Marinus Inc., Long Beach, California. Mussels were wrapped in moist paper towels and transported in a Styrofoam cooler packed with gel refrigerant packs to maintain an ambient temperature of approximately 15°C. The amphipod *A. abdita* was supplied by East Coast Amphipod, Kingston, Rhode Island. *A. abdita* and its native sediment were collected from Narragansett Bay, Rhode Island, by dragging a large dipnet along the sediment surface. Test organisms were carefully removed from their tubes for counting, and then placed in clean, native sediment for overnight transport to the MSL. Mysids were purchased from Aquatic Biosystems, Fort Collins, Colorado. Mysids that were less than 24-h old were shipped via overnight delivery in plastic bags containing oxygen-supersaturated seawater maintained at approximately 15°C with gel refrigerant packs. Clams (*M. nasuta*) were collected from intertidal zones in Discovery Bay, Washington, by Johnson and Gunstone. The clams were kept in large containers filled with sediment and seawater obtained from the collection site and transported to the MSL. Worms (*N. virens*) were purchased through Envirosystems, Inc., and were collected from an intertidal

region in Newcastle, Maine. The worms were packed in insulated boxes with mats of moist seaweed and shipped at ambient temperature to the MSL via overnight delivery.

All organisms were shipped or transported in native sediment or under conditions designed to ensure their viability. After arrival at the MSL, the test organisms were gradually acclimated to test conditions. Animals with abnormal behavior or appearance were not used in toxicological tests. All acclimation and animal care records are part of the raw data files for these projects.

2.3 Sediment Sample Preparation

Sediment sample preparation consists of all steps performed in the laboratory between receipt of the samples at the MSL and the preparation of samples for biological testing and physical/chemical analyses. Sediment samples for physical, chemical, and biological analysis were prepared from individual core samples, composites of a number of core samples, reference sediment, and control sediment. All sediment samples were assigned random, unique code numbers to ensure that samples are handled without bias by staff in the biology or chemistry laboratories.

Sediment for biological testing was used within the 6-week holding period specified in the Green Book. During this holding time, the sediment samples were received at the MSL; inventoried against chain-of-custody forms; processed and used for benthic toxicity and water-column tests, elutriate analysis, and bioaccumulation tests; and subsampled for sediment physical/chemical analyses. This section describes procedures followed for equipment preparation, compositing strategy, and preparation of sediments for biological testing and chemical analyses.

2.3.1 Laboratory Preparation and Safety Considerations

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 (e.g., test containers, aquaria, sediment transfer dishes) was washed with hot water and detergent, rinsed with deionized water, then soaked in a 10% solution of reagent grade nitric acid for a minimum of 4 h and rinsed again with deionized water before it was allowed to air dry. Glassware was then rinsed with methylene chloride and allowed to dry under a fume hood. Polyvinyl chloride (PVC), Nalgene, and Teflon tools were treated in the same manner as glassware. Stainless-steel bowls, spoons, spatulas, and other utensils were washed with hot water and detergent, rinsed with deionized water, and allowed to air dry. They were then solvent-rinsed with methylene chloride and allowed to dry under a fume hood.

Neoprene stoppers and polyethylene sheets or other porous materials were washed with hot water and detergent and rinsed with deionized water. These items were then "seasoned" by continuous soaking in 0.45-µm 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 solution of detergent, and thoroughly rinsed with tap water followed by deionized water.

Equipment used for determining water quality, including the meters for pH, dissolved oxygen (DO), temperature, ammonia and salinity, were calibrated according to the manufacturers' specifications and internal MSL standard operating procedures (SOPs).

Because the potential toxicity of the Red Hook/Bay Ridge sediment was unknown, sediment processing and testing were segregated from other laboratory activities. Specific areas at the MSL were established for sample storage and for core-cutting, sediment mixing, and sediment sieving. Work areas were covered with plastic sheeting to contain any waste sediment. Wastewater generated during all operations was retained in 55-gal barrels and periodically pumped through activated charcoal filters and into the MSL's wastewater treatment system. These procedures minimized any potential for cross-contamination of sediment samples and any potential accidental release to the environment.

Laboratory staff members were protected by personal safety equipment such as eyewear, Tyvek suits, plastic aprons, and rubber gloves. Those who were likely to have the most exposure to the potential volatile compounds in the bulk sediment (i.e., those responsible for opening, homogenizing, and compositing core samples) were also provided with half-mask respirators.

2.3.2 Preparation of Sediment for Benthic Testing and Bulk Sediment Analyses

Each core was opened by scoring the Lexan core liner longitudinally with a circular saw and splitting the liner with a clean linoleum knife to expose the sediment. As each sediment core sample was opened, it was examined for physical characteristics (e.g., sediment type and consistency, color, odor). In particular, the presence of any strata in the cores was noted. All core observations were recorded in the sediment preparation log book. The sediment between the mudline and project depth was then transferred from the core liner to a clean, stainless-steel bowl by scooping the sediment from the core liner with a spoon or spatula. The sediment was mixed by hand with stainless-steel utensils until the color and consistency appeared homogenous, creating a sample representative of the individual sampling station. Sieving was not necessary because organisms that might interfere with the benthic toxicity tests were not present in the sediment samples.

Aliquots of the homogenized sediment were then transferred to the appropriate sample jar(s) for physical or chemical analyses required on individual core samples. A portion of each homogenized core sample was also retained as an archive sample. The remainder of the homogenized sediment from the individual core stations was combined to create one composite sample representing the Red Hook project area, designated RH COMP and two composite samples representing the Reach A and Reach B of the Bay Ridge project area, designated BR-A COMP and BR-B COMP, respectively. The Red Hook composite contained sediments from RH-1 through RH-6. The Reach A composite contained sediments from Stations BR-1 through BR-12. The Reach B composite contained sediments from Stations BR-13 through BR-18. Additional composites were created for chemical analysis, solid-phase toxicity, water column toxicity, and bioaccumulation testing, as required for USACE-NED. The compositing scheme for these samples is provided in Section 3. Each sediment composite was homogenized in an epoxy-coated mixer. Aliquots of homogenized composite sediment were transferred to the appropriate sample jar(s) for physical or chemical analyses required on the composite sample. A portion of the homogenized composited sediment was also retained as an archive sample. The remainder was stored in labeled epoxy-coated pails, tightly covered, at 4°C±2°C until use for SPP/elutriate preparation or benthic toxicity and bioaccumulation tests.

The Mud Dump Reference Site sediment, *M. nasuta* native control sediment, and *N. virens* native control sediment were also homogenized in the large, epoxy-coated mixer, but prior to mixing, these sediments were pressed through a 1-mm mesh to remove live organisms that might affect the outcome of toxicity tests. After mixing, aliquots for physical and chemical analyses were removed. Native control sediment for *A. abdita* was sieved through a 0.5-mm mesh to remove live organisms and mixed in stainless-steel bowls after sieving. All reference and control sediments were stored at 4°C±2°C until use in benthic toxicity and bioaccumulation tests.

2.3.3 Preparation of Suspended-Particulate Phase and Elutriate

Toxicological effects of dredged sediments dissolved and suspended in the water-column at an open-water disposal site were simulated in the laboratory by preparation of the SPP. To prepare the SPP, a sediment-water slurry was created and centrifuged at low speed. The centrifugation procedure replaced the 1-h settling procedure described for elutriate preparation in the Green Book. Low speed centrifugation provided a more timely SPP preparation and maintained consistency between projects. The supernatant was decanted and reserved for testing with water-column organisms. The elutriate phase was prepared by centrifuging the SPP at a higher speed and collecting the decanted supernatant. This liquid was analyzed for chemical constituents to identify potential water-soluble contaminants that could remain in the water-column after dredge and 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-µm-filtered Sequim Bay seawater. Homogenized sediment was added until the water was displaced to the 400-mL mark. Each jar was then filled to 1 L with filtered seawater, placed on a shaker table, and agitated for 30 min at 120 to 150 cycles/min. The slurry was then transferred to 500-mL Teflon jars, tightly sealed, and centrifuged at approximately 1750 rpm for 10 min, at a relative centrifugal force of approximately 1000 g. Following centrifugation, the supernatant was poured into 4-L glass jars. The Teflon jars were rinsed after each use and the above process continued until an adequate amount of SPP was produced from each composite. Between SPP preparations, all glass and Teflon containers were cleaned according to procedures described in Section 2.3.1. When all SPP for a treatment was prepared, portions were taken for elutriate preparation. The remaining SPP was either used immediately for biological tests or stored at 4°C±2°C and used within 24 h for testing. The 100% SPP was mixed with Mud Dump Site water to yield three dilutions: 0%, 10%, and 50% SPP, for a total of four concentrations for each sediment composite.

To prepare elutriate for chemistry analyses, a 1-L aliquot of the SPP was collected in an acid-washed Teflon bottle for trace metals analysis, and three 1-L aliquots were collected in EPA-certified amber glass bottles for analysis of organic compounds. The SPP for metals analysis was transferred to acid-washed polycarbonate centrifuge jars, and the SPP for analysis of organic compounds was transferred to Teflon centrifuge jars. Both were centrifuged at 2000 rpm for 30 min at a relative centrifugal force of approximately 1200 g. The decanted supernatant liquid was the elutriate phase. One liter of elutriate was submitted for triplicate trace metals analysis and three 1-L portions were submitted for analysis of organic compounds.

2.4 Physical and Chemical Analytical Procedures

Individual sediment cores, composited bulk sediment, water, elutriate, and tissue samples were analyzed for selected physical and chemical parameters. Table 2.1 lists the parameters measured in each sample type, the method used for each analysis, and the target analytical detection limits. The following sections briefly describe the procedures used for physical and chemical analyses. Procedures followed those required by the Regional Guidance Manual unless otherwise noted.

2.4.1 Grain Size and Percentage of Moisture

Grain size was measured following two methods described by Plumb (1981). The wet sieve method was used to determine the size distribution of sand or coarser-grained particles

TABLE 2.1. List of Analytes, Methods, and Target Detection Limits

Analyte	Methods	Sediment Detection Limit [a]	Tissue Detection Limit [b]	Water Detection Limit
PHYSICAL PARAMETERS				
Grain Size	Plumb (1981)	1.0%		
Specific Gravity	ASTM D-854			
Bulk Density	EM 1110-2-1906 (USACE 1970)			
Percent Moisture	Sediment: Plumb (1981)	1.0 %		
	Tissue: Freeze-dry		1.0 %	
Total organic carbon	EPA (1986)	0.1%		
METALS				
Arsenic	EPA 200.2, -.3, -.8 [c]	0.1 mg/kg	1.0 mg/kg	
Cadmium	EPA 200.2, -.3, -.8 [c]	0.01 mg/kg	0.1 mg/kg	0.025 µg/L
Chromium	EPA 200.2, -.3, -.8[c]	0.02 mg/kg	0.2 mg/kg	1.0 µg/L
Copper	EPA 200.2, -.3, -.8[c]	0.1 mg/kg	1.0 mg/kg	0.35 µg/L
Lead	EPA 200.2, -.3, -.8 [c]	0.1 mg/kg	0.1 mg/kg	0.35 µg/L
Mercury	EPA 245.5 (sed.); 245.6 (tiss.) [c]	0.02 mg/kg	0.02 mg/kg	
	Bloom and Crecelius (1983) (water)			0.002 µg/L
Nickel	EPA 200.2, -.3, 8 [c]	0.1 mg/kg	0.1 mg/kg	0.30 µg/L
Silver	EPA 200.2, -.3, -.9 [c]	0.1 mg/kg	0.1 mg/kg	0.25 µg/L
Zinc	EPA 200.2, -.3, -.8 [c]	0.1 mg/kg	1.0 mg/kg	0.15 µg/L
ORGANIC COMPOUNDS				
Pesticides				
Aldrin	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.004 µg/L
α-Chlordane	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.014 µg/L
trans-Nonachlor	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.014 µg/L
Dieldrin	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.002 µg/L
4,4'-DDT	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.012 µg/L
2,4'-DDT	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.020 µg/L
4,4'-DDD	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.011 µg/L
2,4'-DDD	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.020 µg/L
4,4'-DDE	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.004 µg/L
2,4'-DDE	EPA 8080 (sediment, tissue)	1.0 µg/kg	0.4 µg/kg	
	EPA 608 (water) [c]			0.020 µg/L

TABLE 2.1. (contd)

Analyte	Method(s)	Sediment Detection Limit	Tissue Detection Limit	Water Detection Limit
Endosulfan I	EPA 8080 (sediment, tissue) EPA 608 (water) (c)	1.0 µg/kg	0.4 µg/kg	0.014 µg/L
Endosulfan II	EPA 8080 (sediment, tissue) EPA 608 (water) (c)	1.0 µg/kg	0.4 µg/kg	0.004 µg/L
Endosulfan sulfate	EPA 8080 (sediment, tissue) EPA 608 (water) (c)	1.0 µg/kg	0.4 µg/kg	0.010 µg/L
Heptachlor	EPA 8080 (sediment, tissue) EPA 608 (water) (c)	1.0 µg/kg	0.4 µg/kg	0.003 µg/L
Heptachlor epoxide	EPA 8080 (sediment, tissue) EPA 608 (water) (c)	1.0 µg/kg	0.4 µg/kg	0.100 µg/L
PCBs				
8 (2,4')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
18 (2,2',5)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
28 (2,4,4')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
44 (2,2',3,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
49 (2,2',4,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
52 (2,2',5,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
66 (2,3',4,4')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
87 (2,2',3,4,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
101 (2,2',3,5,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
105 (2,3,3',4,4')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
118 (2,3',4,4',5)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
128 (2,2',3,3',4,4')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
138 (2,2',4,4',5,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
153 (2,2',4,4',5,5')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
170 (2,2',3,3',4,4',5)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
180 (2,2',3,4',5,5',6)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
183 (2,2',3,4,4',5',6)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
184 (2,2',3,4,4',6,6')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
187 (2,2',3,4',5,5',6)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
195 (2,2',3,3',4,4',5,6)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
206 (2,2',3,3',4,4',5,5',6)	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L
209 (2,2',3,3',4,4',5,5',6,6')	NYSDEC (1992) (c)	1.0 µg/kg	0.4 µg/kg	0.0005 µg/L

TABLE 2.1. (contd)

Analyte	Method(s)	Sediment Detection Limit	Tissue Detection Limit	Water Detection Limit
PAHs				
Acenaphthene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Acenaphthylene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Anthracene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Fluorene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Naphthalene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Phenanthrene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Benzo[*a*]anthracene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Benzo[*a*]pyrene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Benzo[*b*]fluoranthene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Benzo[*ghi*]perylene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Benzo[*k*]fluoranthene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Chrysene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Dibenzo[*a,h*]anthracene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Fluoranthene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Indeno[1,2,3-*cd*]pyrene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
Pyrene	EPA 8270 (c)	10 µg/kg	4 µg/kg	
1,4-Dichlorobenzene	EPA 8270 (c)	1.0 µg/kg	0.4 µg/kg	
OTHER MEASUREMENTS				
Total Lipids	Bligh and Dyer (1959)/ Randall (1988)		0.1%	

(a) Detection limits are in dry weight for all sediment parameters except Hg.
(b) Detection limits are in wet weight for all organic and inorganic tissue parameters.
(c) Equivalent MSL standard operating procedures were substituted for the methods cited.

larger than a U.S. No. 230 standard sieve (62.5-μm mesh). The size distribution of particles smaller than a U.S. No. 230 sieve was determined using the pipet method. Grain size was reported as percentages within four general size classes:

gravel	>2000-μm diameter
sand	≥ 62.5-μm diameter and <2000-μm diameter
silt	≥ 3.9-μm diameter and < 62.5-μm diameter
clay	< 3.9-μm diameter.

Percentage of moisture was obtained using the Plumb (1981) method for determining total solids. The procedure involves drying a sediment sample at 100°C until a constant weight is obtained. Percentage of moisture was calculated by subtracting the percentage of total solids from 100%.

2.4.2 Bulk Density and Specific Gravity

Bulk density, or unit weight, was determined according to EM 111-2-1906 (USACE 1970). Specific gravity, the ratio of the mass of a given volume of material to an equal volume of water at the same temperature, was measured according to ASTM D-854.

2.4.3 Total Organic Carbon

Samples were analyzed according to the EPA Edison, New Jersey, Laboratory Procedure (EPA 1986). Inorganic carbon was removed from the sample by acidification. The sample was combusted and the evolved carbon dioxide was quantitated using a carbon-hydrogen-nitrogen (CHN) analyzer. TOC was reported as a percentage of the dry weight of the unacidified sample.

2.4.4 Metals

Preparation and analysis of water samples for Cd, Cr, Cu, Pb, Ni, Ag, and Zn were conducted according to MSL SOPs equivalent to EPA Methods 200.2 and 200.9 (EPA 1991). Samples were chelated with 2% ammonium pyrrolidinedithiocarbamate (APDC), precipitated out of solution, and filtered. The filter was digested in concentrated nitric acid, and the digestate was analyzed by graphite furnace atomic absorption (GFAA) spectroscopy for Cr and Zn, or by inductively coupled plasma/mass spectrometry (ICP/MS) for Cd, Cu, Pb, Ni, and Ag. Water samples were analyzed for Hg directly by cold vapor atomic fluorescence (CVAF) according to the method of Bloom and Crecelius (1983). This CVAF technique is based on emission of 254 - nm radiation by excited elemental Hg atoms in an inert gas stream. Mercuric ions in an oxidized sample were reduced to elemental Hg with tin chloride ($SnCl_2$), then purged onto gold-coated sand traps to pre-concentrate the Hg and remove interferences. Mercury vapor was thermally

desorbed to a second "analytical" gold trap, and from that into the fluorescence cell. Fluorescence (indicated by peak area) is proportional to the quantity of Hg collected, and was quantified using a standard curve as a function of the quantity of the sample purged.

Sediment samples for analysis of As, Cd, Cr, Cu, Pb, Ni, and Zn were prepared according to an MSL SOP equivalent to EPA Method 200.2 (EPA 1991). Solid samples were first freeze-dried and blended in a Spex mixer mill. A 0.2- to 0.5-g aliquot of dried homogeneous sample was then digested using peroxide and nitric acid. Samples were heated in sealed Teflon bombs overnight at approximately 130°C. Sediment samples were analyzed for Ag,As, Cd, Cr, Cu, Pb, Ni, and Zn using ICP/MS, following an MSL SOP based on EPA Method 200.8 (EPA 1991). Sediments were analyzed for Hg by CVAA according to an MSL procedure for total Hg determination equivalent to EPA Method 245.5 (EPA 1991).

Tissue samples were prepared for analysis of metals according to an MSL SOP based on EPA Method 200.3 (EPA 1991). Solid samples were first freeze-dried and blended, and a 0.2- to 0.5-g aliquot of dried homogeneous sample was then digested in a microwave using nitric acid, hydrogen peroxide, and hydrochloric acid. Tissue samples were analyzed for As, Cd, Cr, Cu, Pb, Ni, Ag, and Zn using the ICP/MS method (EPA Method 200.8 [EPA 1991]). Tissue samples were analyzed for Hg by CVAA following an MSL procedure equivalent to EPA Method 245.6 (EPA 1991).

2.4.5 Chlorinated Pesticides and PCBs

Water samples were prepared and analyzed for chlorinated pesticides and PCBs according to a Battelle Ocean Sciences procedure equivalent to EPA Method 8080 (EPA 1990), and incorporating techniques developed by the National Oceanic and Atmospheric Administration (NOAA) National Status and Trends "Mussel Watch" Program (NOAA 1993). Samples were extracted with methylene chloride. Extract volumes were reduced and solvent-exchanged to hexane. The sample extracts underwent cleanup by alumina and silica column chromatography; further interferences were removed by an additional cleanup treatment using high-performance liquid chromatography (HPLC). Sample extracts were concentrated and analyzed using gas chromatography with electron capture detection (GC-ECD) by the internal standard technique.

Sediment and tissue samples for pesticide and PCB analysis were extracted and analyzed according to an MSL procedure similar to EPA Method 8080 for pesticides and the New York State Department of Environmental Conservation (NYSDEC) Congener-Specific Method 91-11 (NYSDEC 1992). The method also uses techniques from the NOAA Mussel Watch procedure. A 20- to 50-g sample of homogenized sediment or macerated tissue was first combined with sodium sulfate in a sample jar to remove water. Samples were extracted by adding successive portions of methylene chloride and agitating sample jars at ambient

temperature using a roller technique. Extract volumes were reduced and solvent-exchanged to hexane, followed by Florisil column chromatography cleanup. Interferences were removed using HPLC cleanup; tissue sample extracts underwent an additional cleanup by gel permeation chromatography (GPC). Sample extracts were concentrated and analyzed using GC-ECD by the internal standard technique.

The concentration of total PCB in each matrix was estimated by taking the sum of the 22 congeners (x) and multiplying by two. The procedure for calculation of total PCBs was established in 1996 (Mario Del Vicario, Chief of the Marine and Wetlands Protection Branch, U.S. Environmental Protection Agency Region 2, Feb 14, 1996, letter to John F. Tavolaro, Chief Operations Support Branch, U.S. Army Corps of Engineers, New York District). One-half of the detection limit was used in summation when an analyte was undetected.

2.4.6 PAHs and 1,4-Dichlorobenzene

Sediment samples were prepared for the analysis of 16 PAHs and 1,4-dichlorobenzene (see Table 2.1) according to a Battelle Ocean Sciences method based on the NOAA Mussel Watch procedure (NOAA 1993). A 20- to 50-g sample of homogenized sediment or macerated tissue was first combined with sodium sulfate in a sample jar to remove water. Samples were extracted by adding successive portions of methylene chloride and agitating sample jars at ambient temperature using an ambient shaker technique. Extract volumes were reduced and solvent-exchanged to hexane, followed by column chromatography cleanup. Interferences were removed using HPLC cleanup; tissue sample extracts underwent an additional cleanup by GPC. Sample extracts were concentrated and analyzed using gas chromatography with mass spectrometry (GC/MS) in the selective ion monitoring (SIM) mode.

2.4.7 Lipids

The lipid content of *M. nasuta* and *N. virens* was determined by the analysis of unexposed background tissue samples of each species. The lipid analysis procedure is a modification of the Bligh and Dyer (1959) methods, which involves a chloroform extraction followed by gravimetric measurement of lipids. Randall (1988) modified the original Bligh and Dyer method to accommodate a smaller tissue sample size. Lipid analysis was performed in triplicate, once for each species. Lipid concentration was reported as a percentage on both a wet and dry weight basis.

2.5 Biological Testing Procedures

2.5.1 Benthic Acute Toxicity Tests

Deposited sediment effects of open-water dredged material disposal were evaluated by benthic acute toxicity tests with the marine amphipod species, *A. abdita* and the mysid *M. bahia.*

2.5.1.1 Static Renewal Test with *Ampelisca abdita*

Upon receipt, the *A. abdita* were placed in a tub of clean sand from their collection area and gradually acclimated to laboratory conditions with unfiltered flowing Sequim Bay seawater.

A. abdita were received at approximately 12°C and acclimated to 20°C±2°C over a period of 5 days. The test organisms were not fed prior to testing.

All amphipod static renewal tests were performed in 1-L glass jars modified for use as flow-through test chambers. The test chambers were fitted with funneled lids and screens and overflow ports (Figure 2.1). Five replicates of each Red Hook/Bay Ridge composite sediment, Mud Dump Reference Site sediment, and native animal control treatments were tested.

Concentrations of ammonia have been encountered in the pore water of sediment core samples from New York/New Jersey waterways at concentrations high enough to affect survival of amphipods in benthic toxicity tests (Barrows et al. 1996). Therefore, the amphipod tests were conducted according to the ammonia reduction methods recommended in the correction (errata) to the EPA standard methods document for conduct of benthic acute toxicity tests (EPA 1994a). This guidance requires postponing test initiation (exposure of test animals) until pore water total ammonia concentrations are below levels where a toxic effect can be noted (i.e., the no-observable-effects-concentration or NOEC) . During this "purging" period, test chambers were set up and maintained under test conditions, and the overlying water was exchanged twice daily until the pore water ammonia concentrations reached the level appropriate for the particular amphipod. The water-system was turned on daily to deliver a volume of seawater equivalent to two chamber exchanges per day(approximately 10 min, two times per day). Pore water ammonia measurements were made on "dummy" containers that were set up and maintained in the same manner as the actual test containers but without animals added to them. The pore water was obtained by siphoning off the overlying water in the dummy jar and centrifuging the sediment in a Teflon jar for at least 20 min at approximately 3000 rpm. Salinity, temperature, and pH were also determined in the pore water samples. Once the test was initiated, overlying water was renewed at a rate of two chamber exchanges per day throughout the 10-day tests.

The amphipod benthic toxicity tests were initiated by the addition of 20 organisms to each test chamber for a test population of 100 amphipods per sediment treatment. Amphipods were gently sieved from their native sediment in holding tanks and transferred to shallow baking dishes.

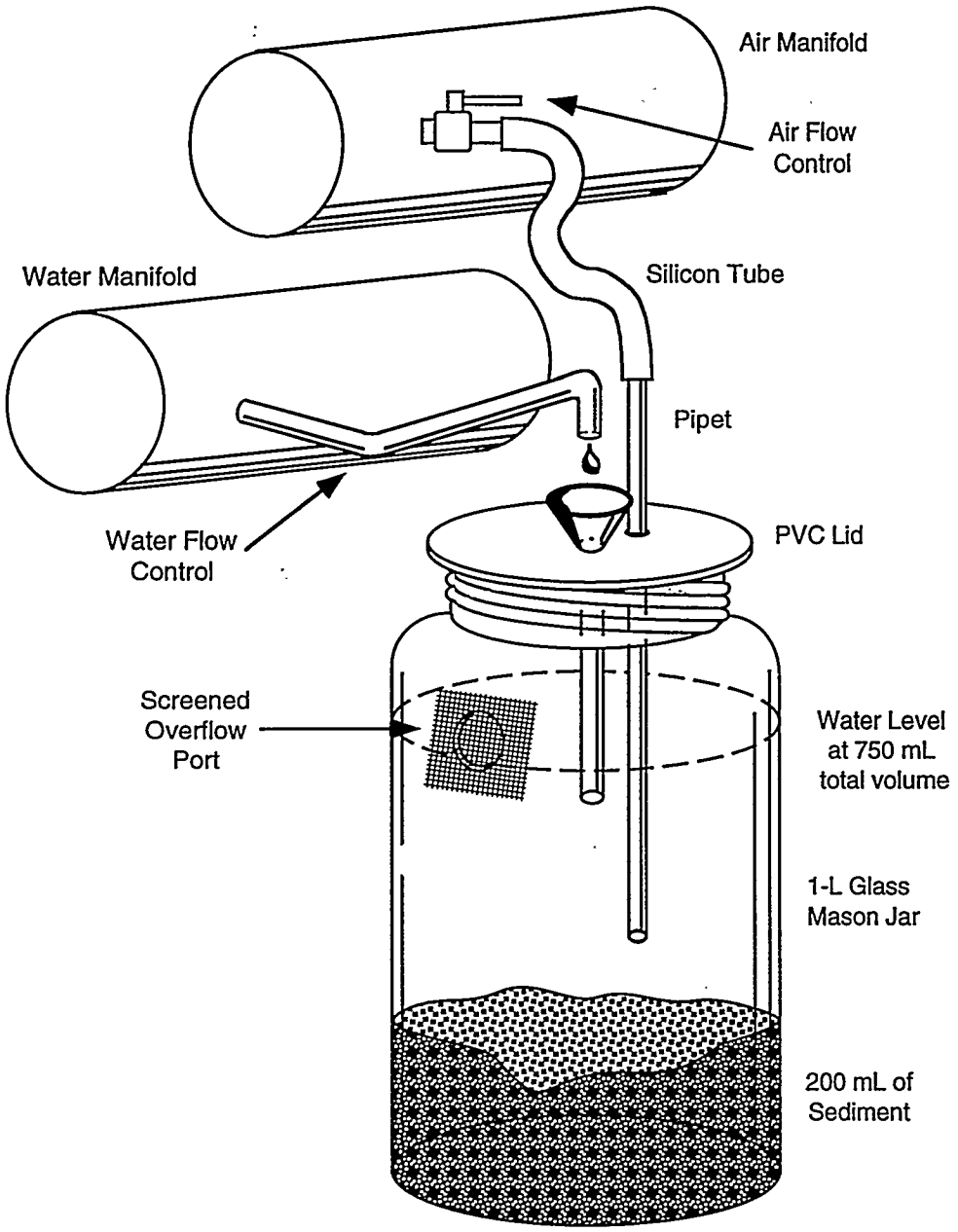

FIGURE 2.1. Testing Containers for Amphipod Static Renewal Toxicity Tests

For each test chamber, five animals were counted and transferred by pipet into each of four small, plastic cups. The animals in each transfer cup were recounted by a second analyst. The animals were placed in the test chamber by dipping the cup below the surface of the water to release the amphipods.

Salinity, temperature, DO, and pH were measured in all replicates prior to test initiation, in at least one replicate per treatment daily, and in all replicates at test termination. Measurements of total ammonia levels in the overlying water and pore water also continued during testing. Overlying water ammonia was measured in all replicates prior to test initiation (Day 0), in at least one replicate per treatment daily, and in all replicates at test termination (Day 10). Pore water ammonia was measured "dummy containers on Day 0 and Day 10. The following were the acceptable ranges for water quality parameters during the *A. abdita* tests:

	A. abdita
Temperature	20°C±2°C
DO	>60% saturation(>4.6mg/L at 20°C, 30‰)
pH	7.8±0.5
Salinity	30‰±2‰
Ammonia	≤30 mg/L in pore water at test initiation
Renewal Rate	2 exchanges/day.

The ammonia pore water maximum limit is based on a directive from the USACE-NYD (personal communication, M. Greges, USACE, April 1995).

Gentle aeration was provided throughout the test, and the amphipods were not fed during testing. At the end of the 10-day period, the contents of each chamber were gently sieved through 0.5-mm mesh, and the number of live, dead, and missing amphipods was recorded on termination forms. An animal was considered dead if it did not respond to gentle probing. As a quality control check, a second observer confirmed surviving test organisms on at least 10% of the termination counts.

Reference toxicant tests with cadmium chloride were performed concurrently with each species. The reference toxicant tests were 96-h, water-only exposures that were otherwise conducted following the same procedures as for the static tests with sediment. *A. abdita* were exposed to nominal concentrations of 0, 0.19, 0.38, 0.75, and 1.5 mg/L Cd.

2.5.1.2 Static Test with *Mysidopsis bahia*

Upon receipt at the laboratory, *M. bahia* were placed in 10-gal aquaria and gradually acclimated from 25‰ seawater to 30‰ and 20°C±2°C with Sequim Bay seawater over a period of 3 days. Mysids were fed concentrated brine shrimp nauplii twice daily prior to testing. Mortality of the *M. bahia* during holding was less than 1%.

The 10-day static benthic acute toxicity test with *M. bahia* was performed in 1-L glass jars. To prepare each test container, 200 mL of clean seawater was placed in each jar. Sediment was added until water was displaced up to the 400-mL mark, then seawater was added up to the 750-mL mark. Five replicates of each Red Hook/Bay Ridge sediment composite and the Mud Dump Reference Site sediment were tested. Static jars were renewed twice daily for 10 days. At the start of the test the porewater ammonia concentrations ranged from 1.44 to 39.4 mg/L and overlying water ammonia concentrations were all less than 1.0 mg/L.

The mysid benthic toxicity test was initiated by the addition of 20 organisms to each test chamber for a test population of 100 mysids per sediment treatment. Mysids were transferred from holding tanks to shallow glass dishes. For each test chamber, five animals were counted and transferred by pipet into each of four small, plastic cups. The animals in each transfer cup were recounted by a second analyst. The animals were placed in the test chamber by dipping the cup below the surface of the water to release the mysids.

Salinity, temperature, DO, pH, and total ammonia in overlying water were measured in all replicates prior to test initiation, in at least one replicate per treatment daily, and in all replicates at test termination. The following were the acceptable ranges for water quality parameters during the *M. bahia* benthic test:

	M. bahia
Temperature	20°C±2°C
DO	>40% saturation(>3.0 mg/L at 20°C,30‰)
pH	7.8±0.5
Salinity	30‰ ± 2‰
Ammonia	≤15 mg/L in overlying water at test initiation.

The ammonia overlying water maximum limit is based on EPA guidance (EPA 1994b) that provided criteria of 0.6 mg/L unionized ammonia at pH of 7.9-8.0 and 0.3 mg/L unionized ammonia at pH of 7.5 (at 26°C and 31‰ salinity). When converted to test temperature, pH, and salinity used at the MSL, these values equal approximately 15 mg/L total ammonia.

Gentle aeration was provided to all test chambers during the test to maintain consistency in DO concentration among test containers. At the end of the 10-day period, the contents of each chamber were gently sieved through 0.5-mm mesh, and the number of live and dead or missing mysids was recorded on termination forms. An animal was considered dead if it did not respond to gentle prodding. As a quality control check, a second observer confirmed surviving test organisms on at least 10% of the termination counts.

Because the same mysid population was used for the benthic test and the water-column test, one 96-h, water-only reference toxicant test with copper sulfate (0,100, 150, 200 and 300 µg/L copper) was performed concurrently with these tests (Refer to Section 2.5.1.2.).

2.5.2 Water-Column Toxicity Tests

Water-column effects of open-water dredged-material disposal were evaluated by exposing three species of water-column organisms to the SPP of the Red Hook/Bay Ridge sediment composites. The three test species were juvenile *M. beryllina* (silverside) and *M. bahia* (mysid), and larval *M. galloprovincialis* (mussel). Total ammonia monitoring was not performed during water-column toxicity tests, but prior to test initiation total ammonia concentrations were measured for the 100% SPP concentration and is presented in Section 3.4.

2.5.2.1 Water-Column Toxicity Test with *Menidia beryllina*

Upon receipt, the *M. beryllina* were placed in a 10-gal glass aquarium and acclimated from 20.5‰ seawater to 30.0‰ Sequim Bay seawater over a 3-day period. *M. beryllina* were received and held at 20°C±2°C prior to testing and were fed concentrated brine shrimp nauplii daily. During acclimation and holding, 2% to 3% mortality of the silversides was observed.

Test containers for the water-column toxicity test with silversides were 500-mL glass jars, labeled with sediment treatment code, concentration, position number, and replicate number. Five replicates of each concentration (0%, 10%, 50%, and 100% SPP) were tested, with a 300-mL test volume per replicate. Each test chamber was then placed in a randomly assigned position on a water table at 20°C±2°C and allowed to equilibrate to test temperature for several hours. After the SPP concentrations reached test temperature, water quality parameters were measured and recorded for all replicates of all concentrations for each sediment treatment.

To initiate the test, *M. beryllina* were transferred from the holding tank to test chambers with a wide-bore pipet via small transfer cups. Ten individuals were introduced to each test chamber, creating a test population of 50 silversides per concentration for each treatment. Ten animals per test chamber were used, rather than the 20 animals per chamber as described in the Regional Guidance Manual, because it is not possible to make accurate daily observations of *M. beryllina* behavior when using 20 animals. Test initiation time and date were recorded.

Following test initiation, water quality parameters were recorded in one replicate of each concentration daily. Because several treatments had DO levels lower than 40% saturation prior to test initiation, all test chambers were aerated to maintain consistency in DO concentration among test containers. Acceptable parameters for this test were as follows:

	M. beryllina
Temperature	20°C±2°C
DO	>40% saturation (>3.0 mg/L at 20°C, 30‰)
pH	7.8±0.5
Salinity	30.0‰±2.0‰.

The test was run under a 16-h light/8-h dark photoperiod, and silversides were fed brine shrimp nauplii daily during the test. Observations of the animals were performed at 2 h, 24 h, 48 h, and 72 h, and the number of live, dead, and missing was recorded. At the end of the 96-h test period, water quality parameters were measured for all test chambers, and the number of live, dead, and missing silversides was recorded on termination forms. As a quality control check, a second observer confirmed surviving test organisms on at least 10% of the termination counts.

A 96-h, water-only, reference toxicant test was performed concurrently with the toxicity test with each population of *M. beryllina* to establish the health and expected response of the test organisms. The reference toxicant test was conducted in the same manner as the water-column toxicity test. *M. beryllina* were exposed to a seawater control plus four concentrations of copper sulfate: 16, 64, 160, and 400 µg/L copper, using three replicates of each concentration.

2.5.2.2 Water-Column Toxicity Test with *Mysidopsis bahia*

Upon receipt, the *M. bahia* were placed in a 10-gal aquarium and gradually acclimated from 28.0‰ seawater to 30‰ Sequim Bay seawater over a 4 day period. Mysids were received and held at 20°C±2°C until testing and were fed concentrated brine shrimp nauplii twice daily prior to testing. Mortality of the *M. bahia* during holding was less than 1%.

The water-column toxicity test with the mysid was performed in 200 mL of test solution in 400-mL jars, labeled with sediment treatment code, concentration, position number, and replicate number. Five replicates of each concentration were tested. Each of the test chambers received 200 mL of test solution, then was placed randomly in a recirculating water bath and allowed to equilibrate to test temperature for several hours. Prior to test initiation, water quality parameters were measured in each replicate of each sediment treatment concentration. Acceptable water quality parameters for this test were as follows:

	M. bahia
Temperature	20°C±2°C
DO	>40% saturation (>3.0 mg/L at 20°C, 30‰)
pH	7.8±0.5
Salinity	30.0‰±2.0‰.

To initiate the test, *M. bahia* were transferred from the holding tank to test chambers with a wide-bore pipet via small transfer cups. Ten individuals were introduced to each test chamber, creating a test population of 50 mysids per concentration (200 mysids per treatment). Ten animals per test chamber were used, rather than the 20 animals per chamber as described in the Regional Guidance Manual, because it is not possible to make accurate daily observations of *M. bahia* behavior when using 20 animals. Test initiation time and date were documented on data forms. Observations of test organisms were performed at 4 h, 24 h, 48 h, and 72 h, using a

fluorescent light table to enhance visibility of the *M. bahia*. After test initiation, water quality parameters were measured daily in one replicate concentration of all concentrations for each sediment treatment. During the 96-h exposure, *M. bahia* were fed <24-h-old brine shrimp daily. Excess food was removed daily with a small pipet, taking care not to disturb test animals. Molted exoskeletons and any particulates from the SPP solutions were also removed.

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

A 96-h, water-only, reference toxicant test was performed concurrently with the toxicity test with each batch of *M. bahia* to establish the health and expected response of the test organisms. The reference toxicant test was conducted in the same manner as the water-column toxicity test. *M. bahia* were exposed to a seawater control plus four concentrations of copper sulfate: 100, 150, 200, and 300 µg/L copper, using three replicates of each concentration.

2.5.2.3 Water-Column Toxicity Test with *Mytilus galloprovincialis* Larvae

Prior to testing, adult *M. galloprovincialis* were held in flowing, unfiltered Sequim Bay seawater at ambient temperatures for approximately 5 days.

Chambers for the bivalve larvae test were 500-mL glass jars labeled with sediment treatment code, concentration, position number, and replicate number. Dilutions of SPP from sediment composites (0%, 10%, 50%, and 100%) were prepared with Mud Dump Site water in a 2000-mL graduated cylinder, then 300 mL of test solution was transferred into each test chamber. Test chambers were placed in random positions on a water table and allowed to equilibrate to test temperature for several hours. Initial water quality parameters were measured in all replicates once test chambers reached testing temperatures (16°C±2°C).

Spawning was induced by placing *M. galloprovincialis* into 15°C, filtered Sequim Bay seawater and rapidly raising the holding water temperature to 20°C. Spawning generally occurs within 1 h of temperature elevation; however, on the first day of spawning, gametes were shed after 3 h to 4 h. For this group of mussels, the water bath was changed when DO levels fell below 3.0 mg/L. When spawning began, males and females were identified and isolated in individual jars containing filtered Sequim Bay seawater and allowed to shed gametes for approximately 45 min. Eggs from each female were filtered through a 75-µm Nytex screen into separate jars to remove feces, detritus, and byssal fibers. Sperm from at least three males were pooled, and 10 mL of sperm solution was then added to each of the egg stocks. Egg-sperm solutions were gently mixed every 10 min with a perforated plunger. Fertilization proceeded for 1 h, then fertilization rate (percentage of fertilized eggs) was determined by removing a

subsample and observing the number of multicell-stage embryos. Fertilization was considered successful if greater than 90% of the embryos were in the multicell stage. Egg stocks with greater than 90% fertilization were combined and rinsed on a 20-µm Nytex screen to remove excess sperm. Stock embryo solution density was estimated by removing a 0.1-mL subsample and counting all multicell embryos, then multiplying by 10 to yield embryo density (embryos/mL). Stock solution was diluted or concentrated to yield 7500 to 9000 embryos/mL. The test was initiated by introducing 1 mL of stock solution into each test chamber, to produce embryo densities of 25 to 30 embryos/mL. Test initiation date and time were recorded on data sheets. Following initiation, 10 mL stocking-density subsamples were removed from each container and preserved in 5% formaldehyde to determine actual stocking density later.

Water quality parameters were measured in one replicate of each concentration per treatment daily throughout the test. Acceptable ranges for water quality parameters were as follows:

	M. galloprovincialis
Temperature	16°C±2°C
DO	>40% saturation (>4.9 mg/L at 16°C, 30‰)
pH	7.8±0.5
Salinity	30.0‰±2.0‰.

Because several treatments had DO levels below the acceptable level of 40% saturation, each chamber was provided with gentle aeration to maintain consistency in DO concentration among test containers. The bivalve test was terminated after 48 h when greater than 80% of the larvae in the controls had reached the D-cell stage. Final water quality parameters were recorded for all replicates. The contents of each chamber were then homogenized with a perforated plunger, and a 10-mL subsample was removed and placed into a 20-mL scintillation vial. The subsample was then fixed with 1 mL of 50% solution of formaldehyde in seawater. Samples were scored for the appearance of normal and abnormal D-shaped larvae, blastula larvae, and total number of larvae. At least 10% of the counts were confirmed by a second observer.

A 72-h reference toxicant test was conducted to verify the health and expected response of the test organisms. The reference toxicant test was set up and conducted in the same manner as the liquid-phase tests. *M. galloprovincialis* larvae were exposed to a filtered Sequim Bay seawater control plus copper sulfate concentrations of 1, 4, 16, and 64 µg/L copper, with three replicates per concentration.

2.5.3 Bioaccumulation Testing

The bivalve *M. nasuta* and the polychaete *N. virens* were used to evaluate the potential bioaccumulation of contaminants from dredged material. The bioaccumulation tests were 28-day flow-through exposures to sediment, followed by a 24-h depuration period that allowed the organisms to void their digestive tracts of sediment. *M. nasuta* and *N. virens* were tested in separate 10-gal flow-through aquaria. Animals were exposed to five replicates of each Red Hook/Bay Ridge sediment composite, Mud Dump Reference Site sediment, and native control sediment. Each chamber contained 25 *M. nasuta* or 20 *N. virens*. Water quality parameters (temperature, DO, pH, and salinity) were measured in all replicates at test initiation, in at least one replicate per treatment daily, and in all replicates at test termination. Flow rates were measured daily in all chambers.

Upon receipt at the laboratory, *M. nasuta* were received damp and held in control sediment with flowing Sequim Bay seawater for 4 days at 15°C±2°C until testing and were not fed. *N. virens* were placed in holding trays of control sediment with heated Sequim Bay seawater flowing into the trays. *N. virens* were received at 17°C and gradually acclimated to 20°C±2°C over a 9-day period. *N. virens* were not fed prior to testing. Mortality of *M. nasuta* and *N. virens* during holding was less than 1%.

The Regional Guidance Manual provides an acceptable temperature range of 13°C±1°C for *M. nasuta*; however, laboratory logistics required that *M. nasuta* be conducted at 15°C under flow-through conditions. This alteration of test temperature was not expected to affect the outcome of the test; bioaccumulation tests with *M. nasuta* have been successfully conducted at 15°C±2°C. After discussion with the USACE-NYD project manager, the following ranges for water quality parameters were established as acceptable for the *M. nasuta* and *N. virens* tests:

	M. nasuta	*N. virens*
Temperature	15°C±2°C	20°C±2°C
DO	> 60% saturation	> 60% saturation
pH	7.8±0.5	7.8±0.5
Salinity	30‰±2‰	30‰±2‰
Flow Rate	125±10 mL/min	125±10 mL/min.

Aeration was provided to all test chambers to maintain consistency in DO concentrations among test chambers. Water quality, organism behavior (e.g., burrowing activity, feeding), and organism mortality were recorded daily. Ammonia reduction procedures were not performed on sediments used for bioaccumulation tests. Dead organisms were removed daily. At the end of the 28-day testing period, *M. nasuta* and *N. virens* were placed in clean, flowing seawater for 24 h, after which the tissues were transferred into the appropriate chemistry jars for metals,

pesticide/PCB, and PAH analyses. All tissue samples were frozen immediately and stored at less than -20°C until analysis.

Water-only reference toxicant tests (96-h) were also performed using copper sulfate in six geometrically increasing concentrations. The exposures were conducted using a test volume of 5 L in static 9.5-L (2.5-gal) aquaria. Three replicates of each concentration were tested, each containing 10 organisms. Water quality parameters were monitored at the same frequency and maintained within the same limits as the 28-day test, except that there were no flow rates. The *M. nasuta* reference toxicant test was conducted with treatments of 0, 0.25, 0.50, 0.75, 1.0, 1.5 and 2.5 mg/L Cu; the *N. virens* test was conducted with treatments of 0, 0.05, 0.075, 0.15, 0.20,0.25, and 0.30 mg/L Cu.

2.6 Data Analysis and Interpretation Procedures

Statistical analyses were conducted to determine the magnitude and significance of toxicity and bioaccumulation in test treatments relative to the reference treatment. Each statistical test was based on a completely random design that allowed unbiased comparison between treatments.

2.6.1 Randomization

All water-column and benthic toxicity tests were designed as completely random tests. Organisms were randomly allocated to treatments, and treatments were randomly positioned on water tables. To determine randomization, a random-number table was generated for each test using the discrete random-number generator in Microsoft *Excel* spreadsheet software.

2.6.2 Statistical Analysis of Benthic Toxicity Tests

Benthic toxicity of all sediment treatments was compared to a single reference treatment using Dunnett's test (Dunnett 1964). The arcsine square root of the proportion of organisms surviving the test was used to stabilize the within-class variances. As recommended by the Green Book an experiment-wise error α=0.05 was used. Acute toxicity for the amphipod test indicates that the test treatment was statistically significant relative to the reference treatment and had a greater than 20% difference in survival from the reference treatment. Acute toxicity for the mysid test indicates that the test treatment was statistically significant relative to the reference treatment and had a greater than 10% difference in survival from the reference treatment.

2.6.3 Statistical Analysis of Water-Column Tests

Two statistical analyses are presented in the Green Book for the interpretation of SPP (water-column) tests. The first is a one-sided t-test between survival in control test replicates and survival in the 100% SPP test replicates. A significant difference indicates acute toxicity in the 100% SPP treatment. This analyses was performed only when survival in the 100% SPP is less than the control (0% SPP) survival, and when control survival is >90% for nonlarval tests and >70% for larval tests. Prior to conducting the t-test, angular transformation (arcsine of the square root) of the proportion surviving in test replicates was performed to reduce possible heterogeneity of variance between mean survival of test organisms in the control and in the 100% SPP. The second analysis required by the Green Book is estimation of the medium lethal concentration (LC_{50}) or median effective concentration (EC_{50}). The LC_{50} or EC_{50} values for these tests were estimated using the trimmed Spearman-Karber method (Finney 1971) and are expressed in percentage of SPP. The Spearman-Karber estimator is appropriate only if there was increasing mortality (or effect) with increasing concentration, and if ≥50% mortality (or effect) was observed in at least one test concentration when normalized to control survival. If 50% mortality (or effect) did not occur in the 100% SPP concentrations for any treatments, then LC_{50} or EC_{50} values were reported as >100% SPP.

2.6.4 Statistical Analysis of Bioaccumulation

The results of the chemical analyses of test organism tissues exposed to the dredged sediment treatments was statistically compared with those tissues similarly exposed to the Mud Dump Reference Site treatment using Dunnett's test with an experiment-wise error of α=0.05. The Dunnett's tests determined whether or not the concentrations of contaminants of concern in the organisms exposed to the dredged sediments statistically exceeded those of organisms exposed to the reference sediment

Statistical analyses were performed on the dry weight concentrations. When a compound (metals, pesticides, PCBs, and PAHs) was undetected (indicated by a "Q" flag in the report tables and a "U" flag in the appendix tables), one-half the detection limit of a compound was used in numerical calculations. If the compound was undetected in all five replicates of a test treatment, or if the mean concentration of a compound was greater in tissue samples from the reference treatment than in tissue samples from the test treatments, no further analysis was necessary. If a compound was undetected in all five replicates of the reference treatment, a one-sided, one-sample t-test (α=0.05) was used to determine if the tissue concentrations from organisms exposed to dredged sediment treatments were statistically greater than the mean detection limit for that compound from the reference tissue. Results of background and control tissues were not statistically compared with the reference.

Magnification factors were calculated for each compound as the dry weight ratio of the mean tissue concentration from organisms exposed to dredged sediment treatments to the mean tissue concentration from organisms exposed to the Mud Dump Reference Site sediment. Whole detection limits were used for non-detects in this calculation.

2.7 Quality Assurance/Quality Control Procedures

The quality assurance/quality control (QA/QC) procedures for the Red Hook/Bay Ridge project were consistent with the Regional Guidance Manual and the Green Book, and were documented in the Work/Quality Assurance Project Plan, *Evaluation of Dredged Material Proposed for Ocean Disposal from Federal Projects in New York (Parts 4,5, and 6)*, prepared by the MSL and submitted to the USACE-NYD for this program. This document describes all QA/QC procedures that were followed for sample collection, sample tracking and storage, and physical/chemical analyses. A member of Pacific Northwest National Laboratory's quality engineering staff was present throughout all phases of this program to observe procedures, review and audit data, and ensure that accepted protocols were followed. Data accumulation notebooks were assigned to each portion of these studies and served as records of day-to-day project activities.

3.0 Results

This section presents results of sample collection and processing, and physical and chemical analyses conducted on sediment collected from the Red Hook/Bay Ridge dredging area.

3.1 Sample Collection and Processing

Sediment core samples were collected from the Red Hook/Bay Ridge project areas on March 21 through March 30, 1995 (Figure 1.1). Table 3.1 lists each sampling station within the Red Hook/Bay Ridge project areas, sampling coordinates, collection date, length of core required for testing (including 2 ft of overdepth), and length of core actually collected. Twenty-four core samples were collected aboard the *Hayward*. Eighteen of the Bay Ridge core samples were collected to the project depth of -40 ft MLW plus 2 ft of overdepth; three core samples were short of project depth by 0.2 ft to 0.4 ft. Project depth was not reached at those stations because the vibratory core sampler met the point of resistance prior to reaching it. It was decided by the NYD project manager that the shorter cores would be used in the chemical and toxicological evaluations. Two of the six Red Hook core samples were collected to the project depth of -40 ft plus 2 ft of overdepth. The other Red Hook core samples were from 0.35 ft to 7.8 ft short of reaching project depth.

Upon delivery of the sediment core samples to the MSL on April, 1994, samples were prepared for the physical and chemical analyses according to the procedures described in Section 2. Individual sediment core samples were analyzed for grain size, moisture content, and TOC. One composite sample representing the Red Hook project area (RH COMP) and two composite sediment composites representing Reaches A and B of the Red Hook/Bay Ridge project area (COMP BR-A and COMP BR-B) were analyzed for bulk density, specific gravity, metals, chlorinated pesticides, PCBs, PAHs, and 1,4-dichlorobenzene. The Red Hook composite contained stations RH-1 through RH-6. Reach A consisted of stations BR-A-1 through BR-A-12. Reach B consisted of stations BR-B-13 through BR-B-18.

3.2 Physical and Chemical Analyses

3.2.1 Sediment Core Sample Description

Table 3.2 lists physical characteristics of each sediment core sample that was examined. Red Hook/Bay Ridge sediment samples were generally black or gray-black, silty-clayey material.

TABLE 3.1. Summary of Sediment Sample Data for Red Hook/Bay Ridge Project Areas

Station	Collection Date	Station Coordinates Latitude N	Station Coordinates Longitude W	Core Length Required (ft)	Core Length Collected (ft)	Depth (ft)
Red Hook						
RH-1	3/21/95	40°39.95'	74°01.37'	11.9	12.0	30.1
RH-2	3/21/95	40°39.98'	74°01.33'	7.5	7.8	34.5
RH-3[a]	3/21/95	40°40.07'	74°01.37'	5.1	4.8	36.9
RH-4	3/21/95	40°40.25'	74°01.15'	9.4	7.2	32.6
RH-5	3/21/95	40°40.57'	74°01.22'	10.7	2.9	31.3
RH-6	3/23/95	40°40.70'	74°01.23'	5.9	4.0	36.1
Bay Ridge Reach A						
BR-A-1	3/22/95	40°39.23'	74°01.88'	4.2	4.7	37.8
BR-A-2	3/22/95	40°39.32'	74°01.73'	3.5	4.0	38.5
BR-A-3	3/22/95	40°39.40'	74°01.62'	4.3	5.0	37.7
BR-A-4	3/22/95	40°39.45'	74°01.53'	4.6	5.2	37.4
BR-A-5	3/22/95	40°39.53'	74°01.62'	11.9	13.0	30.1
BR-A-6	3/22/96	40°39.57'	74°01.52'	7.9	8.8	34.1
BR-A-7	3/23/95	40°39.10'	74°01.62'	11.4	13.0	30.6
BR-A-8[a]	3/22/95	40°39.53'	74°01.40'	3.0	3.0	39.0
BR-A-9	3/22/95	40°39.53'	74°01.30'	3.9	4.0	38.1
BR-A-10	3/22/95	40°39.62'	74°01.32'	5.4	5.0	36.6
BR-A-11	3/22/95	40°39.72'	74°01.38'	4.0	5.0	38.0
BR-A-12	3/21/95	40°39.77'	74°01.27'	2.9	3.0	39.1
Bay Ridge Reach B						
BR-B-13	3/23/95	40°38.23'	74°02.43'	7.2	7.3	34.8
BR-B-14	3/23/95	40°38.58'	74°02.17'	8.3	8.6	33.7
BR-B-15[a]	3/23/95	40°38.67'	74°02.03'	6.2	6.0	35.8
BR-B-16	3/23/95	40°39.02'	74°01.72'	5.5	6.0	36.5
BR-B-17	3/23/95	40°39.08'	74°01.62'	11.9	12.5	30.1
BR-B-18	3/22/95	40°39.32'	74°01.38'	7.0	6.8	35.0
Grab Samples						
MDRS[b]	3/28/95	40°20.20'	74°52.18'	---[c]	---	67 - 68

(a) Site water sample collected at this station.
(b) MDRS Mud Dump Reference Site.
(c) --- Not applicable.

TABLE 3.2. Red Hook/Bay Ridge Sediment Core Descriptions

Station	Depth (-ft MLW) Core Top	Core Bottom	Project Depth[a]	Description of Observations
RH-1	30.1	42.1	42.0	Uniform black silt.
RH-2	34.5	42.3	42.0	Black silt from mudline to 38.5 ft MLW. Remaining core is brownish grey sand.
RH-3	36.9	41.7	42.0	Black silt from mudline to 40.9 ft MLW. Remaining core is brownish grey sand.
RH-4	32.6	39.8	42.0	Black silt from mudline to 36.1 ft MLW. Remaining core is reddish yellow sand with small band of red clay.
RH-5	31.3	34.2	42.0	Black silt followed by yellow coarse sand with gravel at core bottom.
RH-6	36.1	40.1	42.0	Black silt from mudline to 37.1 ft MLW. Remaining core is red sand and clay.
BR-A-1	37.8	42.5	42.0	Uniform black silt.
BR-A-2	38.5	42.5	42.0	Uniform black silt.
BR-A-3	37.7	42.7	42.0	Uniform black silt.
BR-A-4	37.4	42.6	42.0	Uniform black silt.
BR-A-5	30.1	43.1	42.0	Uniform black silt.
BR-A-6	34.1	42.9	42.0	Uniform black silt.
BR-A-7	30.6	43.6	42.0	Uniform black silt.
BR-A-8	39.0	42.0	42.0	Uniform black silt.
BR-A-9	38.1	42.1	42.0	Uniform black silt.
BR-A-10	36.6	41.6	42.0	Uniform black silt.
BR-A-11	38.0	43.0	42.0	Uniform black silt.
BR-A-12	39.1	42.1	42.0	Uniform black silt.
BR-B-13	34.8	42.1	42.0	Uniform black silt.
BR-B-14	33.7	42.3	42.0	Uniform black silt followed by grey clay.
BR-B-15	35.8	41.8	42.0	Uniform black silt to 38.8 ft MLW, followed by grey sand.
BR-B-16	36.5	42.5	42.0	Uniform black silt to 40.5 ft MLW, followed by grey sand.
BR-B-17	30.1	42.6	42.0	Uniform black silt to 33.1 ft MLW. Remaining core is grey sand, oily sand, brown sand, and yellow sand.
BR-B-18	35.0	41.8	42.0	Uniform black silt.

(a) Project depth plus 2 ft overdepth.

3.2.2 Grain Size, Total Organic Carbon, Percentage of Moisture, Bulk Density, and Specific Gravity

Table 3.3 shows the results of the analysis of individual Red Hook/Bay Ridge core samples for grain size, TOC, and percentage of moisture. Table 3.4 shows the results of the bulk density and specific gravity analysis of each composite. A quality control summary and quality control data for grain size and TOC measurements are provided in Appendix A.

The physical characteristics of Red Hook/Bay Ridge sediments were variable; eight stations were predominantly sand and gravel (RH-2, RH-3, RH-4,RH-5, RH-6, BR-B-15, BR-B-16, BR-B-17), whereas the remaining 16 test sediments and the three control sediment were predominantly silt and clay. Percentages of gravel ranged from 0% to 36%; sand ranged from 10% to 84%; silt ranged from 5% to 52%; and clay ranged from 2% to 49%. Each sediment sample (station) was represented by at least three grain-size fractions. The Mud Dump Reference Site sediment was composed of 96% sand.

The TOC values for the individual test stations ranged from 0.28% to 3.59% with 17 of the 24 test stations with TOC values above 2.0%. The Mud Dump Reference site had a TOC concentration of 0.02%. The percentage of moisture of the 24 individual stations ranged from 16% to 63%. The Mud Dump Reference Site sediment had a percentage of moisture of 13%.

Bulk density and specific gravity were also measured on the Red Hook/Bay Ridge composites and the Mud Dump Reference Site. The results are shown in Table 3.4. Bulk density values (dry weight) ranged from 35 lb/cu ft to 96 lb/cu ft. The specific gravity values ranged from 2.63 to 2.68.

3.2.3 Metals

Table 3.5 shows the results of the metals analysis for the three test sediment composites (RH COMP, BR-A COMP, and BR-B COMP). A quality control sample summary and quality control data associated with the metals analysis are provided in Appendix A.

Concentrations of all nine metals analyzed for this project were detected in the Red Hook/Bay Ridge sediment composites. The sediment from BR-A COMP had the highest levels of six of the nine metals analyzed when compared with the other composites. Levels of metals between RH-COMP and BR-B COMP were similar.

3.2.4 Chlorinated Pesticides

Table 3.6 shows the results of the analysis of Red Hook/Bay Ridge composites for chlorinated pesticides. A quality control summary and associated quality control data are provided in Appendix A.

TABLE 3.3. Results of Analysis of Red Hook/Bay Ridge Sediment Samples for Grain Size, Total Organic Carbon, and Percentage of Moisture

Station	Total Percent (dry weight) Gravel ≥2000 µm	Sand 62.5-2000 µm	Silt 3.9-62.5 µm	Clay <3.9 µm	TOC	Percentage Moisture
Red Hook						
RH-1	2	29	35	34	3.59	51
RH-2	7	63	16	14	1.56(a)	37
RH-3	7	54	22	17	1.93	41
RH-4	6	67	15	12	0.74	34
RH-5	36	47	10	7	2.99	23
RH-6	3	75	16	6	0.28	18
Bay Ridge Reach A						
BR-A-1	0	21	43	36	2.70	58
BR-A-2	1	24	43	32	2.66	57
BR-A-3	2	18	45	35	2.80	59
BR-A-4	0	16	52	32	2.82	58
BR-A-5	0	15	42	43	3.19	61
BR-A-6	0	10	43	47	3.02	58
BR-A-7	0	10	41	49	3.17	59
BR-A-8	0	18	44	38	2.80	63
BR-A-9	0	16	47	37	2.77	57
BR-A-10	0	11	47	42	2.95	60
BR-A-11	1	13	44	42	3.02	62
BR-A-12	2	19	47	32	2.82	59
Bay Ridge Reach B						
BR-B-13	0	29	43	28	3.56	48
BR-B-14	0	29	40	31	3.39	51
BR-B-15	1	69	17	13	0.66	33
BR-B-16	5	55	22	18	1.02	43
BR-B-17	9	84	5	2	0.36	16
BR-B-18	0(a)	27(a)	42(a)	31(a)	2.90	51(a)
MDRS(b)	3	96	0	1	0.02	13
Sequim Bay Control	0	21	52	27	2.00	75
Nereis Control	0	13	60	27	2.11	54
Ampelisca Control	0	11	67	22	2.95(a)	69

(a) Mean of replicates.
(b) MDRS Mud Dump Reference Site.

TABLE 3.4. Results of Analysis of Red Hook/Bay Ridge Sediment Composites for Bulk Density and Specific Gravity

Sediment Treatment	Bulk Density Wet lbs/ft^3	Bulk Density Dry lbs/ft^3	Specific Gravity
RH COMP	104	64	2.68
BR-A COMP	85	35	2.63
BR-B COMP	106	69	2.66
MDRS[a]	110	96	2.68

(a) MDRS Mud Dump Reference Site.

TABLE 3.5. Results of Analysis of Red Hook/Bay Ridge Sediment Composites for Metals

Sediment Treatment	Concentrations in mg/kg dry weight Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
RH COMP[a]	3.47	14.9	1.64	64.8	82.4	1.87	43.8	178	132
BR-A COMP	7.06	12.0	2.43	110	122	1.95	31.5	172	177
BR-B COMP	4.32	10.3	2.02	78.2	89.2	1.42	21.7	113	131

(a) Mean of replicates.

TABLE 3.6. Results of Analysis of Red Hook/Bay Ridge Sediment Composites for Pesticides and PCBs

Sediment Treatment	Concentrations in µg/kg dry weight RH COMP	BR-A COMP	BR-B COMP
2,4'-DDD	4.34	7.30	12.3
2,4'-DDE	0.69 U[a]	0.96 U	0.64 U
2,4'-DDT	0.24 U	0.34 U	0.22 U
4,4'-DDD	12.9	21.5	48.5
4,4'-DDE	12.1	27.4	42.3
4,4'-DDT	8.55	13.8	19.9
Total DDTs[b]	**38.4**	**70.7**	**123**
Aldrin	5.81	10.6	6.86
α-Chlordane	3.45	5.56	4.66
Dieldrin	1.79	5.38	2.66
Endosulfan I	4.75	0.45 U	0.30 U
Endosulfan II	0.32 U	0.45 U	0.30 U
Endosulfan Sulfate	0.99	0.44	0.70
Heptachlor	0.07 U	0.09 U	0.06 U
Heptachlor Epoxide	0.32 U	0.44 U	0.29 U
trans-Nonachlor	0.24 U	2.98	0.22 U
PCB 8	6.15	15.7	7.18
PCB 18	34.6	43.2 D[c]	51.4 D
PCB 28	34.4	71.0 D	37.7 D
PCB 44	18.5	27.6	22.7
PCB 49	15.0	25.6	17.1
PCB 52	21.8	33.1	26.9
PCB 66	27.5	50.2 D	33.6 D
PCB 87	5.52	7.39	7.62
PCB 101	14.7	26.3	23.0
PCB 105	9.85	16.3	16.9
PCB 118	16.0	36.1	31.7
PCB 128	2.55	5.64	5.69
PCB 138	13.5	29.7	26.7
PCB 153	18.2	34.8	30.1
PCB 170	4.27	9.85	7.15
PCB 180	8.52	19.3	16.0
PCB 183	3.77	6.63	13.4
PCB 184	0.07 U	0.10 U	0.07 U
PCB 187	8.11	14.7	12.4
PCB 195	0.02 U	1.41	1.56
PCB 206	0.03 U	0.89	1.14
PCB 209	1.14	0.03 U	1.84
Total PCBs[d]	**528**	**951**	**784**

(a) U Undetected at or above given concentration.
(b) Sum of 2,4'-DDD, 2,'4-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; one-half of the detection limit used in summation when analyte was undetected.
(c) D Determined from diluted sample (1:5).
(d) Total PCBs = 2.0(x), where x is the sum of all PCB congeners detected; one-half of the detection limit used in summation when analyte was undetected.

The dominant pesticides found in the three sediment composites were DDT family of compounds, followed by aldrin, α-chlordane, and dieldrin. In general, BR-A COMP and BR-B COMP had higher concentrations of chlorinated pesticides than RH-COMP. Total sum of DDTs were 123 µg/kg for BR-B COMP, 70.7 µg/kg for BR-A COMP, and 38.4 µg/kg for RH COMP.

3.2.5 PCBs

Table 3.6 shows the results of the analysis of the Red Hook/Bay Ridge composites for PCBs. A quality control sample summary and associated quality control data are provided in Appendix A.

All of the 22 PCB congeners analyzed for this project were detected in the three test sediment composites, except for four congeners (PCBs 184, 195, 206, and 209), which were undetected in one or more of the composites. Total PCB concentrations calculated were 951 µg/kg for BR-A COMP, 784 µg/kg for BR-B COMP, and 528 µg/kg for RH-COMP.

3.2.6 PAHs and 1,4-Dichlorobenzene

Table 3.7 shows the results of the analysis of the Red Hook/Bay Ridge sediments for PAHs and 1,4-dichlorobenzene. A quality control sample summary and associated quality control data are provided in Appendix A.

All 16 PAHs analyzed for this project were detected in the three test sediment composites. The distribution of PAHs in sediment from the RH-COMP showed that the low-molecular-weight PAH (LPAH) made up approximately 43% of the total PAH concentration, whereas high-molecular-weight PAH (HPAH) made up 57% of the total. The distribution of PAHs in BR-A COMP was 18% LPAHs and 82% HPAHs. The PAH distribution for BR-B COMP was 60% LPAHs and 40% HPAHs. Sediments from both RH-COMP and BR-B COMP contained approximately three times more total PAHs than sediments from BR-A COMP.

Concentrations of 1,4-dichlorobenzene in the three test sediment composites were 74.5 µg/kg, 145 µg/kg and 120 µg/kg for RH-COMP, BR-A COMP, and BR-B COMP respectively.

3.3 Site Water and Elutriate Analyses

Metals, chlorinated pesticides, and PCBs were analyzed in dredging site water collected from the Red Hook/Bay Ridge project areas, and in elutriate samples prepared with clean seawater (Sequim Bay) and the Red Hook/Bay Ridge test sediment composites. Mud Dump Site water and Sequim Bay control water were also analyzed. All water and elutriate samples were analyzed in triplicate. Mean results of the triplicate analyses are presented and discussed

TABLE 3.7. Results of Analysis of Red Hook/Bay Ridge Sediment Composites for PAHs and 1,4-Dichlorobenzene

Sediment Treatment	Concentrations in µg/kg dry weight		
	RH COMP	BR-A COMP	BR-B COMP
Naphthalene	3360	517	11100
Acenaphthylene	416	231	437
Acenaphthene	2530	172	4370
Fluorene	2020	226	2280
Phenanthrene	8470	1060	6330
Anthracene	3400	656	2450
LPAHs	**20,200**	**2,860**	**27,000**
Fluoranthene	4670	1970	3110
Pyrene	6420	2280	4130
Benzo[a]anthracene	3230	1370	1920
Chrysene	3680	1300	1960
Benzo[b]fluoranthene	2520	1700	1810
Benzo[k]fluoranthene	885	579	651
Benzo[a]pyrene	2720	1460	1820
Indeno[123-cd]pyrene	1290	948	982
Dibenzo[a,h]anthracene	417	277	308
Benzo[g,h,i]perylene	1340	958	1000
HPAHs	**27,200**	**12,800**	**17,700**
Total PAHs	**47,400**	**15,700**	**44,700**
1,4-Dichlorobenzene	74.5	145	120

in the following sections. Complete results of all site water and elutriate samples, as well as a quality control summary and associated quality control data, are provided in Appendix B.

3.3.1 Metals

Results of analysis of Sequim Bay control water, Mud Dump Site water, Red Hook/Bay Ridge Site waters, and Red Hook/Bay Ridge elutriates are shown in Table 3.8. Site water from Red Hook station RH-3, had the highest concentration of metals. The concentration of metals were similar for the two Bay Ridge stations, BR-A-6 and BR-B-15. All metals analyzed except for Cd and Zn were at least three times higher in Red Hook/Bay Ridge Site waters than in Mud Dump Site water or the Sequim Bay Site water.

Concentrations of Ag, Cd, and Ni were similar between the Sequim Bay control water and Mud Dump Site water, whereas concentrations of Cu, Hg, Pb, and Zn were at least one and a half times higher in the Mud Dump Site water than in the control water. In particular, Hg and Pb were about an order of magnitude higher in the Mud Dump Site water than in the control water.

TABLE 3.8. Results of Analysis of Red Hook/Bay Ridge Site Water and Elutriates for Metals

Sediment Treatment	Concentrations in µg/L (a)							
	Ag	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Site Water								
RH-3	0.116	0.073	1.83	3.59	0.0208	1.35	1.83	25.7
BR-A-6	0.081	0.070	1.14	2.79	0.0105	1.33	1.11	12.1
BR-B-15	0.081	0.072	1.22	2.90	0.0091	1.21	1.06	11.2
Mud Dump Site Water	0.009 Q	0.053	0.297	0.963	0.0013	0.409	0.231	25.4
Sequim Bay Control Water	0.009 Q	0.067	0.430	0.576	0.0002	0.466	0.014	16.0
Elutriate								
RH COMP	0.025	0.211	0.853	0.904	0.0174	1.90	0.824	2.35
BR-A COMP	0.044	0.015	1.69	0.963	0.0107	1.44	0.245	2.25
BR-B COMP	0.037	0.022	1.81	1.26	0.0233	0.900	0.534	3.10

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) Q Undetected at or above twice the given concentration.

Elutriate metal concentrations were similar between Red Hook and Bay Ridge samples for Ag, Cu, and Zn. For the remaining metals, the difference among Red Hook and Bay Ridge elutriate preparations ranged from 1.3 to 10 times between the lowest and highest concentration of each analyte. The elutriates prepared from the sediment composites and site water had lower metals concentrations than the original site water in all but 6 of the 24 possible comparisons.

3.3.2 Chlorinated Pesticides and PCBs

Results of analysis of Bay Ridge Reach A and Reach B site waters, Red Hook site water and the Mud Dump Site water are shown in Table 3.9. The results of the elutriate analysis on sediments from these same reaches are shown in Table 3.10. With few exceptions, pesticides and PCB congeners were not detected in the site water samples.

Elutriate samples generally had higher pesticide concentrations than the site water samples. Pesticides were highest in elutriate preparations from BR-B COMP, followed by RH COMP and then BR-A COMP. The DDT family of compounds was found at the highest concentrations in the elutriate samples, followed by aldrin and dieldrin.

Nineteen PCBs were detected in the elutriates from the three test sediment composites. The PCB concentrations were much higher in the elutriate preparation from BR-B COMP than in either the RH or BR-A COMP elutriates. Total PCBs were 553 ng/L for BR-B COMP, 60.9 ng/L for RH COMP, and 22.9 ng/L for BR-A COMP.

TABLE 3.9. Results of Analysis of Red Hook/Bay Ridge Site Water for Pesticides and PCBs

Sediment Treatment	Concentrations in ng/L[a] RH-3	BR-A-6	BR-B-15	Mud Dump Site Water
2,4'-DDD	0.47 Q[b]	0.47 Q	0.23 Q	0.47 Q
2,4'-DDE	0.12 Q	0.12 Q	0.12 Q	0.12 Q
2,4'-DDT	0.88	0.22 Q	0.22 Q	0.22 Q
4,4'-DDD	0.23 Q	0.23 Q	0.23 Q	0.23 Q
4,4'-DDE	4.37	0.14 Q	0.14 Q	0.14 Q
4,4'-DDT	0.20 Q	0.20 Q	0.20 Q	0.20 Q
Total DDT[c]	**6.27**	**1.38**	**1.14**	**1.38**
Aldrin	0.82	1.00	0.20 Q	0.20 Q
α-Chlordane	0.66	0.42 Q	0.42 Q	0.42 Q
Dieldrin	0.06 Q	0.06 Q	0.06 Q	0.06 Q
Endosulfan I	0.69	0.23 Q	0.23 Q	0.23 Q
Endosulfan II	0.23 Q	0.23 Q	0.23 Q	0.23 Q
Endosulfan Sulfate	0.23 Q	0.23 Q	0.23 Q	0.23 Q
Heptachlor	0.24 Q	0.24 Q	0.24 Q	0.24 Q
Heptachlor Epoxide	0.06 Q	0.06 Q	0.06 Q	0.06 Q
trans-Nonachlor	0.56 Q	0.56 Q	0.56 Q	0.56 Q
PCB 8	0.50 Q	0.50 Q	0.50 Q	0.50 Q
PCB 18	0.53 Q	0.53 Q	0.53 Q	0.53 Q
PCB 28	0.36 Q	0.36 Q	0.36 Q	0.36 Q
PCB 44	0.16 Q	0.16 Q	0.16 Q	0.16 Q
PCB 49	0.45	0.27 Q	0.27 Q	0.27 Q
PCB 52	0.18 Q	0.18 Q	0.18 Q	0.18 Q
PCB 66	0.19 Q	0.19 Q	0.19 Q	0.19 Q
PCB 87	0.18 Q	0.24	0.18 Q	0.18 Q
PCB 101	0.24 Q	0.24 Q	0.24 Q	0.24 Q
PCB 105	0.15 Q	0.15 Q	0.15 Q	0.15 Q
PCB 118	0.24 Q	0.24 Q	0.24 Q	0.24 Q
PCB 128	0.12 Q	0.12 Q	0.12 Q	0.12 Q
PCB 138	0.17 Q	0.17 Q	0.17 Q	0.17 Q
PCB 153	0.20 Q	0.20 Q	0.20 Q	0.20 Q
PCB 170	0.10 Q	0.10 Q	0.10 Q	0.10 Q
PCB 180	0.14 Q	0.14 Q	0.14 Q	0.14 Q
PCB 183	0.27 Q	0.27 Q	0.27 Q	0.27 Q
PCB 184	0.27 Q	0.27 Q	0.27 Q	0.27 Q
PCB 187	0.20 Q	0.20 Q	0.20 Q	0.20 Q
PCB 195	0.14 Q	0.14 Q	0.14 Q	0.14 Q
PCB 206	0.20 Q	0.20 Q	0.20 Q	0.20 Q
PCB 209	0.14 Q	0.14 Q	0.14 Q	0.14 Q
Total PCBs[d]	**10.3**	**10.0**	**9.90**	**9.90**

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) Q Undetected at or above twice the given concentration.
(c) Sum of 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; one-half of the detection limit used in summation when analyte was undetected.
(d) Total PCB = 2.0(x), where x=sum of all PCB congeners; one-half of the detection limit used in summation when analyte was undetected.

TABLE 3.10. Results of Analysis of Red Hook/Bay Ridge Elutriate Preparations for Pesticides and PCBs

Sediment Treatment	Concentrations in ng/L[a] RH COMP	BR-A COMP	BR-B COMP
2,4'-DDD	0.48 Q[b]	0.47 Q	6.67
2,4'-DDE	0.12 Q	0.12 Q	0.12 Q
2,4'-DDT	0.22 Q	0.22 Q	0.22 Q
4,4'-DDD	0.23 Q	0.23 Q	13.6
4,4'-DDE	7.33	6.82	29.4
4,4'-DDT	7.96	7.98	15.6
Total DDT[c]	**16.3**	**15.8**	**65.6**
Aldrin	3.85	0.20 Q	8.00
α-Chlordane	0.42 Q	0.42 Q	0.42 Q
Dieldrin	4.11	0.06 Q	6.58
Endosulfan I	0.24 Q	0.23 Q	0.23 Q
Endosulfan II	0.45	0.23 Q	0.53
Endosulfan Sulfate	0.24 Q	0.23 Q	0.23 Q
Heptachlor	0.24 Q	0.34	0.24 Q
Heptachlor Epoxide	0.06 Q	0.06 Q	0.06 Q
trans-Nonachlor	0.57 Q	0.56 Q	0.56 Q
PCB 8	0.51 Q	0.50 Q	0.50 Q
PCB 18	9.62	0.53 Q	52.5
PCB 28	6.31	0.36 Q	18.2
PCB 44	0.16 Q	0.16 Q	31.7
PCB 49	3.80	1.02	14.2
PCB 52	0.34	0.18 Q	25.3
PCB 66	0.20 Q	0.19 Q	27.9
PCB 87	0.66	0.27	4.94
PCB 101	1.20	1.37	21.7
PCB 105	0.15 Q	0.15 Q	0.15 Q
PCB 118	2.56	1.09	16.0
PCB 128	0.12 Q	0.12 Q	1.66
PCB 138	1.48	1.43	14.6
PCB 153	0.90	1.31	19.2
PCB 170	0.10 Q	0.10 Q	3.30
PCB 180	1.06	1.19	10.1
PCB 183	0.27 Q	0.27 Q	2.45
PCB 184	0.27 Q	0.27 Q	0.27 Q
PCB 187	0.20 Q	0.48	5.68
PCB 195	0.14 Q	0.14 Q	0.75
PCB 206	0.26	0.20 Q	3.13
PCB 209	0.14 Q	0.14 Q	2.49
Total PCBs[d]	**60.9**	**22.9**	**553**

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) Q Undetected at or above twice the given concentration.
(c) Sum of 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; one-half of the detection limit used in summation when analyte was undetected.
(d) Total PCB = 2.0(x), where x=sum of all PCB congeners; one-half of the detection limit used in summation when analyte was undetected.

3.4 Benthic Toxicity and Water-Column Testing

Both benthic and water-column tests were performed on the Red Hook/Bay Ridge sediment composites. Benthic acute toxicity tests were performed with the infaunal amphipod *A. abdita* and the mysid *M. bahia*. Suspended-particulate-phase tests were conducted with the silverside *M. beryllina*, the mysid *M. bahia*, and larvae of the bivalve *M. galloprovincialis*. Complete test results, water quality measurements, and the results of the reference-toxicant tests are presented in Appendix C for water-column tests, and Appendix D for benthic test results. Throughout this section the term "acutely toxic" is used to express *statistically* significant differences and at least 10% (mysid) or 20% (amphipod) decreases in survival from the reference sediment. Tests for statistical significance between test treatments and reference treatments were performed following methods outlined in Section 2.6.

3.4.1 *Ampelisca abdita* Benthic Acute Toxicity Test

Results of the benthic acute toxicity test with *A. abdita* are summarized in Table 3.11. Complete test results and water quality data are presented in Appendix C, Tables C.1 through C.4. Survival in the *A. abdita* control sediment was 100%, validating this test. Survival in the three test sediment composites RH COMP, BR-A COMP, and BR-B COMP were 65%, 91%, and 35%. Sediments from BR-B COMP and RH COMP were acutely toxic compared with sediments from the Mud Dump Reference Site (94% survival).

Water quality parameters were within acceptable ranges throughout the test, except for minor deviations in pH measurements (see Table C.2). The Cd reference toxicant test produced an LC50 of 0.55 mg/L Cd, which is within the control range established by other scientists and at the MSL (0.4 mg/L to 0.9 mg/L Cd). Ammonia concentrations were less than 1.0 mg/L in the overlying water and less than 8.2 mg/L in the pore water of the Red Hook and Bay Ridge composites.

3.4.2 *Mysidopsis bahia* Benthic Acute Toxicity Test

Results of the benthic acute toxicity test with *M. bahia* are summarized in Table 3.11. Complete results and water quality data are presented in Appendix C, Tables C.5 through C.8. Survival in the Sequim Bay control sediment was 97%, validating this test. Survival in the three test sediment composites, RH COMP, BR-A COMP, and BR-B COMP were 77%, 76%, and 74%. All three composites were acutely toxic to *M. bahia* when compared with the survival of *M. bahia* in the sediment from the Mud Dump Reference Site (95% survival).

All water quality parameters were within acceptable ranges throughout the test except for pH values for BR-A COMP and the Sequim Bay control which were slightly above the acceptable range throughout testing. The Cu reference toxicant test produced an LC_{50} of

TABLE 3.11. Summary of Benthic Tests Performed with Red Hook/Bay Ridge Sediment Composites

Sediment Treatment	Mean % Survival	Statistically Significant	≥20% Amphipod ≥10% Mysid Difference MDRS
A. abdita			
RH COMP	65	Yes	Yes
BR-A COMP	91	No	No
BR-B COMP	35	Yes	Yes
MDRS	94	NA	NA
M. bahia			
RH COMP	77	Yes	Yes
BR-A COMP	76	Yes	Yes
BR-B COMP	74	Yes	Yes
MDRS	95	NA	NA

225 µg/L Cu, which is within the control range established at the MSL (154 µg/L to 303 µg/L Cu). Overlying-water ammonia concentrations were less than 1.0 mg/L at test initiation.

3.4.3 *Menidia beryllina* Water-Column Toxicity Test

Results of the *M. beryllina* water-column toxicity test are summarized in Table 3.12. Complete test results, as well as water quality data, are presented in Appendix D, Tables D.1 through D.4. The control (filtered Sequim Bay seawater from the concurrent reference toxicant test using the same population of *M. beryllina*) survival was 90%, validating the SPP results associated with all three composites. The survival of the 0% SPP (Mud Dump site water) from RH COMP, BR-A COMP, and BR-B COMP were 94%, 82%, and 88% respectively. The 0% SPP were significantly different from the 100% SPP preparations for all three composites. Survival in the 100% SPP preparations was 6% for RH COMP, and 0% for both BR-A and BR-B COMPs. The calculated LC_{50} for RH-COMP, BR-A COMP and BR-B COMP were 60%, 30%, and 19% of SPP, respectively.

All water quality parameters were within acceptable ranges throughout the test, except for a minor elevation in pH in some of the 50% and 100% SPP preparations. The copper reference toxicant test produced an LC_{50} of 85.1 µg/L Cu, within the control range (mean ± 2 standard deviations) established at the MSL (79µg/L to 123 µg/L Cu). Ammonia was measured in the 100% SPP of each test composite immediately after preparation. The ammonia values at that time were 20.0 mg/L, 34.8 mg/L, and 30.9 mg/L for RH COMP, BR-A COMP, and BR-B COMP.

3.4.4 *Mysidopsis bahia* Water-Column Toxicity Test

Results of the *M. bahia* water-column toxicity test are summarized in Table 3.12. Complete test results, as well as water quality data, are presented in Appendix D, Tables D.5 through D.8. This test was validated by a control survival (taken from the results of the concurrent reference toxicant test) of 100% for all three composites. Survival in the 100% SPP preparations were 76% in RH COMP, 0% in the BR-A COMP and 6% in the BR-B COMP. The survival of *M. bahia* in the 100% SPP preparations of all three composites were significantly lower than the control preparations. The *M. bahia* LC_{50}s for the RH COMP, BR-A COMP, and BR-B COMP were >100%, 60%, and 70% of SPP.

All water quality parameters were within acceptable ranges throughout the test, with the exception of pH, which rose to 8.7 in some of the 50% and 100% SPP preparations. The copper reference toxicant test revealed an LC_{50} of 238 µg/L Cu, which is within the control range established at the MSL (154 µg/L to 303 µg/L Cu). Ammonia was measured in the 100% SPP of each test composite right after preparation. The ammonia values at that time were 20.0 mg/L, 34.8 mg/L, and 30.9 mg/L for RH COMP, BR-A COMP, and BR-B COMP.

3.4.5 *Mytilus galloprovincialis* Water-Column Toxicity Test

Results of the *M. galloprovincialis* water-column toxicity test are summarized in Table 3.12. Complete test results and water quality data are presented in Appendix D, Tables D.9 through D.12. This test was validated by 96% survival and normal development in the controls (results taken from concurrent reference toxicant test). Survival in the 0% SPP (Dredging site water) preparation was 85% for RH COMP, 97% for BR-A COMP, and 100% for BR-B COMP. Significantly reduced survival, relative to the controls, was observed in the 100% SPP treatment of all three composites. Survival in the 100% SPP preparations were 41% for RH COMP, 19% for BR-A COMP, and 14% for BR-B COMP. The LC_{50s} were 58% of SPP for RH COMP, of 65% SPP for BR-A COMP and 71% of SPP for BR-B COMP. Normal development, which is considered a more sensitive indicator of toxicity, was significantly reduced for all three composites with EC_{50}s of 23% SPP for RH COMP and 21% SPP for BR-A COMP and BR-B COMP.

All water quality parameters were within acceptable ranges throughout the test, with the exception of pH, which rose to 8.6 in some of the 50% and 100% SPP preparations of all three test composites. The Cu reference toxicant test produced an EC_{50} of 7.3 µg/L Cu, which is within the control range established for copper at the MSL (EC_{50}: 4.6 µg/L to 9.2 µg/L Cu). Ammonia was measured in the 100% SPP of each test composite immediately after preparation. The ammonia values were 20.0 mg/L, 34.8 mg/L, and 30.9 mg/L for RH COMP, BR-A COMP, and BR-B COMP.

TABLE 3.12. Summary of Water-Column Toxicity Tests Performed with Red Hook/Bay Ridge Sediment Composites

Sediment Treatment	Test Organism	Survival in 0% SPP	Survival in 100% SPP	0% and 100% Significantly Different	LC_{50} (%SPP)
RH COMP	*Menidia beryllina*	94%	6%	Yes	60
BR-A COMP	*Menidia beryllina*	82%	0%	Yes	30
BR-B COMP	*Menidia beryllina*	88%	0%	Yes	19
RH COMP	*Mysidopsis bahia*	98%	76%	Yes	>100
BR-A COMP	*Mysidopsis bahia*	100%	0%	Yes	60
BR-B COMP	*Mysidopsis bahia*	98%	6%	Yes	70
Survival Results					
RH COMP	*M. galloprovincialis*	85%	41%	Yes	58
BR-A COMP	*M. galloprovincialis*	94%	19%	Yes	65
BR-B COMP	*M. galloprovincialis*	96%	14%	Yes	71
Proportion Normal Results					
RH COMP	*M. galloprovincialis*	80%	0%	Yes	23(a)
BR-A COMP	*M. galloprovincialis*	93%	0%	Yes	21
BR-B COMP	*M. galloprovincialis*	99%	0%	Yes	21

(a) Median effective concentration (EC_{50}) based on normal development to the D-cell, prodissoconch I stage.

3.5 Bioaccumulation Tests with *Macoma nasuta* and *Nereis virens*

Bioaccumulation tests with *M. nasuta* and *N. virens* were conducted using the composite from Red Hook (RH COMP), the two composites from Bay Ridge (BR-A COMP and BR-B COMP), the Mud Dump Reference Site, and the native control sediments. Both *M. nasuta* and *N. virens* were exposed for 28 days under flow-through conditions. Survival was 90% in the *M. nasuta* control exposure, and 62% in the *N. virens* control exposure. Causes for the lower survival of *N. virens* exposed to the control sediment are unknown. Complete test results and water quality data are presented in Appendix E. The tissues of the exposed organisms were analyzed for metals and selected organic contaminants (pesticides, PCBs, and PAHs), the results of which are summarized in this section. Complete test results and water quality data are tabulated in Appendix E for both species. Analytical results, including a quality control summary and associated quality control data, are presented in Appendix F for *M. nasuta* and in Appendix G for *N. virens*. The statistical analysis of tissue data was performed using sample dry weight concentrations to remove any variance associated with water content in each sample. Statistical

difference between reference site and test sediment exposures is shown in the following tables with the results of sample analysis on a wet weight basis. Reporting data in this manner allows for comparison of wet weight concentrations obtained from this study with regulatory levels such as the FDA action levels reported in section 4.0 of this report. Lipids were analyzed on the background samples of the *M. nasuta* and *N. virens* tissues. These samples were triplicated and the average lipid contents in wet weight for *M. nasuta* and *N. virens* were 1.79% and 0.71%, respectively. The average dry weight lipid concentrations for these two species were 12.8% and 4.67%, respectively.

3.5.1 Bioaccumulation of Metals in *Macoma nasuta*

Results of analysis of *M. nasuta* tissues exposed to Red Hook/Bay Ridge composites and the Mud Dump Reference Site are shown in Table 3.13. All nine metals were detected in tissues exposed to the Red Hook/Bay Ridge composites. The RH COMP had statistically significant and elevated concentrations of Ni and Pb relative to the Mud Dump Reference Site. The BR-A COMP and BR-B COMP had significantly elevated concentrations of Cr, Ni, and Pb relative to the Mud Dump Reference Site. The magnification factor, the magnitude by which a contaminant concentration in the test composite tissues exceeds that from the reference composite tissues, was less than three for all metals.

3.5.2 Bioaccumulation of Chlorinated Pesticides in *Macoma nasuta*

Results of chlorinated pesticide analysis of *M. nasuta* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site are shown in Table 3.14. In comparison with tissues exposed to the Mud Dump Reference Site sediment, the RH COMP tissues were statistically significant and elevated for most of the DDT family of compounds. These compounds exceeded those of the Mud Dump Reference Site by 1.2 to 11.2 times. In BR-A COMP and BR-B COMP exposed tissues, significant elevations relative to the Mud Dump Reference Site were found for 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, α-chlordane, and aldrin. These compounds were detected at concentrations at least three times higher in tissues from both composites relative to tissues exposed to sediments from the Mud Dump Reference Site.

3.5.3 Bioaccumulation of PCBs in *Macoma nasuta*

Results of analysis of *M. nasuta* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site are shown in Table 3.14. At least 12 of 22 PCBs analyzed were detected in *M. nasuta* tissues exposed to the Red Hook/Bay Ridge test sediment

TABLE 3.13. Mean Concentrations of Metals in *Macoma nasuta* Tissues Exposed to Red Hook/Bay Ridge Composites and the Mud Dump Reference Site Composite

	Concentrations in mg/kg wet weight[a]						
Analyte	RH COMP	SD[b]	BR-A COMP	SD	BR-B COMP	SD	MDRS[c]
Silver	0.041	No	0.065	No	0.072	No	0.046
Arsenic	3.93	No	3.44	No	3.54	No	3.13
Cadmium	0.030	No	0.034	No	0.035	No	0.027
Chromium	0.33	No	0.570	Yes	0.480	Yes	0.225
Copper	2.79	No	3.00	No	3.18	No	2.78
Mercury	0.020	No	0.019	No	0.018	No	0.017
Nickel	0.520	Yes	0.580	Yes	0.480	Yes	0.300
Lead	0.700	Yes	0.785	Yes	0.715	Yes	0.335
Zinc	12.3	No	13.8	No	13.4	No	13.0

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) SD Dry weight concentrations significantly different.
(c) MDRS - Mud Dump Reference Site.

composites. At least eleven PCBs were observed at concentrations that were significantly elevated in either RH COMP, BR-A COMP, or BR-B COMP tissues relative to those in tissues exposed to the Mud Dump Reference Site sediment. The total sum of PCB congeners for the Red Hook/Bay Ridge *M. nasuta* tissues ranged from 62.6 to 113 µg/kg. The magnification factors for five PCB congeners were greater than 10 times higher for all three test treatment tissue samples relative to Mud Dump Reference Site tissue samples.

3.5.4 Bioaccumulation of PAHs & 1,4-Dichlorobenzene in *Macoma nasuta*

Results of analysis of *M. nasuta* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site sediments for PAHs and 1,4-dichlorobenzene are shown in Table 3.15. All sixteen PAHs analyzed were detected in *M. nasuta* tissues exposed to the three test composites at statistically significant and elevated concentrations, relative to tissues exposed to the Mud Dump Reference Site. Magnification factors were greatest for RH COMP, ranging from 3.3 to 345 times concentrations found in the Mud Dump Reference Site tissues and were the lowest for BR- A COMP, ranging from 1.7 to 32.2 times higher than Mud Dump Reference Site tissues.

3.5.5 Bioaccumulation of Metals in *Nereis virens*

Results of *N. virens* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site composite for metals are shown in Table 3.16. All metals analyzed except Ag for the RH COMP were detected in *N. virens* tissues exposed to the Red Hook/Bay Ridge composites. The compound Ni was significantly higher in tissues from RH COMP, BR-A COMP and BR-B COMP than in Mud Dump Reference Site-exposed tissues. Magnification factors were less than two for all metals.

TABLE 3.14. Mean Concentrations of Pesticides and PCBs in *Macoma nasuta* Tissues Exposed to Red Hook/Bay Ridge Composites and the Mud Dump Reference Site Composite

	Concentrations in µg/kg wet weight[a]						
Analyte	RH		BR-A		BR-B		
(ug/kg)	COMP	SD[b]	COMP	SD	COMP	SD	MDRS[c]
2,4'-DDD	1.07	Yes	0.34	No	1.07	Yes	0.13 Q[d]
2,4'-DDE	0.29 Q	No	0.15 Q	No	0.13 Q	No	0.13 Q
2,4'-DDT	0.20 Q	No	0.10 Q	No	0.09 Q	No	0.09 Q
4,4'-DDD	2.49	Yes	2.05	Yes	3.53	Yes	0.13 Q
4,4'-DDE	3.98	Yes	4.66	Yes	7.32	Yes	0.79
4,4'-DDT	1.83	Yes	1.28	Yes	0.98	Yes	0.08 Q
Total DDT[e]	**9.86**	**Yes**	**8.58**	**Yes**	**13.1**	**Yes**	**1.35**
α-Chlordane	0.53	No	0.75	Yes	0.89	Yes	0.20
Aldrin	1.02	No	2.00	Yes	1.88	Yes	0.33
Dieldrin	1.26	No	1.19	No	1.77	Yes	0.65
Endosulfan I	0.30	No	0.10 Q	No	0.09 Q	No	0.09 Q
Endosulfan II	0.20 Q	No	0.10 Q	No	0.22	No	0.09 Q
Endosulfan Sulfate	0.28 Q	No	0.14 Q	No	0.13 Q	No	0.13 Q
Heptachlor	0.21 Q	No	0.17	No	0.09 Q	No	0.12
Heptachlor Epoxide	0.15 Q	No	0.07 Q	No	0.07 Q	No	0.07 Q
trans-Nonachlor	0.16 Q	No	0.15	No	0.07 Q	No	0.07 Q
PCB 8	0.30 Q	No	0.35	No	0.32	No	0.39
PCB 18	3.49	Yes	2.55	Yes	5.93	Yes	0.05 Q
PCB 28	6.22	Yes	5.85	Yes	7.48	Yes	0.22
PCB 44	0.08 Q	No	1.92	Yes	3.95	Yes	0.04 Q
PCB 49	2.49	Yes	4.25	Yes	4.37	Yes	0.09 Q
PCB 52	4.39	Yes	5.89	Yes	7.93	Yes	0.39
PCB 66	3.83	Yes	6.29	Yes	7.61	Yes	0.08 Q
PCB 87	0.90	Yes	1.07	Yes	1.65	Yes	0.13 Q
PCB 101	2.70	Yes	4.44	Yes	5.00	Yes	0.17
PCB 105	0.98	Yes	0.71	Yes	1.09	Yes	0.09 Q
PCB 118	1.68	Yes	3.17	Yes	3.63	Yes	0.12
PCB 128	0.18	No	0.32	Yes	0.46	Yes	0.05 Q
PCB 138	0.92	Yes	2.28	Yes	2.30	Yes	0.17
PCB 153	1.30	Yes	3.13	Yes	2.76	Yes	0.22 Q
PCB 170	0.20 Q	No	0.24	No	0.19	No	0.09 Q
PCB 180	0.42 Q	No	0.68	Yes	0.58	No	0.19 Q
PCB 183	0.21 Q	No	0.22	No	0.19	No	0.09 Q
PCB 184	0.21 Q	No	0.10 Q	No	0.09 Q	No	0.09 Q
PCB 187	0.23 Q	No	0.61	Yes	0.51	Yes	0.11 Q
PCB 195	0.14 Q	No	0.07 Q	No	0.06 Q	No	0.06 Q
PCB 206	0.23 Q	No	0.11 Q	No	0.11 Q	No	0.11 Q
PCB 209	0.21 Q	No	0.10 Q	No	0.10 Q	No	0.10 Q
Total PCB[f]	**62.6**		**88.7**		**113**		**6.1**

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) SD Dry weight concentrations significantly different.
(c) MDRS - Mud Dump Reference Site.
(d) Q Undetected at or above twice the given concentration
(e) Sum of 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; one -half of the detection limit used in summation when analyte was undetected.
(f) Total PCB = 2(x), where x = sum of all PCB congeners; one-half of the detection limit used in summation when analyte was undetected.

TABLE 3.15. Mean Concentrations of PAHs and 1,4-Dichlorobenzene in *Macoma nasuta* Tissues Exposed to Red Hook/Bay Ridge Composites and Mud Dump Reference Site Composite

	Concentrations in µg/kg wet weight[a]						
Analyte	RH COMP	SD[b]	BR-A COMP	SD	BR-B COMP	SD	MDRS[c]
Naphthalene	8.69	Yes	4.24	No	7.86	Yes	2.44
Acenaphthylene	4.00	Yes	2.02	Yes	4.12	Yes	0.37 Q[d]
Acenaphthene	24.8	Yes	2.26	Yes	55.5	Yes	0.66 Q
Fluorene	32.9	Yes	2.39	Yes	46.5	Yes	0.62 Q
Phenanthrene	440	Yes	12.6	Yes	368	Yes	1.69
Anthracene	219	Yes	9.26	Yes	154	Yes	1.46
LPAH	**729**	**NA[e]**	**32.8**	**NA**	**636**	**NA**	**7.24**
Fluoranthene	716	Yes	68.5	Yes	404	Yes	2.70 Q
Pyrene	916	Yes	106	Yes	534	Yes	2.30 Q
Benz[a] anthracene	577	Yes	53.0	Yes	238	Yes	1.57
Chrysene	631	Yes	65.6	Yes	273	Yes	1.11 Q
Benz[b+k] fluoranthene	306	Yes	75.7	Yes	149	Yes	3.07
Benzo[e]pyrene	175	Yes	41.7	Yes	82.8	Yes	0.76 Q
Benzo[a]pyrene	242	Yes	42.4	Yes	111	Yes	1.41
Perylene	29.1	Yes	13.2	Yes	18.7	Yes	0.71 Q
Indeno[123-cd] pyrene	43.1	Yes	11.3	Yes	15.8	Yes	1.60
Dibenz[a,h] anthracene	13.6	Yes	4.11	Yes	4.97	Yes	0.64 Q
Benzo[g,h,i] perylene	53.6	Yes	14.2	Yes	19.5	Yes	1.13
HPAH	**3700**	**NA**	**497**	**NA**	**1850**	**NA**	**17.0**
TPAH	**4430**	**NA**	**530**	**NA**	**2490**	**NA**	**24.2**
1,4-Dichlorobenzene	2.35	No	1.04 Q	No	0.94 Q	No	0.94 Q

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) SD Dry weight concentrations significantly different.
(c) MDRS - Mud Dump Reference Site.
(d) Q Undetected at or above twice the given concentration.
(e) Not applicable; statistical analysis not performed on LPAH, HPAH, or TPAH results.

TABLE 3.16. Mean Concentrations of Metals in *Nereis virens* Tissues Exposed to Red Hook/Bay Ridge Composites and Mud Dump Reference Site Composite

	Concentrations in mg/kg wet weight[a]						
Analyte	RH COMP	SD[b]	BR-A COMP	SD	BR-B COMP	SD	MDRS[c]
Silver	0.016 Q[d]	No	0.225	No	0.0205	No	0.0190
Arsenic	2.16	No	2.09	No	1.93	No	2.36
Cadmium	0.039	No	0.355	No	0.0375	No	0.0370
Chromium	0.182	No	0.171	No	0.180	No	0.166
Copper	1.44	No	1.32	No	1.45	No	1.31
Mercury	0.0194	No	0.0127	No	0.0160	No	0.0187
Nickel	0.194	Yes	0.174	Yes	0.197	Yes	0.104
Lead	0.208	No	0.221	No	0.188	No	0.147
Zinc	29.3	No	18.9	No	20.2	No	15.3

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) SD Dry weight concentrations significantly different.
(c) MDRS - Mud Dump Reference Site.
(d) Q Undetected at or above twice the given concentration.

3.5.6 Bioaccumulation of Chlorinated Pesticides in *Nereis virens*

Results of analysis of *N. virens* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site sediments for chlorinated pesticides are shown in Table 3.17. Some of the DDT-family of compounds (2,4'-DDD, 4,4'-DDD, and 4,4'-DDE) as well as α-chlordane, aldrin, and dieldrin were statistically significantly elevated in the RH COMP composite tissues when compared with the Mud Dump Reference Site tissues. In BR-A COMP and BR-B COMP tissues, in addition to the same family DDT compounds, α-chlordane, aldrin, and trans-nonaclor was also significantly elevated above the reference. Dieldrin was also significantly elevated in BR-B COMP-exposed tissues relative the Mud Dump Reference Site-exposed tissues. Aldrin in tissues from all three test sediment composites exceeded reference tissue concentrations by at least 10 times.

3.5.7 Bioaccumulation of PCBs in *Nereis virens*

Results of analysis of *N. virens* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site sediments for PCBs are shown in Table 3.17. At least 19 of the 22 PCBs congeners analyzed were detected in *N. virens* tissues exposed to Red Hook/Bay Ridge composites. Sixteen of these congeners were detected at concentrations that were significantly elevated relative to those in tissues exposed to the Mud Dump Reference sediment. Concentrations of six PCBs in tissues exposed to all three test sediment composites were significantly elevated by at least a factor of 10 times those of the tissues exposed to the Mud Dump Reference composite. The sum of total PCBs in *N. virens* tissues for the RH COMP, BR-A COMP, and BR-B COMP, were 141, 102, and 214 µg/kg, respectively.

TABLE 3.17. Mean Concentrations of Pesticides and PCBs in *Nereis virens* Tissues Exposed to Red Hook/Bay Ridge Composites and the Mud Dump Reference Site Composite

	Concentrations in µg/kg wet weight[a]						
	RH		BR-A		BR-B		
Analyte	COMP	SD[b]	COMP	SD	COMP	SD	MDRS[c]
2,4'-DDD	1.26	Yes	0.93	Yes	2.41	Yes	0.26
2,4'-DDE	0.15 Q[d]	No	0.13 Q	No	0.13 Q	No	0.13 Q
2,4'-DDT	0.11 Q	No	0.09 Q	No	0.09 Q	No	0.09 Q
4,4'-DDD	3.02	Yes	2.27	Yes	7.92	Yes	0.71
4,4'-DDE	3.22	Yes	2.20	Yes	8.22	Yes	0.09 Q
4,4'-DDT	2.57	No	2.25	No	4.10	No	1.50
Total DDT[e]	**10.3**	**Yes**	**7.87**	**Yes**	**22.9**	**Yes**	**2.78**
α-Chlordane	0.77	Yes	0.84	Yes	1.31	Yes	0.12
Aldrin	2.47	Yes	1.82	Yes	3.25	Yes	0.07 Q
Dieldrin	1.44	Yes	0.96	No	2.58	Yes	0.71
Endosulfan I	0.11	No	0.09 Q	No	0.09 Q	No	0.19
Endosulfan II	0.11 Q	No	0.09 Q	No	0.09 Q	No	0.09 Q
Endosulfan Sulfate	0.15 Q	No	0.13 Q	No	0.13 Q	No	0.13 Q
Heptachlor	0.17	No	0.09 Q	No	0.10 Q	No	0.10 Q
Heptachlor Epoxide	0.08 Q	No	0.07 Q	No	0.07 Q	No	0.35
trans-Nonachlor	0.31	No	0.58	Yes	0.89	Yes	0.17
PCB 8	0.21 Q	No	0.17 Q	No	0.18 Q	No	0.18 Q
PCB 18	11.3	Yes	7.22	Yes	10.7	Yes	0.05 Q
PCB 28	7.06	Yes	4.34	Yes	9.36	Yes	0.06 Q
PCB 44	6.91	Yes	3.82	Yes	7.08	Yes	0.04 Q
PCB 49	4.17	Yes	2.70	Yes	6.10	Yes	0.09 Q
PCB 52	9.52	Yes	5.88	Yes	13.6	Yes	0.16 Q
PCB 66	6.45	Yes	5.10	Yes	11.3	Yes	0.08 Q
PCB 87	0.53	Yes	0.20	No	1.14	Yes	0.13 Q
PCB 101	4.78	Yes	3.85	Yes	8.89	Yes	0.40
PCB 105	1.26	Yes	1.16	Yes	2.89	Yes	0.25
PCB 118	3.24	Yes	2.31	Yes	6.00	Yes	0.23
PCB 128	0.24	No	0.38	Yes	1.03	Yes	0.11
PCB 138	3.51	Yes	3.30	Yes	6.84	Yes	1.40
PCB 153	5.19	Yes	4.94	Yes	9.25	Yes	2.50
PCB 170	0.72	Yes	0.77	Yes	1.63	Yes	0.29
PCB 180	1.86	Yes	1.85	Yes	4.01	Yes	0.74
PCB 183	0.65	Yes	0.62	No	1.60	Yes	0.25
PCB 184	0.11 Q	No	0.09 Q	No	0.09 Q	No	0.09 Q
PCB 187	1.79	Yes	1.76	Yes	3.31	Yes	0.85
PCB 195	0.11	No	0.08	No	0.18	No	0.07 Q
PCB 206	0.54	Yes	0.33	Yes	1.01	Yes	0.13
PCB 209	0.24	No	0.10 Q	No	0.57	Yes	0.10 Q
Total PCB[f]	**141**		**102**		**214**		**16.4**

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) SD Dry weight concentrations significantly different.
(c) MDRS - Mud Dump Reference Site.
(d) Q Undetected at or above twice the given concentration.
(e) Sum of 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; one -half of the detection limit used in summation when analyte was undetected.
(f) Total PCB = 2.0(x), where x = sum of all PCB congeners; one-half of the detection limit used in summation when analyte was undetected.

3.5.8 Bioaccumulation of PAHs and 1,4-Dichlorobenzene in *Nereis virens*

Results of analysis of *N. virens* tissues exposed to the Red Hook/Bay Ridge composites and the Mud Dump Reference Site for PAHs and 1,4-dichlorobenzene are shown in Table 3.18. All PAHs analyzed (with the exception of perylene for BR-A COMP) were detected in tissues exposed to all three Red Hook/Bay Ridge composites. Concentrations of nine PAHs in tissues exposed to RH COMP and BR-B COMP were significantly elevated by at least a factor of 10 over tissues exposed to the Mud Dump Reference Site. The compound 1,4-dichlorobenzene was not detected in any of the test composite tissues.

TABLE 3.18. Mean Concentrations of PAHs and 1,4-Dichlorobenzene in *Nereis virens* Tissues Exposed to Red Hook/Bay Ridge Composites and Mud Dump Reference Site Composite

	Concentrations in µg/kg wet weight[a]						
Analyte	RH COMP	SD[b]	BR-A COMP	SD	BR-B COMP	SD	MDRS[c]
Naphthalene	11.1	No	3.56	No	61.4	Yes	3.58
Acenaphthylene	8.07	Yes	1.25	Yes	10.3	Yes	0.377 Q[d]
Acenaphthene	80.4	Yes	3.14	No	199	Yes	1.54
Fluorene	26.0	Yes	1.19	No	40.1	Yes	1.03
Phenanthrene	112	Yes	2.12	No	72.2	Yes	3.87
Anthracene	40.7	Yes	1.35	No	23.5	Yes	1.57
LPAH	**278**	**NA[e]**	**12.6**	**NA**	**407**	**NA**	**12.0**
Fluoranthene	291	Yes	14.6	Yes	109	Yes	2.78 Q
Pyrene	270	Yes	23.5	Yes	111	Yes	3.63
Benz[a]anthracene	64.2	Yes	2.52	No	16.8	Yes	1.23
Chrysene	183	Yes	9.43	Yes	57.3	Yes	1.93
Benzo[b] flouranthene	36.1	Yes	5.12	Yes	13.2	Yes	1.86
Benzo[k] fluoranthene	14.2	Yes	1.02	No	3.32	No	0.865 Q
Benzo[e]pyrene	56.7	Yes	3.44	Yes	16.5	Yes	1.18
Benzo[a]pyrene	49.5	Yes	2.71	Yes	13.6	Yes	0.935
Perylene	4.93	Yes	0.70 Q	No	1.79	No	0.726 Q
Indeno[123-cd]pyrene	7.26	Yes	2.07	Yes	3.16	Yes	1.11
Dibenz[a,h] anthracene	4.37	Yes	0.81	No	2.11	Yes	0.653 Q
Benzo[g,h,i]perylene	13.9	Yes	2.56	Yes	5.45	Yes	1.29
HPAH	**995**	**NA**	**68.5**	**NA**	**353**	**NA**	**18.2**
TPAH	**1270**	**NA**	**81.1**	**NA**	**760**	**NA**	**30.2**
1,4-Dichloro-benzene	1.10 Q	No	0.92 Q	No	0.96 Q	No	0.97 Q

(a) Value shown is the mean of triplicate analyses; one-half the detection limit used when analyte was undetected.
(b) SD Dry weight concentration significantly different.
(c) MDRS - Mud Dump Reference Site.
(d) Q Undetected at or above twice the given concentration.
(e) Not applicable; statistical analysis not performed on LPAH, HPAH, or TPAH results.

3.5.9 Magnification Factors of Compounds in *Macoma nasuta* and *Nereis virens*

Tables 3.19 and 3.20 show the calculated magnification factors of all compounds analyzed in tissues of *M. nasuta* and *N. virens*. Magnification factors were calculated with the dry weight concentrations of the compounds in the tissues of the test organism. These factors show the magnification of the Red Hook/Bay Ridge-exposed tissues over the Mud Dump Reference Site-exposed tissues. When all replicate analysis of a compound showed that the compound was undetected, the magnification factor displays the magnification of the Red Hook/Bay Ridge-exposed tissues above the detection limit of the Mud Dump Reference Site-exposed tissues.

TABLE 3.19. Magnification Factors of All Analyzed Compounds in *Macoma nasuta* Tissues Exposed to Red Hook/Bay Ridge Composites Relative to Tissues Exposed to the Mud Dump Reference Site Composite

Analyte	Magnification Factors[a]		
	RH COMP	BR-A COMP	BR-B COMP
Ag	0.815	1.24	1.44
As	1.16	1.04	1.13
Cd	1.00	1.16	1.28
Cr	1.34	2.40	2.10
Cu	0.92	1.00	1.12
Hg	1.11	1.09	1.09
Ni	1.58	1.82	1.58
Pb	1.91	2.21	2.10
Zn	0.88	1.01	1.02
2,4'-DDD	4.51	1.72	4.25
2,4'-DDE	1.17	0.60	0.56
2,4'-DDT	2.03	1.06	1.00
4,4'-DDD	8.81	7.38	**13.3**
4,4'-DDE	4.65	5.55	9.13
4,4'-DDT	**11.2**	8.01	6.76
α-Chlordane	2.14	3.12	3.87
Aldrin	2.88	5.25	5.17
Dieldrin	2.03	1.52	2.33
Endosulfan I	2.43	1.06	1.00
Endosulfan II	2.05	1.06	1.42
Endosulfan Sulfate	2.05	1.06	1.00
Heptachlor	2.00	1.25	0.96
Heptachlor Epoxide	2.09	1.06	1.00
trans-Nonachlor	2.04	1.32	0.98
PCB 8	1.60	1.01	1.00
PCB 18	**32.3**	**23.7**	**57.8**
PCB 28	**24.8**	**23.5**	**31.5**
PCB 44	2.11	**26.2**	**56.0**
PCB 49	**13.4**	**22.2**	**23.9**
PCB 52	9.52	**12.4**	**17.5**
PCB 66	**24.4**	**39.4**	**49.8**
PCB 87	3.82	3.99	6.46
PCB 101	**13.2**	**21.9**	**25.8**
PCB 105	5.53	4.20	6.39
PCB 118	8.14	**15.4**	**18.4**
PCB 128	2.39	2.96	4.23
PCB 138	3.69	7.98	8.40
PCB 153	3.26	6.74	6.21
PCB 170	2.03	1.39	1.17
PCB 180	2.04	1.75	1.59
PCB 183	2.09	1.41	1.36
PCB 184	2.09	1.06	1.01
PCB 187	2.04	2.89	2.48
PCB 195	2.07	1.05	0.98
PCB 206	2.03	0.95	1.00
PCB 209	1.96	0.95	1.00

TABLE 3.19. (contd)

Analyte	Magnification Factors[a] RH COMP	BR-A COMP	BR-B COMP
Naphthalene	3.34	1.66	3.20
Acenaphthylene	5.11	2.61	5.57
Acenaphthene	**17.8**	1.74	**41.9**
Fluorene	**24.7**	1.96	**36.9**
Phenanthrene	**152**	4.42	**135**
Anthracene	**86.6**	3.72	**64.7**
Fluoranthene	**125**	**12.1**	**74.4**
Pyrene	**187**	**21.8**	**115**
Benz[a]anthracene	**345**	**32.2**	**151**
Chrysene	**242**	**25.3**	**110**
Benzo[b]fluoranthene	**65.2**	**17.3**	**34.7**
Benzo[k]flouranthene	**32.4**	**12.0**	**17.1**
Benzo[b+k]flouranthene	**67.8**	**16.8**	**34.6**
Benzo[e]pyrene	**77.0**	**18.4**	**38.2**
Benzo[a]pyrene	**133**	**23.5**	**64.3**
Perylene	**19.4**	8.88	**13.1**
Indeno[123-c]pyrene	**20.7**	5.50	8.10
Dibenz[a,h]anthracene	9.97	3.07	3.89
Benzo[g,h,i]perylene	**29.7**	8.01	3.89
1,4-dichlorobenzene	2.06	1.05	1.00

(a) Magnification factors are the number of times the test treatment concentration is greater than the reference treatment concentration. When the analyte is undetected in one or more replicates, the achieved detection limit value is used in the calculation. Calculations are based on dry weight concentrations. Underlined values are between 5 and <10 times reference site values; values shown in bold are ≥10 times reference site values.

TABLE 3.20. Magnification Factors of All Analyzed Compounds in *Nereis virens* Tissues Exposed to Red Hook/Bay Ridge Composites Relative to Tissue Exposed to the Mud Dump Reference Site

Analyte	Magnification Factors[a]		
	RH COMP	BR-A COMP	BR-B COMP
Ag	0.98	1.04	1.01
As	0.85	0.80	0.77
Cd	0.98	0.89	0.97
Cr	1.03	0.95	1.04
Cu	1.03	0.92	1.04
Hg	0.97	0.62	0.82
Ni	1.80	1.57	1.84
Pb	1.33	1.25	1.23
Zn	1.82	1.15	1.28
2,4'-DDD	3.57	2.58	6.88
2,4'-DDE	1.15	0.96	1.02
2,4'-DDT	1.15	0.96	1.02
4,4'-DDD	4.08	2.97	**10.9**
4,4'-DDE	8.65	5.74	**22.5**
4,4'-DDT	1.73	1.46	2.78
α-Chlordane	5.07	5.30	8.72
Aldrin	**19.1**	**13.7**	**25.4**
Dieldrin	2.03	1.31	3.70
Endosulfan I	0.81	0.67	0.72
Endosulfan II	1.15	0.96	1.02
Endosulfan Sulfate	1.16	0.95	1.02
Heptachlor	1.43	0.95	1.00
Heptachlor Epoxide	0.39	0.32	0.34
trans-Nonachlor	1.55	2.50	4.03
PCB 8	1.16	0.96	1.02
PCB 18	**111**	**68.2**	**106**
PCB 28	**63.2**	**37.9**	**85.1**
PCB 44	**96.7**	**51.7**	**99.9**
PCB 49	**22.5**	**15.9**	**33.3**
PCB 52	**29.1**	**17.5**	**42.1**
PCB 66	**42.0**	**32.3**	**74.1**
PCB 87	2.09	1.03	4.51
PCB 101	**11.3**	8.81	**21.2**
PCB 105	4.07	3.63	9.43
PCB 118	**12.1**	8.36	**22.6**
PCB 128	1.98	2.77	7.74
PCB 138	2.52	2.29	4.93
PCB 153	2.09	1.92	3.74
PCB 170	2.51	2.61	5.75
PCB 180	2.51	2.43	5.45
PCB 183	2.59	2.39	6.42
PCB 184	1.15	0.95	1.01
PCB 187	2.13	2.02	3.94
PCB 195	1.22	0.99	1.57
PCB 206	2.51	1.55	4.72
PCB 209	1.38	0.96	2.85

TABLE 3.20. (contd)

Analyte	Magnification Factors (a) RH COMP	BR-A COMP	BR-B COMP
Naphthalene	3.14	0.97	**17.8**
Acenaphthylene	**10.8**	1.62	**14.1**
Acenaphthene	**48.9**	1.84	**124**
Fluorene	**18.4**	0.98	**29.2**
Phenanthrene	**23.3**	0.58	**15.4**
Anthracene	**16.4**	0.88	9.73
Fluoranthene	**52.5**	2.55	**20.1**
Pyrene	**49.0**	4.15	**20.8**
Benz[a]anthracene	**44.4**	1.68	**11.9**
Chrysene	**64.3**	3.20	**20.4**
Benzo[b]fluoranthene	**16.7**	2.29	6.25
Benzo[k]flouranthene	8.33	0.95	2.11
Benzo[e]pyrene	**31.1**	1.83	9.18
Benzo[a]pyrene	**31.8**	1.68	8.87
Perylene	3.40	0.94	1.45
Indeno[123-cd]pyrene	3.94	1.10	1.72
Dibenz[a,h]anthracene	3.35	0.98	1.63
Benzo[g,h,i]perylene	7.49	1.34	2.95
1,4-Dichlorobenzene	1.15	0.94	1.01

(a) Magnification factors are the number of times the test treatment concentration is greater than the reference treatment concentration. When the analyte is undetected in one or more replicates, the achieved detection limit value is used in the calculation. Calculations are based on dry weight concentrations. Underlined values are between 5 and <10 times reference site values, values shown in bold are ≥10 times reference site values.

4.0 Discussion and Conclusions

In this section, physical and chemical analyses, and bioassays performed on the Red Hook/Bay Ridge test sediment composites are evaluated relative to the Mud Dump Reference Site composite by Green Book Tier III guidelines and by additional guidelines provided by USACE-NYD. Tier III evaluations include water-column toxicity tests, benthic toxicity tests, and whole-sediment bioaccumulation studies. Tier III evaluations assess the impact of contaminants in the dredged material on marine organisms to determine whether there is potential for the material to have an unacceptable environmental effect during ocean disposal. The Green Book and USACE-NYD provide the following guidance for determining whether the proposed dredged material is unacceptable for ocean disposal based on the Tier III test:

- Water-Column Toxicity. 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 within the first 4 h after disposal, or at any point in the marine environment after the first 4 h. The acutely toxic concentration in this case is taken to be the median lethal concentration (LC_{50}); therefore, acute toxicity in SPP tests would require at least 50% mortality in an SPP treatment to be evaluated according to the Green Book. A numerical mixing model should be used to predict whether concentrations greater than 0.01 of the acutely toxic SPP concentrations are likely to occur beyond the boundaries of the disposal site within the first 4 h after disposal.

- Benthic Acute Toxicity. The proposed dredged material does not meet the LPC for benthic toxicity when organism survival in the test sediment and the reference site sediment is statistically significant, and the survival in the test sediment is at least 20% lower than survival in the reference treatment for *A. abdita*, or 10% for *M. bahia*.

- Bioaccumulation. The proposed dredged material does not meet the LPC for bioaccumulation if tissue concentrations of one or more contaminants of concern are greater than the applicable FDA levels. Regional guidance (USACE 1981) for interpretation of bioaccumulation was also considered. When the bioaccumulation of contaminants in the dredged material exceeds that in the reference material exposures, further case-specific evaluation criteria listed in the Green Book should be consulted to determine LPC and benthic effects compliance.

Sections 4.1 through 4.4 discuss the proposed Red Hook/Bay Ridge dredged material in terms of sediment characterization and Tier III evaluations. The contribution of the Red Hook and Bay Ridge composites to water-column or benthic acute toxicity and potential for bioaccumulation relative to the Mud Dump Reference Site is also presented.

4.1 Sediment Physical and Chemical Characterizations

Red Hook/Bay Ridge sediment core samples were generally black or gray-black, silty-clayey material. Five of the six stations from the Red Hook composite were predominantly sand and gravel (RH-2, RH-3, RH-4, RH-5, and RH-6), whereas sediment from station RH-1 was predominantly silt and clay. The individual stations from Bay Ridge Reaches A and B were predominantly silts and clays with the exception of sediments from BR-B-15, 16, and 17 which were mainly sand. Sediment moisture contents ranged from 16% to 63% in individual cores from the Red Hook/Bay Ridge project areas. The dominant pesticides found in all three test sediment composites were the DDT family of compounds (38.4 µg/kg, 70.7 µg/kg and 123 µg/kg total DDTs, respectively), followed by aldrin. At least 19 of the 22 PCB congeners analyzed were detected in the three test sediment composites, with total PCB concentrations of 528 µg/kg for RH COMP, 951 µg/kg for BR-A COMP and 784 µg/kg for BR-B COMP. All 16 PAHs analyzed were detected in Red Hook/Bay Ridge test sediment composites. Concentrations of total PAHs were similar between RH COMP and BR-B COMP, with values of 47,400 µg/kg and 44,700 µg/kg respectively. Concentrations of total PAHs were much lower for BR-A COMP, with a value of 15,700 µg/kg. The concentrations of 1,4-dichlorobenzene were 74.5 µg/kg, 145 µg/kg, and 120 µg/kg (dry weight) in RH COMP, BR-A COMP and BR-B COMP, respectively.

4.2 Site Water and Elutriate Chemical Characterization

Concentrations of metals were variable among the Sequim Bay control water, the Mud Dump Site water and the Red Hook/Bay Ridge Site water samples. The highest metals concentrations were found in the sample from station RH-3, whereas elutriate concentrations of metals were similar among the Red Hook/Bay Ridge samples. Chromium, Cu, and Zn were the three metals found in the highest concentrations for both the site water and elutriate samples. In most cases the concentration of metals in the elutriate preparation are less than the metals values in the site water. The majority of pesticides and PCB congeners were not detected in the site water samples. The elutriate sample from BR-B COMP had the highest concentrations of pesticides and PCB congeners. The most elevated concentrations of compounds included the DDT family of compounds, aldrin, dieldrin, PCB congeners 18, 44, 66, 52, and 101.

4.3 Toxicity

The contribution of the Red Hook and Bay Ridge composites to benthic acute toxicity relative to the Mud Dump Reference Site is presented in Figure 4.1. Acute toxicity and at least a 20% increase in mortality relative to the Mud Dump Reference Site sediment was found in

	Sediment Treatment	Red Hook vs. MDRS	Bay Ridge Reach A vs. MDRS	Bay Ridge Reach B vs. MDRS
Acute Toxicity	*A. abdita* Benthic Static-Renewal Test	AT (a)	- (b)	AT
	M. bahia Benthic Static Test	AT	AT	AT
	M. beryllina SPP Test	S (c)	S	S
	M. bahia SPP Test	S	S	S
	M. galloprovincialis SPP Test	S	S	S

	Test Species[d]	*M.nasuta*	*N. virens*	*M. nasuta*	*N. virens*	*M.nasuta*	*N. virens*
Any Significant Bioaccumulation	# of Metals (9 total)	2	1	3	1	3	1
	# of Pesticide compounds (15 total)	4	6	5	6	7	7
	# of PCB congeners (22 total)	11	17	15	16	14	19
	# of PAH compounds (17 or 18 total)	17	17	16	9	17	16
	1,4-dichlorobenzene	-	-	-	-	-	
Bioaccumulaton ≤ 2 times Ref.	# of Metals (9 total)	2	1	1	1	1	1
	# of Pesticide compounds (15 total)	-	-	-	-	-	-
	# of PCB congeners (22 total)	-	-	1	2	-	-
	# of PAH compounds (17 or 18 total)	-	-	2	5	-	2
	1,4-dichlorobenzene	-	-	-	-	-	-
Bioaccumulaton >2≤ 5 times Ref.	# of Metals (9 total)	-	-	2	-	2	-
	# of Pesticide compounds (15 total)	2	3	1	3	3	2
	# of PCB congeners (22 total)	3	9	4	6	2	6
	# of PAH compounds (17 or 18 total)	1	3	4	4	3	1
	1,4-dichlorobenzene	-	-	-	-	-	-
Bioaccumulaton >5≤10 times Ref.	# of Metals (9 total)	-	-	-	-	-	-
	# of Pesticide compounds (15 total)	1	2	4	2	3	2
	# of PCB congeners (22 total)	3	-	2	2	4	5
	# of PAH compounds (17 or 18 total)	2	2	3	-	2	4
	1,4-dichlorobenzene	-	-	-	-	-	-
Bioaccumulaton >10 times Ref.	# of Metals (9 total)	-	-	-	-	-	-
	# of Pesticide compounds (15 total)	1	1	-	1	1	3
	# of PCB congeners (22 total)	5	8	8	6	8	8
	# of PAH compounds (17 or 18 total)	14	12	7	-	12	9
	1,4-dichlorobenzene	-	-	-	-	-	-

(a) AT Acutely toxic; significantly different from reference and mortality greater than 20% difference (10%) mysids greater than reference.
(b) - No significant difference/no significant bioaccumulation at this level.
(c) S Significantly different mortality between 0% and 100% SPP.
(d) Number of compounds bioaccumulating in tissues of test species.

FIGURE 4.1. Summary Matrix of Red Hook/Bay Ridge Sediment Toxicity and Bioaccumulation in Comparison with the Mud Dump Reference Site

A. abdita test for both RH COMP and BR-B COMP. Acute toxicity and a at least 10% increase in mortality relative to the Mud Dump Reference Site sediment was found in the *M. bahia* test for all three Red Hook/Bay Ridge test sediment composites. Therefore, both the Red Hook composite and the two Bay Ridge sediment composites did not meet the LPC for benthic toxicity to these test organisms at the Mud Dump Site, if the observed effects were due to persistent contaminants.

The water-column toxicity of each composite is also presented in Figure 4.1. In water-column toxicity tests, acute toxicity was found for all three test sediment composites and for the three species tested. For RH COMP, the LC_{50}s were 60% SPP for *M. beryllina,* >100% SPP for *M. bahia* and 58% for *M. galloprovincialis.* The EC_{50} for *M. galloprovincialis* normal development, a more sensitive measure than survival, was 23.0% for the Red Hook composite. Based on acute mortality results for RH COMP (LC_{50}s), the LPCs for water-column effects outside of the disposal site boundaries after 4 h is 0.60% SPP for *M. beryllina,* >1.0% SPP for *M. bahia* and 0.58% for *M. galloprovincialis.* A projection of SPP concentrations exceeding this value after 4 h at the Mud Dump Site would be unacceptable. The LC_{50} results for BR-A COMP were 30% for *M. beryllina*, 60% for *M. bahia*, and 65% for *M. galloprovincialis.* The EC_{50} for this composite was 21% SPP. Based on acute mortality results for BR-A COMP (LC_{50}s), the LPCs for water-column effects outside of the disposal site boundaries after 4 h is 0.30% SPP for *M. beryllina,* 0.60% SPP for *M. bahia* and 0.65% for *M. galloprovincialis.* Water-column toxicity results for BR-B COMP, expressed as LC_{50} results, were 19% SPP for *M. beryllina,* 70% SPP for *M. bahia,* and 71% for *M. galloprovincialis.* The calculated EC_{50} for the *M. galloprovincialis* test was 21% SPP. The LPCs for BR-B COMP are 0.19% SPP, 0.70% SPP, and 0.71% SPP for the *M. beryllina*, the *M. bahia*, and the *M. galloprovincialis* tests, respectively.

4.4 Bioaccumulation

Results of *N. virens* and *M. nasuta* tissue analyses from test sediment bioaccumulation studies were compared with action levels for poisonous or deleterious substances in fish and shellfish for human consumption published by the FDA and with USACE-NYD (1981) bioaccumulation matrix tables. Concentrations of As, Cd, Cr, Ni, and Pb were also compared with the FDA level of concern for chronic shellfish consumption (FDA 1993a, 1993b, 1993c, 1993d, 1993e) for each of these metals. Results of tissue analyses from test sediment bioaccumulation studies were also compared with contaminant concentrations in tissues of organisms similarly exposed to Mud Dump Reference Site sediment.

When *M. nasuta* and *N. virens* were exposed to Red Hook/Bay Ridge test sediment composites in 28-day bioaccumulation tests, concentrations of some contaminants were elevated in tissues of both species relative to levels in organisms exposed to the Mud Dump Reference Site. Concentrations of all metals (except Cd and Zn) were higher in *M. nasuta* than in *N. virens*. Pesticide and PCB concentrations were similar in the two species, with some analytes higher in the *N. virens*, and others higher in the *M. nasuta*. Sediments from BR-B COMP had overall higher concentrations of pesticides and PCBs in *N. virens* tissues relative to *M. nasuta* tissues. Concentrations of most PAHs were higher in *M. nasuta* tissues, many compounds by factors of 4 to 10 or more times, than in *N. virens*. Table 4.1 compares the NYD bioaccumulation matrix guidance levels (USACE 1981), FDA action levels for poisonous or deleterious substances in fish and shellfish for human consumption for selected pesticides, and FDA levels of concern for chronic shellfish consumption for selected metals with the mean concentration of these contaminants found in tissues of each test species. The *M. nasuta* and *N. virens* tissues exposed to Red Hook/Bay Ridge test sediments had tissue body burdens that were lower than the FDA levels for each of these selected contaminants.

When tissue burdens of organisms exposed to Red Hook/Bay Ridge test sediment composites were compared with those exposed to the Mud Dump Reference Site, the tissue burdens were statistically significant and higher for metals, pesticides, PCBs, and PAHs. Therefore, Red Hook/Bay Ridge sediment requires further evaluation to determine LPC and benthic effects compliance. Figure 4.1 shows bioaccumulation potential as the number of contaminants that were elevated in the tissues of *M. nasuta* and *N. virens* at certain magnitudes (i.e., 2, 5, or 10 times) above tissues of each species exposed to the reference sediment. This format clearly indicates where and to what degree similar classes of contaminants were accumulated in both species.

Table 4.1. Comparison of Contaminant Concentrations in *M. Nasuta* and *N. virens* Tissues Exposed to Proposed Dredged Material for Red Hook/Bay Ridge Project Area with FDA Action Levels and Levels of Concern

Substance	Guidance Level (mg/kg wet wt)	Concentrations[a] in *M. nasuta* Tissues (mg/kg wet wt) RH COMP	BR-A COMP	BR-B COMP	Concentrations[a] in *N. virens* Tissues (mg/kg wet wt) RH COMP	BR-A COMP	BR-B COMP
Chlordane[b]	0.3[c]	0.0005	0.0008	0.0009	0.0008	0.0008	0.0013
Total DDT[d]	5.0[c]	0.010	0.009	0.013	0.010	0.008	0.023
Dieldrin + Aldrin	0.3[c]	0.002	0.003	0.004	0.004	0.003	0.006
Heptachlor							
Heptachlor epoxide	0.3[c]	0.0004	0.0002	0.0002	0.0003	0.0002	0.0002
Total PCBs[e]	2.0[c]	0.063	0.089	0.113	0.141	0.102	0.214
Arsenic	86[f]	7.85	6.88	7.08	4.32	4.18	3.85
Cadmium	3.7[f]	0.059	0.067	0.070	0.077	0.071	0.075
Chromium	13[f]	0.656	1.14	0.96	0.364	0.341	0.360
Lead	1.7[f]	1.40	1.57	1.43	0.415	0.401	0.375
Nickel	80[f]	1.04	1.16	0.96	0.388	0.348	0.393
Methyl Mercury	1.0[f]	0.039[g]	0.037[g]	0.036[g]	0.039[g]	0.025[g]	0.032[g]
Total DDT[d]	0.04[h]	0.010	0.009	0.013	0.010	0.008	0.023
Total PCBs[e]	0.40[h]	NA[i]	NA	NA	0.141	0.102	0.214
Total PCBs[e]	0.10[h]	0.063	0.089	0.113	NA	NA	NA
Mercury (total)	0.20[h]	0.0390	0.037	0.036	0.039	0.025	0.032
Cadmium	0.30[h]	0.059	0.067	0.070	0.077	0.071	0.075

(a) Concentration shown is the mean of five replicate tissue analysis. If any constituents were undetected, one-half of the detection limit was used in calculation of the mean concentration.
(b) Sum of α-chlordane and *trans*-nonachlor only, whereas FDA action level is a sum of nine chlordane analytes.
(c) FDA Action Levels for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food.
(d) Sum of mean values for 2,4'-DDT, 4,4'-DDT, 2,4'-DDE, and 4,4'-DDE, 2,4'-DDD, and 4,4'-DDD. One-half of the detection limit was used in the summation when mean values were undetected in a replicate.
(e) Total PCBs= 2.0(x), where x equals the sum of the 22 congeners. One-half of the detection limit was used in summation when mean values were undetected in a replicate.
(f) FDA Level of concern for chronic shellfish consumption.
(g) Value reported here is for total mercury.
(h) NYD bioaccumulation matrix value designated in 1981 (USACE 1981).
(i) Not applicable.

5.0 References

Barrows, E.S., M.R. Pinza, W.W. Gardiner, N.P. Kohn, B.D. Gruendell, H.L. Mayhew, J.Q. Word, and L.B. Rosman. 1996. *Evaluation of Dredged Material Proposed for Ocean Disposal from Federal Projects in New York and New Jersey and the Military Ocean Terminal (MOTBY).* Prepared for Department of the Army, U.S. Army Corps of Engineers, New York District, Water Quality Branch, by Battelle/Marine Sciences Laboratory, Pacific Northwest National Laboratory, Richland, Washington. (In preparation.)

Bligh, E.G., and W.J. Dyer. 1959. "A Rapid Method of Total Lipid Extraction and Purification." *Canadian Journal of Biochemistry and Physiology.* 37:8 911-917.

Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Mar. Chem.* 14:49-59.

Dunnett, C.W. 1964. "New Tables for Multiple Comparisons with a Control." *Biometrics* 20:482-491.

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

EPA (U.S. Environmental Protection Agency). 1990. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846:* 3rd Ed. U.S. Environmental Protection Agency. Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1991. *Methods for the Determination of Metals in Environmental Samples.* EPA/600/4-91-010. U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

EPA/USACE (U.S. Environmental Protection Agency/U.S. Army Corps of Engineers). 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual).* EPA-503/8-91/001. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1994a. *Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods.* EPA/600/R-94-025. U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1994b. *Memorandum: Recommendations for Conducting Sediment Toxicity Tests with Mysidopsis bahia when Ammonia may be present at Toxic Levels.* June 14, 1994. U.S. Environmental Protection Agency, Office of Science and Technology, Washington, D.C.

FDA (U.S. Food and Drug Administration). 1993a. Guidance Document for Arsenic in Shellfish. U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Washington, D.C.

FDA (U.S. Food and Drug Administration). 1993b. Guidance Document for Cadmium in Shellfish. U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Washington, D.C.

FDA (U.S. Food and Drug Administration). 1993c. Guidance Document for Chromium in Shellfish. U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Washington, D.C.

FDA (U.S. Food and Drug Administration). 1993d. Guidance Document for Nickel in Shellfish. U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Washington, D.C.

FDA (U.S. Food and Drug Administration). 1993e. Guidance Document for Lead in Shellfish. U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Washington, D.C.

Finney, D. J. 1971. *Probit Analysis.* 3rd Ed. Cambridge University Press, Boston, Massachusetts.

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods of the National Status and Trends Program National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G. G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

NYSDEC (New York State Department of Environmental Conservation). 1992. *Analytical Method for the Determination of PCB congeners by Fused Silica Capillary Column Gas Chromatography with Electron Capture Detector.* NYSDEC Method 91-11. New York State Department of Environmental Conservation, Albany, New York.

Plumb, R. H., Jr. 1981. *Procedure for Handling and Chemical Analysis of Sediment and Water Samples.* Tech. Rep. EPA/CE-81-1. Prepared by Great Lakes Laboratory, State University College at Buffalo, New York, for the U.S. Environmental Protection Agency/U.S. Army Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Randall, R. C. 1988. *Lipid Standard Operating Procedure, Modified Bligh/Dyer.* U.S. Environmental Protection Agency Office of Research and Development, Environmental Research, Washington D.C.

USACE (U.S. Army Corps of Engineers). 1970 (Revised 1980). *Engineer Manual, Engineering and Design, Laboratory Soils Testing.* EM 110-2-1906. Headquarters, Department of the Army, Office of the Chief of Engineers, Washington, D.C.

USACE (U.S. Army Corps of Engineers). 1981. Memorandum: Final Interpretive Guidance for Bioaccumulation of Petroleum Hydrocarbons, DDT, Cadmium, and Mercury in the New York Bight. USACE Office of the Chief of Engineers. April 7, 1981.

USACE-NYD/EPA Region II (U.S. Army Corps of Engineers, New York District/U.S. Environmental Protection Agency, Region II). 1992. *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal.* 18 December 1992 Draft. U.S. Army Corps of Engineers, New York District and U.S. Environmental Protection Agency, Region II. New York, New York.

Appendix A.

Quality Assurance/Quality Control Data for
Sediment Physical/Chemical Analyses,
Red Hook and Bay Ridge Channels

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Grain Size, Bulk Density, Specific Gravity, and Total Solids

LABORATORY: Soil Technology, Bainbridge Island, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	Reference Method	Target Relative Precision	Detection Limit
Grain Size	ASTM D-2217 & D-422	≤20%	1.0%
Bulk Density	ASTM-D854	≤20%	NA
Specific Gravity	EM-1110-2-1906	≤20%	NA
Total Solids	Plumb 1981	NA	1.0%

METHOD Grain size was measured for four fractions using a combination of sieve and pipet techniques, following ASTM method D-2217 and D-422 for wet sieving. Bulk density was measured in accordance with ASTM method D-854. Specific gravity was measured in accordance with Method EM 1110-2-1906 (USACE 1970). Total solids was measured gravimetrically following Plumb (1981).

HOLDING TIMES Samples were analyzed within the 6-month holding time.

DETECTION LIMITS Target detection limits of 1.0% were met for each sample.

METHOD BLANKS Not applicable.

MATRIX SPIKES Not applicable.

REPLICATES Four samples were analyzed in triplicate for grain size and total solids. Precision was measured by calculating the relative standard deviation (RSD) among triplicate results. The RSDs ranged from 0% to 9% for grain size and from 0% to 2% for total solids, indicating acceptable precision. One sample was analyzed in triplicate for bulk density and specific gravity. The RSDs for this sample ranged from 0% to 1%, again indicating acceptable precision.

SRM Not applicable.

QA/QC SUMMARY GRAIN SIZE (contd)

REFERENCES

ASTM D-2217. Standard Method for Wet Preparation of Soil Samples for Particle-size Analysis and Determination of Soil Constants.

ASTM D-422. Standard Method for Particle-size Analysis of Soils

ASTM D-854. Standard Method for Specific Gravity

USACE (U.S. Army Corps of Engineers). 1970. *Engineering and Design Laboratory Soils Testing.* EM-1110-2-1906, Vicksburg, Mississippi.

Plumb, R. H., Jr. 1981. *Procedure for Handling and Chemical Analysis of Sediment and Water Samples.* Tech. Rep. EPA/USACE-81-1. Prepared by Great Lakes Laboratory, State University College at Buffalo, New York, for the U.S. Environmental Protection Agency/U.S. Army Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Total Organic Carbon

LABORATORY: Applied Marine Sciences, Inc., College Station, Texas

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Target Range of Recovery	Relative Precision	Detection Limit (%)
EPA 1986	≤20%	≤10%	0.1

METHOD Total organic carbon is the amount of non-volatile, partially volatile, volatile, and particulate organic carbon compounds in a sample. Each sample was dried and ball-milled to a fine powder. Before combustion, inorganic carbon in the sample was removed by acidification. The TOC was then determined by measuring the carbon dioxide released during combustion of the sample.

HOLDING TIMES The holding time of 6 months was met for all TOC analyses.

DETECTION LIMITS Target detection limits of 0.1% were met for all samples.

METHOD BLANKS Not applicable.

MATRIX SPIKES Not applicable.

REPLICATES Five samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the triplicate results. All RSDs were between 1% and 4%, indicating acceptable precision.

SRMs The standard reference material 1941a was analyzed with each batch of analytical samples. The non-certified value for this SRM is 4.8 ± 1.2. The SRM values obtained in each analytical batch were within this non-certified range.

REFERENCES

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

QA/QC SUMMARY

PROGRAM: New York/ New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Metals

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	Method	Range of Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (mg/kg dry wt)
Arsenic	ICP/MS	75-125%	≤20%	≤20%	0.1
Cadmium	ICP/MS	75-125%	≤20%	≤20%	0.01
Chromium	ICP/MS	75-125%	≤20%	≤20%	0.02
Copper	ICP/MS	75-125%	≤20%	≤20%	0.1
Lead	ICP/MS	75-125%	≤20%	≤20%	0.1
Mercury	CVAA	75-125%	≤20%	≤20%	0.02
Nickel	ICP/MS	75-125%	≤20%	≤20%	0.1
Silver	ICP/MS	75-125%	≤20%	≤20%	0.1
Zinc	ICP/MS	75-125%	≤20%	≤20%	0.1

SAMPLE CUSTODY---Eight samples were received on 4/11/95, logged into the Battelle system and stored frozen until extraction.

METHOD

Nine metals were analyzed: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Hg was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). The remaining metals were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following EPA Method 200.8 (EPA 1991).

To prepare sediment samples for analysis, they were freeze-dried and blended in a Spex mixer-mill. Approximately 5 g of mixed sample was ground in a ceramic ball mill. For ICP/MS and CVAA analyses, 0.2- to 0.5-g aliquots of dried homogenous sample were digested using two different methods. One method used hot nitric acid following a modified version of EPA method 200.2 (EPA 1991). The modification involved precluding the addition of hydrochloric acid during digestion. This was to avoid interferences caused by the formation of argon chloride in the ICP-MS which interferes with the quantitation of arsenic which has the same mass. The second digestion was an Aqua Regia method. This digestate was analyzed only for Ag because it precludes precipitation of AgCl, which occurs in samples that are from marine environments.

QA/QC SUMMARY METALS (contd)

HOLDING TIMES Samples were frozen to -80°C and subsequently freeze-dried. Samples were all analyzed within 180 days of collection. The following list summarizes all analysis dates:

Task	Date Performed
Aqua Regia Digestion	4/26/95
Nitric Digestion	5/1/95
ICP-MS	5/9-10/95
CVAA-Hg	5/9/95.

DETECTION LIMITS Target detection limits were exceeded for some metals; however, metals were detected above the MDLs in all samples. MDLs were determined by multiplying the standard deviation of the results of a minimum of seven replicate low level sediment spikes by the student t value at the 99th percentile (3.142).

METHOD BLANKS One method blank was analyzed. No metals were detected above the MDL in the blank with the exception of Cr and Hg. The Cr blank value was less than three times the MDL and all sample values were detected at levels greater than five times the blank concentration so no data were flagged. All data were blank corrected.

MATRIX SPIKES One sample was spiked with all nine metals. Recoveries of all metals were within the QC limits of 75-125% with the exception of As, which was recovered at 73%.

REPLICATES One sample was digested and analyzed in triplicate. Precision for triplicate analyses is reported by calculating the relative standard deviation (RSD) between the replicate results. RSD values ranged from 1 to 5%, within the QC limits of ±20%, with the exception of Pb, which had an RSD of 59%. Two of the three replicate values for this sample were similar with the third replicate high. No apparent analytical cause was evident, and since other QC for lead was acceptable, no further action was taken.

SRM SRM 1646a (estuarine sediment from the National Institute of Standards and Technology [NIST]), was analyzed for all metals. Only results for Cd, Pb and Hg were within ±20 % of the certified value (Ag is not certified). Values for the remaining metals were low, because the digestion method used is not as strong as the method (perchloric and hydrofluoric acids) used to certify the SRM; thus the results for this analysis should not be expected to match the SRM certified values. Therefore, no corrective actions were taken.

REFERENCES

Bloom, N.S., and E.A. Crecelius. 1983. *Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels.* Mar. Chem. 14:49-59.

EPA (U.S. Environmental Protection Agency). 1991. *Methods for the Determination of Metals in Environmental Samples.* EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch, Washington D.C.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: PCB Congeners/Chlorinated Pesticides

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	Spike Recovery	Relative Precision	Target Detection Limit (ug/kg dry wt.
GC/ECD	30-150%	50-120%	≤30%	1.0

SAMPLE CUSTODY Eight samples were received on 4/11/95, logged into the Battelle system and stored frozen at -20°C until extraction.

METHOD A 20 gram (wet wt) aliquot of sediment was extracted with methylene chloride using the roller technique under ambient conditions following a procedure based on methods used by the National Oceanic and Atmospheric Administration for its Status and Trends Program (NOAA 1993). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (NOAA 1993). Extracts were analyzed for 15 chlorinated pesticides and 22 individual PCB congeners using gas chromatography/electron capture detection (GC/ECD) following a procedure based on EPA Method 8080 (EPA 1986). The column used was a J&W DB-17, and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES Samples were extracted on 5/3/95. Extracts were analyzed by GC/ECD from 5/18-19/95, within the established holding time of 40 days.

DETECTION LIMITS Target detection limits were met for all PCBs and pesticides. MDLs were determined from multiplying the standard deviation of seven spiked replicates of a representative clean marine sediment by the student t value(3.142). A MDL verification was performed consisting of four spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the four replicate spike results by 4.54. All MDL verification results were below the target detection limit.

QA/QC SUMMARY PCB CONGENERS/PESTICIDES (contd)

METHOD BLANKS One method blank was extracted. No PCB congeners or pesticides were detected above the MDL in the method blank.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries were all within the QC guidelines of 30% to 150%.

MATRIX SPIKES Five out of the twenty two congeners and eleven of the fifteen pesticides were spiked into one sample. Matrix spike recoveries ranged from 90% to 174%. Three pesticides and three congeners exceeded the QC range of 5% to 120%. However, all recoveries, except Endosulfan II, that were outside of the control limits were for compounds that were spiked from one to eight times below the native levels; therefore, no corrective action was taken.

REPLICATES One sample was analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. RSDs for all detectable values were below the target precision goal of ≤30% indicating acceptable precision.

SRMs One SRM, 1941a, a marine sediment obtained by the National Institute for Science and Technology (NIST), was analyzed with the samples. Thirteen of the twenty two PCB congeners and five of the fifteen pesticide compounds analyzed are certified. Four pesticides and 10 congeners were detected within 30% of the certified mean. Two of the pesticides are certified at levels less than 10 times the MDL. Only one PCB congener was detected at greater than 50% difference from the certified value and this congener exhibited chromatographic interferences. The average percent difference from mean certified values was 22.4%, and only 26.7% of the compounds exceeded 35% difference.

MISCELLANEOUS

All congener and pesticide results are confirmed using a second dissimilar column. Results for each column must be within a factor of two of each other to be considered a confirmed value.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* SW-846. U.S. Document No. 955-001-00000, U.S. EPA, Washington, D. C.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH) and 1,4-Dichlorobenzene

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	Spike Recovery	Relative Precision	Target Detection Limit (ug/kg dry wt.)
GC/MS/SIM	50-120%	30-150%	≤30%	10

SAMPLE CUSTODY Eight samples were received on 4/11/95, logged into the Battelle system, and stored frozen until extraction.

METHOD Sediment samples were extracted with methylene chloride using a roller under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for its Status and Trends Program (NOAA 1993). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup.

Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) in the selected ion mode (SIM) following a procedure based on EPA Method 8270 (EPA 1986).

HOLDING TIMES Samples were extracted on 5/3/95. All extracts were analyzed by GC/MS/SIM on 5/15-5/16/95.

DETECTION LIMITS Target detection limits of 10 ng/g dry wt were met for all PAH compounds. Method detection limits (MDLs) were determined by multiplying the standard deviation of seven spiked replicates of a background clam sample by the student t value (3.142). A MDL verification was performed consisting of four spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the four replicate spike results by 4.54. All MDL verification results were below the target detection limit.

METHOD BLANKS One method blank was extracted with the extraction batch. Flouranthene and benzo[a]anthracene were detected in the blank. All blank levels were less than the target MDL of 10 ng/g dry wt and all sample concentrations were well above five times the blank concentration; therefore, no data were flagged. No data were blank corrected.

QA/QC SUMMARY/PAHs (contd)

SURROGATES Five isotopically labeled compounds were added to the samples prior to extraction, to assess the efficiency of the method. These were d8-naphthalene, d10-acenaphthene, d12-chrysene, d14-dibenzo[a,h]anthracene and d4-1,4 dichlorobenzene. All surrogate recoveries were within the quality control limits of 30% to 150%. All sample results are surrogate corrected.

MATRIX SPIKES One sample was spiked with all PAH compounds. Matrix spike recoveries were outside of the QC limits of 50% to 120% due to high native levels, relative to the levels spiked. Spike concentrations were from 10-200 times lower than native concentrations.

REPLICATES One sample was extracted and analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. RSDs ranged from 1% to 29%, indicating acceptable precision.

SRMs One SRM, 1941a, a marine sediment obtained by the National Institute for Science and Technology (NIST), was analyzed with the samples. Fourteen of the 16 PAH compounds analyzed are certified. Ten of the 14 PAHs were detected within 30% of the certified mean. Three compounds; chrysene, benzo[b]fluoranthene and dibenzo[a,h]anthracene were recovered above the certified range at recoveries ranging from 148% to 197%. These three compounds all coelute with other specific compounds present at significant levels in the SRM, which accounts for the high recoveries.

MISCELLANEOUS Some of the compounds are flagged to indicate that the ion ratio for that compound was outside of the QC range. This is due primarily to low levels of the compound of interest. Because the confirmation ion is present at only a fraction of the level of the parent ion, when the native level of the compound is low, the amount of error in the concentration measurement of the confirmation ion increases. The compound is actually quantified from the parent ion only, so it is unlikely that this would affect the quality of the data. For sample values that are relatively high (>5 times the MDL) it may be an indication of some sort of interference.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846. U.S. Document No. 955-001-00000, U.S. Environmental Protection Agency, Washington, D.C.

Table A.1. Grain Size of Sediment Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Batch	Total Percent (dry wt) Gravel >2000 µm	Sand 62.5-2000 µm	Silt 3.9-62.5 µm	Clay <3.9 µm
Red Hook						
RH-1	1	1	2	29	35	34
RH-2	1	1	7	63	16	14
RH-3	1	1	7	54	22	17
RH-4	1	1	6	67	15	12
RH-5	1	1	36	47	10	7
RH-6	1	1	3	75	16	6
Bay Ridge Reach A						
BR-A-1	1	1	0	21	43	36
BR-A-2	1	1	1	24	43	32
BR-A-3	1	1	2	18	45	35
BR-A-4	1	1	0	16	52	32
BR-A-5	1	1	0	15	42	43
BR-A-6	1	1	0	10	43	47
BR-A-7	1	1	0	10	41	49
BR-A-8	1	1	0	18	44	38
BR-A-9	1	1	0	16	47	37
BR-A-10	1	1	0	11	47	42
BR-A-11	1	1	1	13	44	42
BR-A-12	1	1	2	19	47	32
Bay Ridge Reach B						
BR-B-13	1	1	0	29	43	28
BR-B-14	1	1	0	29	40	31
BR-B-15	1	1	1	69	17	13
BR-B-16	1	1	5	55	22	18
BR-B-17	1	1	9	84	5	2
BR-B-18	1	1	0	27	42	31
BR-B-18	2	1	0	28	42	30
BR-B-18	3	1	0	27	42	31
MDRS[(a)]	1	1	3	96	0	1
Mysidopsis/Macoma Control	1	1	0	21	52	27
Nereis Control	1	1	0	13	60	27
Ampelisca Control	1	1	0	11	67	22

(a) MDRS Mud Dump Reference Site.

Table A.2. Quality Control Data for Sediment Grain Size Analysis

Sediment Treatment	Replicate	Batch	Total Percent (dry wt) Gravel >2000 µm	Sand 62.5-2000 µm	Silt 3.9-62.5 µm	Clay <3.9 µm
Analytical Replicates						
BR-B-18[a]	1	1	0	27	42	31
BR-B-18	2	1	0	28	42	30
BR-B-18	3	1	0	27	42	31
RSD (%)			NA[b]	2	0	2
CL-A-5[a]	1	2	1	6	53	40
CL-A-5	2	2	0	6	52	42
CL-A-5	3	2	1	7	51	41
RSD (%)			NA	9	2	2
CL-C-21[a]	1	3	1	33	40	26
CL-C-21	2	3	1	34	40	25
CL-C-21	3	3	1	34	40	25
RSD (%)			NA	2	0	2
PJ-B-21[a]	1	4	1	15	44	40
PJ-B-21	2	4	0	13	45	42
PJ-B-21	3	4	0	13	45	42
RSD (%)			NA	8	1	3

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) NA Not applicable; grain size fractions < 5%.

Table A.3. Specific Gravity and Bulk Density of Sediment Samples and Quality Control Data, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Batch	Bulk Density Wet lbs/ft3	Bulk Density Dry lbs/ft3	Specific Gravity
Red Hook					
RH COMP	1	1	104	64	2.68
Bay Ridge Reach A					
BR-A COMP	1	1	85	35	2.63
Bay Ridge Reach B					
BR-B COMP	1	1	106	69	2.66
MDRS[a]	1	1	110	96	2.68
Quality Control Data					
Analytical Replicates					
CL-C COMP[b]	1	1	97	53	2.66
CL-C COMP	2	1	96	52	2.65
CL-C COMP	3	1	96	53	2.64
RSD (%)			1	1	0

(a) MDRS Mud Dump Reference Site.
(b) Sample run concurrently with this study and used as a quality control sample.

Table A.4. Total Organic Carbon (TOC) and Percentage of Moisture in Sediment Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Batch	TOC (% dry wt)	Solids %	Moisture %
Red Hook					
RH-1	1	1	3.59	49	51
RH-2	1	1	1.57	63	37
RH-2	2	1	1.62	NA[a]	NA
RH-2	3	1	1.50	NA	NA
RH-3	1	2	1.93	59	41
RH-4	1	2	0.74	66	34
RH-5	1	2	2.99	77	23
RH-6	1	2	0.28	82	18
Bay Ridge Reach A					
BR-A-1	1	1	2.70	42	58
BR-A-2	1	1	2.66	43	57
BR-A-3	1	1	2.80	41	59
BR-A-4	1	1	2.82	42	58
BR-A-5	1	1	3.19	39	61
BR-A-6	1	1	3.02	42	58
BR-A-7	1	1	3.17	41	59
BR-A-8	1	1	2.80	37	63
BR-A-9	1	1	2.77	43	57
BR-A-10	1	1	2.95	40	60
BR-A-11	1	1	3.02	38	62
BR-A-12	1	1	2.82	41	59
Bay Ridge Reach B					
BR-B-13	1	1	3.56	52	48
BR-B-14	1	1	3.39	49	51
BR-B-15	1	1	0.66	67	33
BR-B-16	1	1	1.02	57	43
BR-B-17	1	1	0.36	84	16
BR-B-18	1	1	2.90	49	51
BR-B-18	2	1	NA	49	51
BR-B-18	3	1	NA	49	51
MDRS[b]	1	5	0.02	87	13
Mysidopsis/Macoma Control	1	2	2.00	25	75
Nereis Control	1	2	2.11	46	54
Ampelisca Control	1	2	3.05	31	69
Ampelisca Control	2	2	2.86	NA	NA
Ampelisca Control	3	2	2.94	NA	NA

(a) NA Not applicable.
(b) MDRS Mud Dump Reference Site.

Table A.5. Quality Control Data for Total Organic Carbon (TOC) Analysis of Sediment Samples

Sediment Treatment	Replicate	Analytical Batch	TOC (% dry wt)
Standard Reference Material			
SRM 1941a	1	1	4.90
SRM 1941a	1	2	4.82
SRM 1941a	1	3	4.83
SRM 1941a	1	4	4.84
SRM 1941a	1	5	4.97
Non-Certified Value			4.80
Range			±1.2
Percent Difference		1	2
Percent Difference		2	0
Percent Difference		3	1
Percent Difference		4	1
Percent Difference		5	4
Analytical Replicates			
RH-2[(a)]	1	1	1.57
RH-2	2	1	1.62
RH-2	3	1	1.50
RSD (%)			4
Ampelisca Control	1	2	3.05
Ampelisca Control	2	2	2.86
Ampelisca Control	3	2	2.94
RSD (%)			3
CL-C-17[(a)]	1	3	3.36
CL-C-17	2	3	3.18
CL-C-17	3	3	3.19
RSD (%)			3
PJ-B-14[(a)]	1	4	2.31
PJ-B-14	2	4	2.15
PJ-B-14	3	4	2.23
RSD (%)			4
PJ-B-24[(a)]	1	5	2.79
PJ-B-24	2	5	2.79
PJ-B-24	3	5	2.85
RSD (%)			1

(a) Sample randomly selected for use as a quality control sample in analytical batch.

Table A.6. Quality Control Data for Percentage of Moisture Analysis of Sediment Samples

Sediment Treatment	Replicate	Analytical Batch	Percentage Solids	Percentage Moisture
Analytical Replicates				
BR-B-18[(a)]	1	1	49	51
BR-B-18	2	1	49	51
BR-B-18	3	1	49	51
RSD (%)			0	0
CL-A-5[(a)]	1	3	46	54
CL-A-5	2	3	44	56
CL-A-5	3	3	46	54
RSD (%)			2	2
CL-C-21[(a)]	1	4	63	37
CL-C-21	2	4	63	37
CL-C-21	3	4	63	37
RSD (%)			0	0
PJ-B-21[(a)]	1	5	45	55
PJ-B-21	2	5	45	55
PJ-B-21	3	5	45	55
RSD (%)			0	0

(a) Sample randomly selected for use as a quality control sample in analytical batch.

Table A.7. Metals in Sediment Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Batch	Metals (µg/g dry wt)								
			Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Target Detection Limit			0.1	0.1	0.01	0.02	0.1	0.02	0.1	0.1	0.1
Method Detection Limit			0.20	0.426	0.025	0.235	0.485	0.001	0.217	0.238	1.25
Red Hook											
RH-COMP	1	1	3.58	14.1	1.71	61.8	79.5	1.69	41.5	118	132
RH-COMP	2	1	3.38	15.4	1.64	66.7	81.5	1.95	43.3	117	135
RH-COMP	3	1	3.45	15.1	1.57	65.8	86.1	1.96	46.6	298	129
Bay Ridge Reach A											
BR-A COMP	1	1	7.06	12.0	2.43	110	122	1.95	31.5	172	177
Bay Ridge Reach B											
BR-B COMP	1	1	4.32	10.3	2.02	78.2	89.2	1.42	21.7	113	131

Table A.8. Quality Control Data for Metals Analysis of Sediment Samples

Sediment Treatment	Replicate	Analytical Batch	Concentrations (µg/g dry wt) Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Method Blank	1	1	0.200 U[a]	0.426 U	0.025 U	0.274	0.485 U	0.022	0.217 U	0.238 U	1.25 U
Matrix Spike Results											
RH COMP		1	3.47	14.9	1.64	64.8	82.4	1.87	43.8	178	132
RH COMP (MS)		1	7.73	29.4	6.78	253	239	6.28	67.1	634	512
Concentration Spiked			5.00	20.0	5.00	200	200	5.00	20.0	500	500
Concentration Recovered			4.26	14.5	5.14	188	156	4.41	23.3	456	380
Percent Recovery			85	73 [b]	103	94	78	88	117	91	76
Standard Reference Material											
Certified Value			NC [c]	11.6	0.36	76.0	18.0	0.063	32.0	28.2	138
Range			NC	±1.3	±0.07	±3	±3	±0.012	±3	±1.8	±6
SRM 1646	1	1	0.19	7.84	0.39	42.4	12.3	0.071	20.4	21.8	84.4
Percent Difference			NA [d]	32% [e]	8%	44% [e]	32% [e]	13%	36% [e]	23% [e]	39% [e]
SRM 1646	2	1	NA	6.85	0.31	39.7	11.8	0.071	19.9	22.8	76.2
Percent Difference				41 [e]	14	48 [e]	34 [e]	13	38 [e]	19	45 [e]
Analytical Replicates											
RH-COMP	1	1	3.58	14.1	1.71	61.8	79.5	1.69	41.5	118	132
RH-COMP	2	1	3.38	15.4	1.64	66.7	81.5	1.95	43.3	117	135
RH-COMP	3	1	3.45	15.1	1.57	65.8	86.1	1.96	46.6	298	129
RSD (%)			3	5	4	4	4	8	6	59 [f]	2

(a) U Undetected at or above given concentration.
(b) Outside quality control criteria (75-125%) for spike recovery.
(c) NC Not certified.
(d) NA Not applicable.
(e) Outside SRM quality control criteria (≤20%).
(f) Outside quality control criteria (≤20%) for replicate analysis.

Table A.9. Pesticides and Polychlorinated Biphenyls (PCBs) in Sediment Samples, Red Hook and Bay Ridge Channels

Sediment Treatment:	Concentration (µg/kg dry wt) RH COMP	BR-A COMP	BR-B COMP
Replicate:	1	1	1
Heptachlor[a]	0.07 U[b]	0.09 U	0.06 U
Aldrin	5.81	10.6	6.86
Heptachlor Epoxide	0.32 U	0.44 U	0.29 U
2,4'-DDE	0.69 U	0.96 U	0.64 U
Endosulfan I	4.75	0.45 U	0.30 U
α-Chlordane	3.45	5.56	4.66
Trans Nonachlor	0.24 U	2.98	0.22 U
4,4'-DDE	12.1	27.4	42.3
Dieldrin	1.79	5.38	2.66
2,4'-DDD	4.34	7.30	12.3
2,4'-DDT	0.24 U	0.34 U	0.22 U
4,4'-DDD	12.9	21.5	48.5
Endosulfan II	0.32 U	0.45 U	0.30 U
4,4'-DDT	8.55	13.8	19.9
Endosulfan Sulfate	0.99	0.44	0.70
PCB 8	6.15	15.7	7.18
PCB 18	34.6	43.2 D[c]	51.4 D
PCB 28	34.4	71.0 D	37.7 D
PCB 52	21.8	33.1	26.9
PCB 49	15.0	25.6	17.1
PCB 44	18.5	27.6	22.7
PCB 66	27.5	50.2 D	33.6 D
PCB 101	14.7	26.3	23.0
PCB 87	5.52	7.39	7.62
PCB 118	16.0	36.1	31.7
PCB 184	0.07 U	0.10 U	0.07 U
PCB 153	18.2	34.8	30.1
PCB 105	9.85	16.3	16.9
PCB 138	13.5	29.7	26.7
PCB 187	8.11	14.7	12.4
PCB 183	3.77	6.63	13.4
PCB 128	2.55	5.64	5.69
PCB 180	8.52	19.3	16.0
PCB 170	4.27	9.85	7.15
PCB 195	0.02 U	1.41	1.56
PCB 206	0.03 U	0.89	1.14
PCB 209	1.14	0.03 U	1.84
Surrogate Recoveries (%)			
PCB 103 (SIS)	60	70	71
PCB 198 (SIS)	51	63	56

(a) Target detection limits are 1.0 µg/kg for all analytes.
(b) U Undetected at or above given concentration.
(c) D Determined from diluted sample (1:5).

Table A.10. Quality Control Data for Pesticide and Polychlorinated Biphenyl (PCB) Analysis of Sediment Samples

Matrix Spike Results

Sediment Treatment:	Concentration (µg/kg dry wt)					
	Method Blank	RH COMP[a]	RH COMP(MS)	Concentration	Concentration	Percent
Replicate:	1	1	1	Spiked	Recovered	Recovery
Heptachlor	0.06 U[b]	0.07 U	4.16	4.20	4.16	99
Aldrin	0.19 U	5.81	11.4	4.20	5.59	133 [c]
Heptachlor Epoxide	0.28 U	0.32 U	5.01	4.20	5.01	119
2,4'-DDE	0.61 U	0.69 U	NA [d]	NS[e]	NA	NA
Endosulfan I	0.28 U	4.75	9.49	4.20	4.74	113
α-Chlordane	0.46 U	3.45	7.21	4.20	3.76	90
Trans Nonachlor	0.21 U	0.24 U	NA	NS	NA	NA
4,4'-DDE	0.13 U	12.1	16.5	4.20	4.40	105
Dieldrin	0.19 U	1.79	6.33	4.20	4.54	108
2,4'-DDD	0.18 U	4.34	NA	NS	NA	NA
2,4'-DDT	0.21 U	0.24 U	NA	NS	NA	NA
4,4'-DDD	0.24 U	12.9	17.2	4.20	4.30	102
Endosulfan II	0.28 U	0.32 U	6.15	4.20	6.15	146 [c]
4,4'-DDT	0.67 U	8.55	15.8	4.20	7.25	173 [c]
Endosulfan Sulfate	0.20 U	0.99	5.19	4.20	4.20	100
PCB 8	0.53 U	6.15	NA	NS	NA	NA
PCB 18	0.18 U	34.6	NA	NS	NA	NA
PCB 28	0.05 U	34.4	43.7	5.36	9.30	174 [c]
PCB 52	0.03 U	21.8	33.7	11.17	11.90	107
PCB 49	0.06 U	15.0	NA	NS	NA	NA
PCB 44	0.02 U	18.5	NA	NS	NA	NA
PCB 66	0.03 U	27.5	NA	NS	NA	NA
PCB 101	0.04 U	14.7	22.6	7.58	7.90	104
PCB 87	0.03 U	5.52	NA	NS	NA	NA
PCB 118	0.04 U	16.0	NA	NS	NA	NA
PCB 184	0.06 U	0.07 U	NA	NS	NA	NA
PCB 153	0.03 U	18.2	24.2	4.43	6.00	135 [c]
PCB 105	0.02 U	9.85	NA	NS	NA	NA
PCB 138	0.03 U	13.5	19.2	3.42	5.70	167 [c]
PCB 187	0.03 U	8.11	NA	NS	NA	NA
PCB 183	0.06 U	3.77	NA	NS	NA	NA
PCB 128	0.02 U	2.55	NA	NS	NA	NA
PCB 180	0.02 U	8.52	NA	NS	NA	NA
PCB 170	0.01 U	4.27	NA	NS	NA	NA
PCB 195	0.02 U	0.02 U	NA	NS	NA	NA
PCB 206	0.03 U	0.03 U	NA	NS	NA	NA
PCB 209	0.02 U	1.14	NA	NS	NA	NA
Surrogate Recoveries (%)						
PCB 103 (SIS)	83	60	61	NA	NA	NA
PCB 198 (SIS)	88	51	49	NA	NA	NA

Table A.10. (contd)

	Standard Reference Material			Analytical Replicates			
	Concentration (µg/kg dry wt)			Concentration (µg/kg dry wt)			
Sediment Treatment:	SRM 1941a	Certified	Percent	PJ-A COMP[a]	PJ-A COMP	PJ-A COMP	RSD
Replicate:	1	Value	Difference	1	2	3	(%)
Heptachlor	0.06 U	NC [f]	NA	0.07 U	0.06 U	0.07 U	NA
Aldrin	4.18	NC	NA	9.98	9.93	9.84	1
Heptachlor Epoxide	0.27 U	NC	NA	0.33 U	0.30 U	0.32 U	NA
2,4'-DDE	0.58 U	0.73	NA	0.71 U	0.65 U	0.70 U	NA
Endosulfan I	0.27 U	NC	NA	0.33 U	0.30 U	0.33 U	NA
α-Chlordane	2.56	2.33	10	4.17	3.99	4.21	3
Trans Nonachlor	0.635	1.26	50 [h]	2.60	2.53	2.75	4
4,4'-DDE	6.61	6.59	0	20.7	23.0	21.2	6
Dieldrin	3.04	1.26 [g]	NA	4.87	5.17	4.99	3
2,4'-DDD	0.17 U	NC	NA	6.29	6.42	6.58	2
2,4'-DDT	0.20 U	NC	NA	0.25 U	0.23 U	0.25 U	NA
4,4'-DDD	6.16	5.06	22	14.2	14.9	14.2	3
Endosulfan II	0.27 U	NC	NA	0.33 U	0.30 U	0.33 U	NA
4,4'-DDT	5.83	1.25 [g]	NA	10.3	11.8	10.4	8
Endosulfan Sulfate	0.19 U	NC	NA	0.71	0.50	0.54	19
PCB 8	3.73	1.39 [g]	NA	17.2	17.0	17.2	1
PCB 18	8.13	1.15 [g]	NA	60.2 D[i]	59.6 D	59.1 D	1
PCB 28	0.05 U	9.80 [g]	NA	71.6 D	70.7 D	70.4 D	1
PCB 52	9.98	6.89	45 [h]	38.8	39.9	38.1	2
PCB 49	5.15	9.50	46 [h]	27.4	26.8	27.1	1
PCB 44	6.18	4.80	29	34.3	33.9	33.1	2
PCB 66	7.60	6.80	12	49.2 D	50.8 D	48.9 D	2
PCB 101	10.8	11.0	2	24.5	27.4	24.6	6
PCB 87	5.26	6.70	21	7.32	8.66	7.23	10
PCB 118	10.9	10.0	9	26.4	30.5	26.0	9
PCB 184	0.06 U	NC	NA	0.07 U	0.07 U	0.07 U	NA
PCB 153	13.9	17.6	21	24.9	27.3	23.8	7
PCB 105	4.80	3.65	32 [h]	11.6	13.5	11.7	9
PCB 138	11.6	13.38	13	20.2	24.3	20.0	11
PCB 187	6.04	7.00 [g]	14	9.46	9.88	9.26	3
PCB 183	2.59	1.63 [g]	59	4.35	5.09	4.24	10
PCB 128	1.86	1.87	1	3.87	4.83	3.75	14
PCB 180	9.76	5.83	67 [h]	15.0	15.7	14.7	3
PCB 170	4.24	3.00	41 [h]	6.98	7.28	6.76	4
PCB 195	0.91	NC	NA	1.10	0.93	0.91	11
PCB 206	3.74	3.67	2	1.11	0.96	1.16	10
PCB 209	8.74	8.34	5	1.47	1.11	1.21	15
Surrogate Recoveries (%)							
PCB 103 (SIS)	NA	NA	NA	60	62	63	NA
PCB 198 (SIS)	NA	NA	NA	63	65	66	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) Outside quality control criteria (50-120%) for spike recovery.
(d) NA Not applicable.
(e) NS Not spiked.
(f) NC Not certified.
(g) Non-certified value.
(h) Outside SRM quality control criteria (<30%).
(i) D Determined from diluted sample (1:5).

Table A.11 Polynuclear Aromatic Hydrocarbons (PAH) in Sediment Samples, Red Hook and Bay Ridge Channels

	Concentration (µg/kg dry wt)		
Sediment Treatment:	RH-COMP	BR-A COMP	BR-B COMP
Replicate:	1	1	1
1,4-Dichlorobenzene[(a)]	74.5	145	120
Naphthalene	3360	517	11100
Acenaphthylene	416	231	437
Acenaphthene	2530	172	4370
Fluorene	2020	226	2280
Phenanthrene	8470	1060	6330
Anthracene	3400	656	2450
Fluoranthene	4670	1970	3110
Pyrene	6420	2280	4130
Benzo[a]anthracene	3230	1370	1920
Chrysene	3680	1300	1960
Benzo[b]fluoranthene	2520	1700	1810
Benzo[k]fluoranthene	885	579	651
Benzo[a]pyrene	2720	1460	1820
Indeno[123-cd]pyrene	1290	948	982
Dibenzo[a,h]anthracene	417	277	308
Benzo[g,h,i]perylene	1340	958	1000
Surrogate Recoveries (%)			
d4 1,4-Dichlorobenzene	56	72	67
d8 Naphthalene	61	71	70
d10 Acenaphthene	63	67	68
d12 Chrysene	59	59	64
d14 Dibenzo[a,h,i]anthracene	87	86	93

(a) Target detection limits are 10 µg/kg for all analytes.

Table A.12. Quality Control Data for Polynuclear Aromatic Hydrocarbons (PAH) Analysis of Sediment Samples

Matrix Spike Results

Sediment Treatment:	Concentration (µg/kg dry wt)					
	Method Blank	Matrix Spike		Conc. Spiked	Conc. Recovered	Percent Recovery
Replicate:		RH COMP[a] 1	RH COMP(MS) 1			
1,4-Dichlorobenzene	2.01 U[b]	74.5	NA [c]	NA	NA	NA
Naphthalene	2.01 U	3360	3710	42	350	833 [d]
Acenaphthylene	2.13 U	416	506	42	90.0	214 [d]
Acenaphthene	1.91 U	2530	3000	42	470	1119 [d]
Fluorene	3.80 U	2020	2370	42	350	833 [d]
Phenanthrene	4.49 U	8470	9670	42	1200	2857 [d]
Anthracene	5.46 U	3400	3820	42	420	1000 [d]
Fluoranthene	4.43 [e]	4670	5260	42	590	1405 [d]
Pyrene	1.54 U	6420	7390	42	970	2310 [d]
Benzo[a]anthracene	4.53 [e]	3230	3600	42	370	881 [d]
Chrysene	0.83 U	3680	4260	42	580	1381 [d]
Benzo[b]fluoranthene	1.58 U	2520	2660	42	140	333 [d]
Benzo[k]fluoranthene	2.67 U	885	939	42	54.0	129 [d]
Benzo[a]pyrene	2.08 U	2720	2970	42	250	595 [d]
Indeno[123-cd]pyrene	0.95 U	1290	1410	42	120	286 [d]
Dibenzo[a,h]anthracene	1.21 U	417	521	42	104	248 [d]
Benzo[g,h,i]perylene	0.87 U	1340	1470	42	130	310 [d]
Surrogate Recoveries (%)						
d4 1,4-Dichlorobenzene	67	56	59	NA	NA	NA
d8 Naphthalene	68	61	66	NA	NA	NA
d10 Acenaphthene	69	63	67	NA	NA	NA
d12 Chrysene	70	59	63	NA	NA	NA
d14 Dibenzo[a,h,i]anthracene	60	87	93	NA	NA	NA

Table A.12. (contd)

Standard Reference Material

	Concentration (µg/kg dry wt)		
Sediment Treatment:	1941a SRM	Certified Value	Percent Difference
Replicate:	1	NA	NA
1,4-Dichlorobenzene	132	NC [f]	NA
Naphthalene	1100	1010	9
Acenaphthylene	62.5	37.0 [g]	NA
Acenaphthene	49.1	41.0 [g]	NA
Fluorene	94.6	97.3	3
Phenanthrene	567	489	16
Anthracene	226	184	23
Fluoranthene	1020	981	4
Pyrene	831	811	2
Benzo[a]anthracene	456	427	7
Chrysene	561	380	48 [h]
Benzo[b]fluoranthene	1330	740	80 [h]
Benzo[k]fluoranthene	431	361	19
Benzo[a]pyrene	636	628	1
Indeno[123-cd]pyrene	587	501	17
Dibenzo[a,h]anthracene	145	73.9	96 [h]
Benzo[g,h,i]perylene	548	525	4
Surrogate Recoveries (%)			
d4 1,4-Dichlorobenzene	62	NA	NA
d8 Naphthalene	64	NA	NA
d10 Acenaphthene	63	NA	NA
d12 Chrysene	55	NA	NA
d14 Dibenzo[a,h,i]anthracene	60	NA	NA

Table A.12. (contd)

Analytical Replicates

Sediment Treatment: Replicate:	Concentration (µg/kg dry wt) PJ-A-COMP[(a)] 1	PJ-A-COMP 2	PJ-A-COMP 3	RSD (%)
1,4-Dichlorobenzene	148	149	147	1
Naphthalene	215	186	182	9
Acenaphthylene	38.0	40.3	41.4	4
Acenaphthene	126	74.3	99.6	26
Fluorene	145	94.4	124	21
Phenanthrene	686	374	564	29
Anthracene	316	226	278	17
Fluoranthene	995	686	848	18
Pyrene	976	725	852	15
Benzo[a]anthracene	494	351	412	17
Chrysene	480	347	395	17
Benzo[b]fluoranthene	597	519	640	10
Benzo[k]fluoranthene	199	170	211	11
Benzo[a]pyrene	430	375	452	9
Indeno[123-cd]pyrene	334	279	331	10
Dibenzo[a,h]anthracene	85.7	71.6	82.9	9
Benzo[g,h,i]perylene	326	274	330	10
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	58	60	57	NA
d8 Naphthalene	65	65	66	NA
d10 Acenaphthene	67	70	69	NA
d12 Chrysene	63	61	63	NA
d14 Dibenzo[a,h,i]anthracene	89	87	87	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NA Not applicable.
(d) Outside quality control criteria (50-120%) for spike recovery.
(e) Ion ratio out or confirmation ion not detected.
(f) NC Not certified.
(g) Non-certified value.
(h) Outside SRM quality control criteria (≤30%).

Appendix B.

Quality Assurance/Quality Control Data for
Water and Elutriate Analyses,
Red Hook and Bay Ridge Channels

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Metals

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Site Water

QA/QC DATA QUALITY OBJECTIVES

	Reference Method	Range of Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (μg/L)
Cadmium	ICP/MS	75-125%	≤20%	≤20%	0.025
Chromium	GFAA	75-125%	≤20%	≤20%	1.0
Copper	ICP/MS	75-125%	≤20%	≤20%	0.30
Lead	ICP/MS	75-125%	≤20%	≤20%	0.30
Mercury	CVAA	75-125%	≤20%	≤20%	0.002
Nickel	ICP/MS	75-125%	≤20%	≤20%	0.30
Silver	ICP/MS	75-125%	≤20%	≤20%	0.10
Zinc	GFAA	75-125%	≤20%	≤20%	0.15

SAMPLE CUSTODY Samples were received on 3/31 through 4/3/95 in good condition. These samples were logged into the Battelle system and stored cold (4°C) until extraction.

METHOD Eight metals were analyzed in water and elutriate samples: silver (Ag), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Hg was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). Cr and Zn were analyzed by graphite furnace atomic absorption (GFAA) spectrometry following the EPA Method 200.9 (EPA 1991). The remaining metals were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following a procedure based on EPA Method 200.8 (EPA 1991).

All water and elutriate samples were acidified to pH <2 upon receipt in the laboratory. Five metals, Cd, Cu, Pb, Ni and Ag, were extracted from the water according to a procedure based on EPA Method 218.3 (EPA 1979). This preconcentration involves addition of a chelating agent which results in precipitation of the metals from solution, followed by filtration, and digestion of the filter in concentrated acid in order to achieve low detection limits. The digestates were then analyzed by ICP/MS as described above.

HOLDING TIMES Mercury in water has a holding time of 28 days from collection to analysis. All samples were analyzed within this holding time. Samples were all analyzed for the remaining metals within 180 days of collection. The following table summarizes all analysis:

QA/QC - METALS - SITE WATER (contd)

Task	Date
APDC Extraction	7/13/95
ICP-MS	7/19/95
CVAA-Hg	4/11/95
GFAA-Cr	5/12/95
GFAA-Zn	5/15/95
APDC Re-extract	8/24/95
ICP-MS Re-analysis (Cd only)	8/24/95.

Some samples had high levels of Cd; these samples were reprocessed and re-analyzed.

DETECTION LIMITS Target detection limits were met for all metals except Zn. Detection limits for Zn exceeded the target limits; however, all sample values were well above the achieved detection limits. MDLs for Ag, Cd, Cu, Hg, Ni and Pb were determined by spiking eight replicates of laboratory deionized water and multiplying the standard deviation of the resulting analysis by the student t value for n=8. MDLs reported for Cr and Zn were determined by calculating the standard deviation of three replicate analyses of the method blank and multiplying by three.

An MDL verification study was performed for ICP-MS metals by spiking four replicates of Sequim Bay seawater and multiplying the standard deviation of the resulting analysis by 4.54.

METHOD BLANKS Procedural blanks were generated during the APDC extraction step and only analyzed for the metals that were preconcentrated (Ag, Cd, Cu, Ni and Pb.). Two types of blanks were generated: 1) the reagent blank, which consists of the APDC reagents only, and 2) the procedural blank, which consists of the reagents and DI water. Ni was the only metal detected in one of the reagent blanks.

The blanks reported for Hg, Cr and Zn (the metals analyzed directly on waters) consist of solutions (including modifiers for the GFAA analyses), which are used to dilute all samples for analysis. Zn and Cr were detected in the blank. Both are present at less than three times the MDL. In addition, all zinc values are greater than five times the blank zinc concentration. All data are corrected for the blank concentrations.

MATRIX SPIKES One sample was spiked with all metals. An additional sample was spiked for the APDC procedure. The APDC metals were spiked prior to sample processing and the other metals were spiked just prior to analysis. All recoveries were within the QC limits of 75% to 125% with the exception of Cu in one APDC spike. Since the Cu recovery was acceptable for the other spike, no further action was taken.

QA/QC SUMMARY-METALS-SITE WATER (contd)

REPLICATES

Each sample was analyzed in triplicate. Precision for triplicate analyses is reported by calculating the relative standard deviation (RSD) among the replicate results. RSD values were all within the QC limits of ±20% with the exception of Ni in one sample and Hg in another sample.

SRMs

SRM, SLRS-3, a certified riverine water sample from the National Research Council of Canada (NRCC), was analyzed for all metals with the exception of Ag and Hg, which are not certified in this SRM. Results for all metals were within ±20 % of mean certified value.

A second SRM, 1643c, a freshwater sample from NIST, was analyzed only for Cr and Zn. They were recovered within the control limits of ±20 % of mean certified value.

A third SRM, CASS-3, a seawater ample from NRCC was analyzed for Cd. The result was within ±20% of the mean certified value.

In addition, 1641b, a freshwater sample from NIST, was analyzed twice for Hg. Results were within ±20 % of mean certified value.

REFERENCES

Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Mar. Chem.* 14:49-59.

EPA (U.S. Environmental Protection Agency). 1979. Revised (1983). *Methods for the Chemical Analysis of Water and Wastes.* EPA-600/4-79-020. Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

EPA (U.S. Environmental Protection Agency). 1991 *Methods for the Determination of Metals in Environmental Samples.* EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch, Cincinnati, Ohio.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Metals

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Elutriate

QA/QC DATA QUALITY OBJECTIVES

	Reference Method	Range of Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (µg/L)
Cadmium	ICP/MS	75-125%	≤20%	≤20%	0.025
Chromium	GFAA	75-125%	≤20%	≤20%	1.0
Copper	ICP/MS	75-125%	≤20%	≤20%	0.35
Lead	ICP/MS	75-125%	≤20%	≤20%	0.35
Mercury	CVAA	75-125%	≤20%	≤20%	0.002
Nickel	ICP/MS	75-125%	≤20%	≤20%	0.3
Silver	ICP/MS	75-125%	≤20%	≤20%	0.25
Zinc	GFAA	75-125%	≤20%	≤20%	0.15

SAMPLE CUSTODY Samples were received on 4/25/95 in good condition, logged into the Battelle system, acidified to pH<2 and held at ambient temperature until analysis.

METHOD Eight metals were analyzed in water and elutriate samples: silver (Ag), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Hg was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). Cr and Zn were analyzed by graphite furnace atomic absorption (GFAA) spectrometry following the EPA Method 200.9 (EPA 1991). The remaining metals were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following a procedure based on EPA Method 200.8 (EPA 1991).

All water and elutriate samples were acidified to pH <2 upon receipt in the laboratory. Five metals, Cd, Cu, Pb, Ni and Ag, were extracted from the water according to a procedure based on EPA Method 218.3 (EPA 1979). This preconcentration involves addition of a chelating agent which results in precipitation of the metals from solution, followed by filtration, and digestion of the filter in concentrated acid in order to achieve low detection limits. The digestates were then analyzed by ICP/MS as described above.

HOLDING TIMES Mercury in water has a holding time of 28 days from collection to analysis. All samples were analyzed within this holding time. Samples were all analyzed for the remaining metals within 180 days of collection. The following table summarizes all analysis:

QA/QC SUMMARY-METALS-ELUTRIATE (contd)

Task	Date
APDC Extraction	7/10/95
ICP-MS	7/21/95
CVAA-Hg	5/11/95
GFAA-Cr	5/12/95
GFAA-Zn	5/16/95
APDC Re-extract	8/24 and 9/1/95.

Some samples had high levels of Cd (two replicates of one sample) and were reprocessed and re-analyzed.

DETECTION LIMITS Target detection limits were met for all metals except Zn. Detection limits for Zn exceeded the target limits; however, all sample values were well above the detection limits achieved. MDLs for Ag, Cd, Cu, Hg, Ni and Pb were determined by spiking eight replicates of laboratory deionized water and multiplying the standard deviation of the resulting analysis by the student t value for n=8. MDLs reported for Cr and Zn were determined by taking the standard deviation of three replicate analyses of the method blank and multiplying the standard deviation by three.

METHOD BLANKS Procedural blanks were generated during the APDC extraction step and only analyzed for the metals that were preconcentrated (Ag, Cd, Cu, Ni and Pb). Two types of blanks were generated: 1) the reagent blank, which consists of the APDC reagents only, and 2) the procedural blank which consists of the reagents and DI water. Ni was the only metal detected above the MDL in both of the reagent blanks. The values were less than three times the MDL.

The blanks reported for Hg, Cr and Zn (the metals analyzed directly on waters) consist of a solution (including modifiers for the GFAA analyses) which is used to dilute all samples for analysis. The compounds Zn and Cr were detected in the blank. Both are present at less than three times the MDL. All data is corrected for the blank concentrations.

MATRIX SPIKES Two samples were spiked with APDC metals (Ag, Cd, Cu, Ni, Pb). A different sample was spiked with the GFAA metals (Cr and Zn) and Hg. The APDC metals were spiked prior to sample processing and the other metals were spiked just prior to analysis. All recoveries were within the QC limits of 75% to 125% with the exception of Cd and Pb in both APDC spikes and Ni in one of the spikes. An additional Cd matrix spike was performed with the reprocessed samples. Cd recovery in this spike was below the lower QC limit.

REPLICATES Each sample was analyzed in triplicate. Precision for triplicate analyses is reported by calculating the relative standard deviation (RSD) between the replicate results. RSD values were all within the QC limits of ±20% with the exception of Cd in two samples and Cu, Ni and Pb in another sample. Except for one Cd RSD of 158%, all other out of control RSDs were between 20 and 40%.

QA/QC SUMMARY-METALS-ELUTRIATE (contd)

SRMs

SRM, SLRS-3, a certified riverine water sample from the National Research Council of Canada (NRCC), was analyzed twice for all APDC metals and once for GFAA metals. Ag and Hg are not certified in this SRM. Results for all metals were within ±20 % of mean certified value with the exception of Cd, Ni and Pb in the first SRM.

A second SRM, 1643c, a freshwater sample from NIST, was analyzed in triplicate for APDC metals and once for Cr and Zn. Cd and Pb were recovered within 30 to 40% of the certified value, which was outside of the control limits of ±20 % of mean certified value. All other metals were recovered within the control limit.

In addition, 1641b, a freshwater sample from NIST, was analyzed twice for Hg. Results were within ±20 % of mean certified value.

REFERENCES

Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Mar. Chem.* 14:49-59.

EPA (U.S. Environmental Protection Agency). 1979. Revised (1983). *Methods for the Chemical Analysis of Water and Wastes.* EPA-600/4-79-020. Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

EPA (U.S. Environmental Protection Agency). 1991. *Methods for the Determination of Metals in Environmental Samples.* EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch, Cincinnati, Ohio.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: PCB Congeners/Chlorinated Pesticides

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Site Water

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	Spike Recovery	Relative Precision	Target Detection Limit (ng/L)
GC/ECD	30-150%	50-120%	≤30%	1.0

SAMPLE CUSTODY Samples were received on 3/31 through 4/3/95 in good condition, logged into the Battelle system and stored cold (4°C) until extraction.

METHOD One liter of water was extracted with methylene chloride in a separatory funnel following a procedure based on methods used by the National Oceanic and Atmospheric Administration for its Status and Trends Program (NOAA 1993). Sample extracts were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (NOAA 1993). Extracts were analyzed for 15 chlorinated pesticides and 22 individual PCB congeners using gas chromatography/electron capture detection (GC/ECD) following a procedure based on EPA Method 8080 (EPA 1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES Samples were extracted on 3/29 and 4/3/95. Extracts were analyzed by GC/ECD from 4/20 through 4/24/95, within the established holding time of 40 days.

DETECTION LIMITS Target detection limits were met for all PCBs and pesticides. MDLs were determined from multiplying the standard deviation of seven spiked replicates of a representative clean Sequim Bay water by the student t value(3.142). A MDL verification was performed by spiking a representative clean sediment replicate samples four times. MDL verification values were determined by multiplying the standard deviation of the four replicate spike results by 4.54. All MDL verification results were below the target detection limit.

METHOD BLANKS Two method blanks were extracted. No PCB congeners or pesticides were detected above the MDL in the blank.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries were all within the QC guidelines of 30% to 150%.

QA/QC SUMMARY/PCB CONGENERS/PESTICIDES - SITE WATER (contd)

MATRIX SPIKES Five out of the 22 congeners and 12 of the 15 pesticides were spiked into one sample. Matrix spike recoveries ranged from 81% to 111%, all within the quality control range of 50% to 120%.

REPLICATES All samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. No PCBs were detected above the MDL in all three replicates of any of the samples and only a limited number of pesticides were detected. RSDs for all detectable values were below the target precision goal of ≤30% indicating acceptable precision with the exception of 4,4-'DDE (RSD=32%) in one replicate.

SRMs Not available.

MISCELLANEOUS

All congener and pesticide results are confirmed using a second dissimilar column. Results for each column must be within a factor of 2 of each other to be considered a confirmed value.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984 - 1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* SW-846. U.S. Document No. 955-001-00000, U.S. Environmental Protection Agency, Washington, D.C.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: PCB Congeners/Chlorinated Pesticides

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Elutriate

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	Spike Recovery	Relative Precision	Target Detection Limit (ng/L)
GC/ECD	30-150%	50-120%	≤30%	1.0

SAMPLE CUSTODY Samples were received on 4/25/95 in good condition, logged into the Battelle system, and stored cold at (4°C).

METHOD One liter of water was extracted with methylene chloride in a separatory funnel following a procedure based on methods used by the National Oceanic and Atmospheric Administration for its Status and Trends Program (NOAA 1993). Sample extracts were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (NOAA 1993). Extracts were analyzed for 15 chlorinated pesticides and 22 individual PCB congeners using gas chromatography/electron capture detection (GC/ECD) following a procedure based on EPA Method 8080 (EPA 1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES Samples were extracted on 5/2 and 5/3/95. Extracts were analyzed by GC/ECD from 5/9 through 5/11/95, within the established holding time of 40 days.

DETECTION LIMITS Target detection limits were met for all PCBs and pesticides. MDLs were determined from multiplying the standard deviation of seven spiked replicates of a representative clean Sequim Bay water by the student t value(3.142). A MDL verification was performed consisting of four spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the four replicate spike results by 4.54. All MDL verification results were below the target detection limit.

QA/QC SUMMARY/PCB CONGENERS/PESTICIDES - ELUTRIATE (contd)

METHOD BLANKS One method blank was extracted. No PCB congeners or pesticides were detected above the MDL in the method blank.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries were all within the QC guidelines of 30% to 50%.

MATRIX SPIKES Five out of the 22 congeners and 12 of the 15 pesticides were spiked into a sample of Sequim Bay seawater. Matrix spike recoveries ranged from 69 - 129%, all within the control limit range of 50% to 120% with the exception of PCB 101 (129%).

REPLICATES All samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. RSDs for all detectable values were below the target precision goal of ≤30% in five of the eight samples. Three of the samples had a number of replicate RSD values between 30 and 100%, primarily involving PCB congeners. Since these samples had relatively high particulate loads, the low precision is most likely due to non-homogeneity of samples extracted.

SRMs Not available.

MISCELLANEOUS

All congener and pesticide results are confirmed using a second dissimilar column. Results for each column must be within a factor of two of each other to be considered a confirmed value.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* SW-846. U.S. Document No. 955-001-00000, U.S. Environmental Protection Agency, Washington, D.C.

Table B.1. Metals in Site Water Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP-MS	Cd ICP-MS	Cr GFAA	Cu ICP-MS	Hg CVAF	Ni ICP-MS	Pb ICP-MS	Zn GFAA
Target Detection Limit			0.10	0.025	1.0	0.30	0.002	0.30	0.30	0.15
Method Detection Limit			0.018	0.003	0.060	0.021	0.00005	0.028	0.011	0.84
Red Hook										
RH-3	1	1	0.102	0.0649 [a]	1.87	3.44	0.0224	1.35	1.67	26.3
RH-3	2	1	0.112	0.0859	1.83	3.78	0.0195	1.40	2.03	25.4
RH-3	3	1	0.133	0.0681 [a]	1.80	3.56	0.0206	1.31	1.78	25.2
Bay Ridge Reach A										
BR-A-6	1	1	0.0824	0.0749	1.16	2.89	0.0108	1.17	1.15	11.1
BR-A-6	2	1	0.0821	0.0734	1.09	2.92	0.0113	1.78	1.17	13.5
BR-A-6	3	1	0.0785	0.0602	1.16	2.56	0.00944	1.04	1.02	11.5
Bay Ridge Reach B										
BR-B-15	1	1	0.0816	0.0799	1.09	2.98	0.00927	1.24	1.14	12.2
BR-B-15	2	1	0.0820	0.0693	1.46	2.81	0.00915	1.18	0.995	10.0
BR-B-15	3	1	0.0801	0.0658	1.12	2.92	0.00874	1.20	1.03	11.3
MDS[b]	1	1	0.0180 U[c]	NA [d]	0.310	0.943	0.00147	0.415	0.240	24.1
MDS	2	1	0.0180 U	0.0515	0.240	1.02	0.00125	0.416	0.235	26.0
MDS	3	1	0.0180 U	0.0540	0.340	0.926	0.00124	0.397	0.218	26.0
Sequim Bay Water	1	1	0.0180 U	0.0668	0.340	0.527	0.00036	0.414	0.0110 U	17.1
Sequim Bay Water	2	1	0.0180 U	0.0717	0.370	0.632	0.00017	0.480	0.0157	14.3
Sequim Bay Water	3	1	0.0180 U	0.0617 [a]	0.580	0.569	0.00005	0.505	0.0206	16.5

(a) Value obtained from re-processing and re-analysis of sample.
(b) MDS Mud Dump Site.
(c) U Undetected at or above given concentration.
(d) NA Not available due to interference in original analysis. No water remained for re-processing and analysis.

Table B.2. Quality Control Data for Metals Analysis of Site Water Samples

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Blank-1	1	1	0.018 U[a]	0.003 U	NA [b]	0.021 U	NA	0.028 U	0.011 U	NA
	2	1	0.018 U	0.003 U	NA	0.021 U	NA	0.0374	0.011 U	NA
Blank-2	1	1	NA	NA	0.102	NA	0.00005 U	NA	NA	1.48
Matrix Spike										
RH-3[c]	3	1	0.133	NS [d]	NS	3.56	NS	1.31	1.78	NS
RH-3 (MS)	1	1	1.00	NS	NS	4.58	NS	2.30	2.75	NS
Concentration Spiked			1.00	NS	NS	1.00	NS	1.00	1.00	NS
Concentration Recovered			0.87	NA	NA	1.02	NA	0.99	0.97	NA
Percent Recovery			87	NA	NA	102	NA	99	97	NA
CL-C-24[c]	1	1	0.0627	0.081	NS	2.67	NS	1.18	1.19	NS
CL-C-24 (MS)	1	1	1.02	0.936	NS	4.01	NS	2.22	2.19	NS
Concentration Spiked			1.00	1.00	NS	1.00	NS	1.00	1.00	NS
Concentration Recovered			0.96	0.85	NA	1.34	NA	1.04	1.00	NA
Percent Recovery			96	85	NA	134 [e]	NA	104	100	NA
MDS[f]	3	1	NS	NS	NS	NS	0.00124	NS	NS	NS
MDS (MS)	1	1	NS	NS	NS	NS	16.3	NS	NS	NS
Concentration Spiked			NS	NS	NS	NS	14.1	NS	NS	NS
Concentration Recovered			NA	NA	NA	NA	16.3	NA	NA	NA
Percent Recovery			NA	NA	NA	NA	116	NA	NA	NA

Table B.2. (contd)

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Standard Reference Material										
1641b	1	1	NA	NA	NA	NA	1583712	NA	NA	NA
Certified Value			NA	NA	NA	NA	1520000	NA	NA	NA
Range			NA	NA	NA	NA	±40000	NA	NA	NA
Percent Difference	1	1	NA	NA	NA	NA	4	NA	NA	NA
1643c	1	1	NA	NA	20.9	NA	NA	NA	NA	84.6
Certified Value			NA	NA	19.0	NA	NA	NA	NA	73.9
Range			NA	NA	±0.6	NA	NA	NA	NA	±0.9
Percent Difference			NA	NA	10	NA	NA	NA	NA	14%
SLRS - 3	1	1	0.018 U	0.017	0.24	1.54	NA	0.887	0.0887	1.63
SLRS - 3	2	1	0.018 U	0.015	NA	1.55	NA	0.846	0.0718	NA
Certified Value			NC	0.013	0.30	1.35	NA	0.830	0.0680	1.04
Range			NC	±0.002	±0.04	±0.07	NA	±0.080	±0.0070	±0.09
Percent Difference	1	1	NA	32 (g)	20	14	NA	7	30 (g)	57 (g)
Percent Difference	2	1	NA	15	NA	15	NA	2	6	NA
CASS - 3	1	2	NA	0.032	NA	NA	NA	NA	NA	NA
Certified Value			NA	0.030	NA	NA	NA	NA	NA	NA
Range			NA	±0.005	NA	NA	NA	NA	NA	NA
Percent Difference	1	2	NA	7	NA	NA	NA	NA	NA	NA

Table B.2. (contd)

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Analytical Replicates										
RH-3[c]	1	1	0.102	0.0649 [h]	1.87	3.44	0.0224	1.35	1.67	26.3
RH-3	2	1	0.112	0.0859	1.83	3.78	0.0195	1.40	2.03	25.4
RH-3	3	1	0.133	0.0681 [h]	1.80	3.56	0.0206	1.31	1.78	25.2
RSD (%)			14	16	2	5	7	3	10	2
BR-A-6[c]	1	1	0.0824	0.0749	1.16	2.89	0.0108	1.17	1.15	11.1
BR-A-6	2	1	0.0821	0.0734	1.09	2.92	0.0113	1.78	1.17	13.5
BR-A-6	3	1	0.0785	0.0602	1.16	2.56	0.00944	1.04	1.02	11.5
RSD (%)			3	12	4	7	9	30 [i]	7	11
BR-B-15[c]	1	1	0.0816	0.0799	1.09	2.98	0.00927	1.24	1.14	12.2
BR-B-15	2	1	0.0820	0.0693	1.46	2.81	0.00915	1.18	0.995	10.0
BR-B-15	3	1	0.0801	0.0658	1.12	2.92	0.00874	1.20	1.03	11.3
RSD (%)			1	10	17	3	3	3	7	10
CL-A-7[c]	1	1	0.257	0.150	3.70	7.57	0.0781	2.11	5.70	35.6
CL-A-7	2	1	0.219	0.137	3.64	7.45	0.0758	2.08	5.97	35.3
CL-A-7	3	1	0.259	0.145	3.77	7.83	0.0788	2.17	5.60	27.5
RSD (%)			9	5	2	3	2	2	3	14
CL-B-12[c]	1	1	0.0475	0.0550	1.05	1.98	0.00823	0.806	0.802	10.0
CL-B-12	2	1	0.0528	0.0678	1.05	2.44	0.00897	1.04	0.978	10.8
CL-B-12	3	1	0.0530	0.0660	1.12	2.50	0.00816	1.06	1.01	9.83
RSD (%)			6	11	4	12	5	15	12	5

Table B.2. (contd)

Sediment Treatment	Replicate	Batch	Concentration (µg/L) - blank corrected							
			Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Analytical Replicates (contd)										
CL-C-24[c]	1	1	0.0627	0.0811	1.12	2.67	0.0107	1.18	1.19	13.7
CL-C-24	2	1	0.0652	0.0933	1.05	2.78	0.0107	1.18	1.25	12.8
CL-C-24	3	1	0.0677	0.0727	1.09	2.74	0.0108	1.27	1.31	13.9
RSD (%)			4	13	3	2	1	4	5	4
PJ-A-6[c]	1	1	0.0399	0.0656	1.12	2.05	0.00859	0.908	0.702	11.0
PJ-A-6	2	1	0.0452	0.0675 [h]	1.16	2.10	0.00658	0.938	0.737	10.8
PJ-A-6	3	1	0.0417	0.0646	1.05	1.89	0.00649	0.902	0.640	10.4
RSD (%)			6	2	5	5	16	2	7	3
PJ-B-22[c]	1	1	0.0807	0.0827	1.19	3.28	0.0110	1.20	1.52	15.1
PJ-B-22	2	1	0.0643	0.0677	1.12	2.78	0.0114	1.03	1.27	12.4
PJ-B-22	3	1	0.0690	0.0767	1.12	3.06	0.0105	1.22	1.50	13.4
RSD (%)			12	10	4	8	4	9	10	10
Sequim Bay Water	1	1	0.018 U	0.0668	0.34	0.527	0.00036	0.414	0.011 U	17.1
Sequim Bay Water	2	1	0.018 U	0.0717	0.37	0.632	0.00017	0.480	0.0157	14.3
Sequim Bay Water	3	1	0.018 U	0.0617 [h]	0.58	0.569	0.00005	0.505	0.0206	16.5
RSD (%)			NA	7	30 [i]	9	81 [i]	10	NA	9

(a) U Undetected at or above given concentration.
(b) NA Not applicable.
(c) Sample randomly selected for use as a quality control sample in analytical batch.
(d) NS Not spiked.
(e) Outside quality control criteria (75-125%) for spike recovery.
(f) MDS Mud Dump Site.
(g) Outside SRM quality control criteria (±20%).
(h) Value obtained from re-processing and re-analysis of different batch.
(i) Outside quality control criteria (≤ 20%) for replicate analysis.

Table B.3. Method Detection Limit Verification Study for Metals in Site Water

		Concentration (µg/L) - blank corrected							
	Replicate	Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Sequim Bay Water + Spike	1	0.978	0.952	0.410	1.55	0.00209	1.35	0.788	2.41
Sequim Bay Water + Spike	2	0.948	0.899	0.370	1.45	0.00203	1.28	0.759	1.86
Sequim Bay Water + Spike	3	0.932	0.922	0.440	1.46	0.00296	1.30	0.757	2.78
Sequim Bay Water + Spike	4	0.934	0.913	0.410	1.43	0.00312	1.36	0.773	2.23
Detection Limit[(a)]		0.096	0.102	0.130	0.241	0.00259	0.175	0.065	1.74

(a) Detection limit determined by multiplying the standard deviation of the four replicates by Students-t (4.54).

Table B.4. Metals in Elutriate Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Batch	Concentration (µg/L) - blank corrected							
			Ag APDC ICP-MS	Cd APDC ICP-MS	Cr GFAA	Cu APDC ICP-MS	Hg CVAF	Ni APDC ICP-MS	Pb APDC ICP-MS	Zn GFAA
Target Detection Limit:			0.10	0.025	1.0	0.30	0.002	0.30	0.30	0.15
Method Detection Limit:			0.018	0.003	0.07	0.021	0.0001	0.028	0.011	0.24
Red Hook										
COMP RH	1	1	0.0236	0.0158	0.880	0.862	0.0186	1.63	0.586	2.14
COMP RH	2	1	0.0245	0.0219	0.850	0.840	0.0175	1.84	0.685	2.46
COMP RH	3	1	0.0256 (a)	0.596 (a)	0.830	1.01 (a)	0.0160	2.22 (a)	1.20 (a)	2.46
Bay Ridge Reach A										
COMP BR-A	1	1	0.0442	0.0150	1.62	0.973	0.0112	1.49	0.236	2.30
COMP BR-A	2	1	0.0443	0.013	1.64	0.933	0.0101	1.32	0.246	2.06
COMP BR-A	3	1	0.0437	0.016	1.80	0.985	0.0108	1.49	0.253	2.38
Bay Ridge Reach B										
COMP BR-B	1	1	0.0348	0.028	1.91	1.25	0.0231	0.878	0.558	2.78
COMP BR-B	2	1	0.0391	0.02	1.75	1.36	0.0237	0.972	0.546	3.34
COMP BR-B	3	1	0.0377	0.018	1.78	1.17	0.0231	0.850	0.497	3.18

(a) Value obtained from re-processing and re-analysis of different sample.

Table B.5. Quality Control Data for Metals Analysis of Elutriate Samples

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Blank	1	1	0.018 U[a]	0.003 U	0.066	0.0151	0.000381	0.0330	0.011 U	0.556
Blank	2	1	0.018 U	0.003 U	NA [b]	0.0155	NA	0.0426	0.011 U	NA
Matrix Spike Results										
BR-B COMP[c]	MEAN[d]	1	NA	NA	1.81	NA	NA	NA	NA	3.10
BR-B COMP (MS)	1	1	NA	NA	3.97	NA	NA	NA	NA	13.5
Concentration Spiked			NS [e]	NS	2.39	NS	NS	NS	NS	8.91
Concentration Recovered			NA	NA	2.16	NA	NA	NA	NA	10.4
Percent Recovery			NA	NA	90	NA	NA	NA	NA	117
PJ-B COMP[c]	1	1	NA	NA	NA	NA	0.0179	NA	NA	NA
PJ-B COMP (MS)	1	1	NA	NA	NA	NA	0.0404	NA	NA	NA
Concentration Spiked			NS	NS	NS	NS	0.0210	NS	NS	NS
Concentration Recovered			NA	NA	NA	NA	0.0225	NA	NA	NA
Percent Recovery			NA	NA	NA	NA	107	NA	NA	NA
CL-B COMP[c]	MEAN	1	0.0326	0.0416	NA	1.50	NA	2.40	0.616	NA
CL-B COMP (MS)	1	1	0.938	0.561	NA	2.46	NA	3.67	1.28	NA
Concentration Spiked			1.00	1.00	NS	1.00	NS	1.00	1.00	NS
Concentration Recovered			0.905	0.519	NA	0.960	NA	1.28	0.664	NA
Percent Recovery			91	52 [f]	NA	96	NA	128 [f]	66 [f]	NA
PJ-A COMP[c]	MEAN	1	0.018 U	0.0258	NA	0.554	NA	1.33	0.462	NA
PJ-A COMP (MS)	1	1	0.769	0.599	NA	1.52	NA	2.21	1.04	NA
Concentration Spiked			1.00	1.00	NS	1.00	NS	1.00	1.00	NS
Concentration Recovered			0.751	0.573	NA	0.971	NA	0.883	0.578	NA
Percent Recovery			75	57 [f]	NA	97	NA	88	58 [f]	NA

Table B.5. (contd)

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Matrix Spike Results (contd)										
RH COMP[c]	1	1	NA	NA	NA	NA	0.0186	NA	NA	NA
RH COMP (MS)	1	1	NA	NA	NA	NA	0.0351	NA	NA	NA
Concentration Spiked			NS	NS	NS	NS	0.0203	NS	NS	NS
Concentration Recovered			NA	NA	NA	NA	0.0165	NA	NA	NA
Percent Recovery			NA	NA	NA	NA	81%	NA	NA	NA
CL-C COMP[c]	1	2	NA	0.0447	NA	NA	NA	NA	NA	NA
CL-C COMP (MS)			NA	0.682	NA	NA	NA	NA	NA	NA
Concentration Spiked			NS	1.00	NS	NS	NS	NS	NS	NS
Concentration Recovered			NA	0.637	NA	NA	NA	NA	NA	NA
Percent Recovery			NA	64 [f]	NA	NA	NA	NA	NA	NA
Standard Reference Material										
1641b	1	1	NA	NA	NA	NA	1580	NA	NA	NA
1641b	2	1	NA	NA	NA	NA	1790	NA	NA	NA
Certified Value			NC [g]	NC	NC	NC	1520	NC	NC	NC
Range			NC	NC	NC	NC	±40	NC	NC	NC
Percent Difference	1	1	NA	NA	NA	NA	4	NA	NA	NA
Percent Difference	2	1	NA	NA	NA	NA	18	NA	NA	NA
1643c	1	1	1.92	7.02	21.8	22.3	NA	49.9	20.5	84.1
1643c	2	1	1.82	8.54	NA	23.1	NA	53.7	23.2	NA
1643c	3	1	1.91	8.49	NA	23.9	NA	54.6	23.7	NA
Certified Value			2.21	12.2	19.0	22.3	NC	60.6	35.3	73.9
Range			±0.30	±1.0	±0.6	±2.8	NC	±7.3	±0.9	±0.9
Percent Difference	1	1	13	42 [h]	15	0	NA	18	42 [h]	14
Percent Difference	2	1	18	30 [h]	NA	4	NA	11	34 [h]	NA
Percent Difference	3	1	14	30 [h]	NA	7	NA	10	33 [h]	NA

Table B.5. (contd)

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Standard Reference Material										
SLRS-3	1	1	0.0113	0.007	0.35	1.19	NA	0.605	0.048	1.24
SLRS-3	2	1	0.0114	0.0112	NA	1.34	NA	0.706	0.053	NA
Certified Value			NC	0.013	0.30	1.35	NC	0.83	0.068	1.04
Range			NC	±0.002	±0.04	±0.07	NC	±0.08	±0.007	±0.09
Percent Difference	1	1	NA	46 (h)	17	12	NA	27 (h)	29 (h)	19
Percent Difference	2	1	NA	14	NA	0	NA	15	23 (h)	NA
Analytical Replicates										
BR-B COMP(c)	1	1	0.0348	0.0281	1.91	1.25	0.0231	0.878	0.558	2.78
BR-B COMP	2	1	0.0391	0.0197	1.75	1.36	0.0237	0.972	0.546	3.34
BR-B COMP	3	1	0.0377	0.0184	1.78	1.17	0.0231	0.850	0.497	3.18
RSD (%)			6	24 (i)	5	8	1	7	6	9
BR-A COMP(c)	1	1	0.0442	0.0150	1.62	0.973	0.0112	1.49	0.236	2.30
BR-A COMP	2	1	0.0443	0.0129	1.64	0.933	0.0101	1.32	0.246	2.06
BR-A COMP	3	1	0.0437	0.0163	1.80	0.985	0.0108	1.49	0.253	2.38
RSD (%)			1	12	6	3	5	7	3	7
PJ-B COMP(c)	1	1	0.0329	0.0225	1.78	1.33	0.0179	1.50	0.423	2.78
PJ-B COMP	2	1	0.0300	0.0232	1.73	1.19	0.0167	1.38	0.501	2.94
PJ-B COMP	3	1	0.0276	0.0242	1.82	1.21	0.0164	1.46	0.476	4
RSD (%)			9	4	3	6	5	4	9	20
CL-B COMP(c)	1	1	0.0304	0.0434	1.69	1.59	0.0148	2.46	0.641	5.48
CL-B COMP	2	1	0.0321	0.0422	1.56	1.52	0.0146	2.33	0.599	5.08
CL-B COMP	3	1	0.0352	0.0391	1.60	1.39	0.0153	2.39	0.607	5.64
RSD (%)			7	5	4	7	2	3	4	5

Table B.5. (contd)

Sediment Treatment	Replicate	Batch	Concentration (µg/L) Ag ICP/MS	Cd ICP/MS	Cr GFAA	Cu ICP/MS	Hg CVAF	Ni ICP/MS	Pb ICP/MS	Zn GFAA
Analytical Replicates (contd)										
CL-A COMP[c]	1	1	0.0376	0.0250	1.69	1.30	0.0180	0.787	0.630	2.38
CL-A COMP	2	1	0.0332	0.0189	1.51	1.05	0.0167	0.655	0.614	2.38
CL-A COMP	3	1	0.0363	0.0229	1.60	1.28	0.0161	0.854	0.709	2.22
RSD (%)			6	14	6	11	6	13	8	4
PJ-A COMP[c]	1	1	0.018 U	0.0272	0.850	0.423	0.00806	1.01	0.459	1.75
PJ-A COMP	2	1	0.018 U	0.0279	0.770	0.650	0.00787	1.52	0.471	1.51
PJ-A COMP	3	1	0.018 U	0.0223	0.770	0.589	0.00701	1.45	0.455	1.67
RSD (%)			NA	12	6	21 (i)	7	21 (i)	2	7
RH COMP[c]	1	1	0.0236	0.0158	0.880	0.862	0.0186	1.63	0.586	2.14
RH COMP	2	1	0.0245	0.0219	0.850	0.840	0.0175	1.84	0.685	2.46
RH COMP	3	1	0.0256 (j)	0.596 (i)	0.830	1.01 (j)	0.0160	2.22 (j)	1.20 (j)	2.46
RSD (%)			4	158 (i)	3	10	8	16	40 (i)	8
CL-C COMP[c]	1	1	0.0276	0.0447 (j)	1.03	0.978	0.00876	0.887	0.357	3.02
CL-C COMP	2	1	0.0253	0.0335	1.05	1.00	0.00870	0.982	0.336	3.89
CL-C COMP	3	1	0.0282	0.0452 (j)	1.07	1.11	0.00992	0.861	0.314	3.41
RSD (%)			6	16	2	7	8	7	6	13

(a) U Undetected at or above given concentration.
(b) NA Not applicable.
(c) Sample randomly selected for use as quality control sample in analytical batch.
(d) Mean of three replicates used for matrix spike analysis.
(e) NS Not spiked.
(f) Outside quality control criteria (75-125%) for spike recovery.
(g) NC Not certified.
(h) Outside SRM quality control criteria (≤20%).
(i) Outside quality control criteria (≤20%) for replicate analysis.
(j) Value obtained from re-processing and re-analysis of sample.

Table B.6. Pesticides and Polychlorinated Biphenyls (PCBs) in Site Water Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (ng/L)					
	RH-3	RH-3	RH-3	BR-A-6	BR-A-6	BR-A-6
Replicate	1	2	3	1	2	3
Heptachlor[a]	0.47 U[b]	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
Aldrin	0.39 U	1.48	0.79	0.94	0.91	1.14
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
2,4'-DDE	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
Endosulfan I	0.46 U	0.46 U	1.61	0.46 U	0.46 U	0.46 U
α-Chlordane	1.16	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U
Trans Nonachlor	1.11 U	1.11 U	1.11 U	1.11 U	1.11 U	1.11 U
4,4'-DDE	4.42	5.73	2.96	0.28 U	0.28 U	0.28 U
Dieldrin	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
2,4'-DDD	0.94 U	0.94 U	0.94 U	0.94 U	0.94 U	0.94 U
2,4'-DDT	0.44 U	0.44 U	2.20	0.44 U	0.44 U	0.44 U
4,4'-DDD	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
Endosulfan II	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
4,4'-DDT	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
PCB 8	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
PCB 18	1.05 U	1.05 U	1.05 U	1.05 U	1.05 U	1.05 U
PCB 28	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U
PCB 52	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
PCB 49	0.53 U	0.53 U	0.82	0.53 U	0.53 U	0.53 U
PCB 44	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
PCB 66	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
PCB 101	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
PCB 87	0.35 U	0.35 U	0.35 U	0.38	0.35 U	0.35 U
PCB 118	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
PCB 184	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
PCB 153	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 105	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
PCB 138	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
PCB 187	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 183	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
PCB 128	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
PCB 180	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
PCB 170	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PCB 195	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
PCB 206	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 209	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Surrogate Recoveries (%)						
PCB 103 (SIS)	66	73	68	65	58	64
PCB 198 (SIS)	85	87	91	81	73	75

Table B.6. (contd)

Sediment Treatment	Concentration (ng/L)					
Replicate	BR-B-15 1	BR-B-15 2	BR-B-15 3	MDS[c] 1	MDS 2	MDS 3
Heptachlor	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
Aldrin	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
2,4'-DDE	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
Endosulfan I	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
α-Chlordane	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U
Trans Nonachlor	1.11 U	1.11 U	1.11 U	1.11 U	1.11 U	1.11 U
4,4'-DDE	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Dieldrin	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
2,4'-DDD	0.94 U	0.94 U	0.94 U	0.94 U	0.94 U	0.94 U
2,4'-DDT	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U
4,4'-DDD	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
Endosulfan II	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
4,4'-DDT	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
PCB 8	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
PCB 18	1.05 U	1.05 U	1.05 U	1.05 U	1.05 U	1.05 U
PCB 28	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U
PCB 52	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
PCB 49	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
PCB 44	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
PCB 66	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
PCB 101	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
PCB 87	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
PCB 118	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
PCB 184	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
PCB 153	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 105	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
PCB 138	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
PCB 187	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 183	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
PCB 128	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
PCB 180	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
PCB 170	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PCB 195	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
PCB 206	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 209	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Surrogate Recoveries (%)						
PCB 103 (SIS)	69	66	61	69	69	71
PCB 198 (SIS)	78	76	91	72	74	73

Table B.6. (contd)

Sediment Treatment Replicate	Concentration (ng/L) Sequim Bay Water 1	Sequim Bay Water 2	Sequim Bay Water 3
Heptachlor	0.47 U	0.47 U	0.47 U
Aldrin	0.39 U	0.39 U	0.39 U
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U
2,4'-DDE	0.23 U	0.23 U	0.23 U
Endosulfan I	0.46 U	0.46 U	0.46 U
α-Chlordane	0.83 U	0.83 U	0.83 U
Trans Nonachlor	1.11 U	1.11 U	1.11 U
4,4'-DDE	0.28 U	0.28 U	0.28 U
Dieldrin	0.12 U	0.12 U	0.12 U
2,4'-DDD	0.94 U	0.94 U	0.94 U
2,4'-DDT	0.44 U	0.44 U	0.44 U
4,4'-DDD	0.45 U	0.45 U	0.45 U
Endosulfan II	0.46 U	0.46 U	0.46 U
4,4'-DDT	0.40 U	0.40 U	0.40 U
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U
PCB 8	1.00 U	1.00 U	1.00 U
PCB 18	1.05 U	1.05 U	1.05 U
PCB 28	0.71 U	0.71 U	0.71 U
PCB 52	0.35 U	0.35 U	0.35 U
PCB 49	0.53 U	0.53 U	0.53 U
PCB 44	0.31 U	0.31 U	0.31 U
PCB 66	0.38 U	0.38 U	0.38 U
PCB 101	0.48 U	0.48 U	0.48 U
PCB 87	0.35 U	0.35 U	0.35 U
PCB 118	0.47 U	0.47 U	0.47 U
PCB 184	0.53 U	0.53 U	0.53 U
PCB 153	0.39 U	0.39 U	0.39 U
PCB 105	0.30 U	0.30 U	0.30 U
PCB 138	0.34 U	0.34 U	0.34 U
PCB 187	0.39 U	0.39 U	0.39 U
PCB 183	0.53 U	0.53 U	0.53 U
PCB 128	0.24 U	0.24 U	0.24 U
PCB 180	0.27 U	0.27 U	0.27 U
PCB 170	0.20 U	0.20 U	0.20 U
PCB 195	0.27 U	0.27 U	0.27 U
PCB 206	0.39 U	0.39 U	0.39 U
PCB 209	0.27 U	0.27 U	0.27 U
Surrogate Recoveries (%)	78	78	78
PCB 103 (SIS)	81	81	81
PCB 198 (SIS)			

(a) Target detection limits range from 0.5 ng/L - 100 ng/L for all analytes.
(b) U Undetected at or above given concentration.
(c) MDS Mud Dump Site.

Table B.7. Quality Control Data for Pesticide and Polychlorinated Biphenyl (PCB) Analysis of Site Water Samples, Blank and Spike Recovery Results

ediment Treatment Replicate	Concentration (ng/L) Method Blank 1	Method Blank 2	Concentration (ng/L) Sequim Bay Water Mean[a]	Sequim Bay Water (MS) 1	Concentration Spiked	Concentration Recovered	Percent Recovery
Heptachlor	0.50 U[b]	0.50 U	0.47 U	43.0	47.0	43.0	92
Aldrin	0.41 U	0.41 U	0.39 U	38.1	47.0	38.1	81
Heptachlor Epoxide	0.12 U	0.12 U	0.11 U	44.3	47.0	44.3	94
2,4'-DDE	0.24 U	0.24 U	0.23 U	47.6	47.0	47.6	101
Endosulfan I	0.49 U	0.49 U	0.46 U	NS[c]	NS	NS	NA[d]
α-Chlordane	0.88 U	0.88 U	0.83 U	41.1	47.0	41.1	87
Trans Nonachlor	1.18 U	1.18 U	1.11 U	39.4	47.0	39.4	84
4,4'-DDE	0.29 U	0.29 U	0.28 U	40.6	47.0	40.6	86
Dieldrin	0.13 U	0.13 U	0.12 U	40.5	47.0	40.5	86
2,4'-DDD	1.00 U	1.00 U	0.94 U	45.2	47.0	45.2	96
2,4'-DDT	0.46 U	0.46 U	0.44 U	46.6	47.0	46.6	99
4,4'-DDD	0.48 U	0.48 U	0.45 U	41.2	47.0	41.2	88
Endosulfan II	0.49 U	0.49 U	0.46 U	NS	NS	NS	NA
4,4'-DDT	0.43 U	0.43 U	0.40 U	41.4	47.0	41.4	88
Endosulfan Sulfate	0.49 U	0.49 U	0.46 U	NS	NS	NS	NA
PCB 8	1.06 U	1.06 U	1.00 U	NS	NS	NS	NA
PCB 18	1.12 U	1.12 U	1.05 U	NS	NS	NS	NA
PCB 28	0.75 U	0.75 U	0.71 U	16.6	15.0	16.6	111
PCB 52	0.38 U	0.38 U	0.35 U	30.9	31.3	30.9	99
PCB 49	0.57 U	0.57 U	0.53 U	NS	NS	NS	NA
PCB 44	0.33 U	0.33 U	0.31 U	NS	NS	NS	NA
PCB 66	0.41 U	0.41 U	0.38 U	NS	NS	NS	NA
PCB 101	0.52 U	0.52 U	0.48 U	22.4	21.2	22.4	105
PCB 87	0.38 U	0.38 U	0.35 U	NS	NS	NS	NA
PCB 118	0.50 U	0.50 U	0.47 U	NS	NS	NS	NA
PCB 184	0.57 U	0.57 U	0.53 U	NS	NS	NS	NA
PCB 153	0.42 U	0.42 U	0.39 U	12.6	12.4	12.6	101
PCB 105	0.32 U	0.32 U	0.30 U	NS	NS	NS	NA
PCB 138	0.36 U	0.36 U	0.34 U	9.56	9.57	9.6	100
PCB 187	0.41 U	0.41 U	0.39 U	NS	NS	NS	NA
PCB 183	0.57 U	0.57 U	0.53 U	NS	NS	NS	NA
PCB 128	0.26 U	0.26 U	0.24 U	NS	NS	NS	NA
PCB 180	0.29 U	0.29 U	0.27 U	NS	NS	NS	NA
PCB 170	0.21 U	0.21 U	0.20 U	NS	NS	NS	NA
PCB 195	0.29 U	0.29 U	0.27 U	NS	NS	NS	NA
PCB 206	0.42 U	0.42 U	0.39 U	NS	NS	NS	NA
PCB 209	0.29 U	0.29 U	0.27 U	NS	NS	NS	NA
Surrogate Recoveries (%)							
PCB 103 (SIS)	60	60	NA	61	NA	NA	NA
PCB 198 (SIS)	70	70	NA	93	NA	NA	NA

(a) Mean of three replicates used for matrix spike analysis.
(b) U Undetected at or above given concentration.
(c) NS Not spiked.
(d) NA Not applicable.

Table B.8 Quality Control Data for Pesticide and Polychlorinated Biphenyl (PCB) Analysis of Site Water Samples, Analytical Replicates

Sediment Treatment	Concentration (ng/L)			
Replicate	RH-3[a] 1	RH-3 2	RH-3 3	RSD (%)
Heptachlor	0.47 U[b]	0.47 U	0.47 U	NA [c]
Aldrin	0.39 U	1.48	0.79	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	1.61	NA
α-Chlordane	1.16	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	4.42	5.73	2.96	32 [d]
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	2.20	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.35 U	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.82	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.35 U	0.35 U	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	66	73	68	NA
PCB 198 (SIS)	85	87	91	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L)			
Replicate	BR-A-6[a] 1	BR-A-6 2	BR-A-6 3	RSD (%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	0.94	0.91	1.14	13
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.35 U	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.53 U	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.38	0.35 U	0.35 U	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	65	58	64	NA
PCB 198 (SIS)	81	73	75	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L)			RSD
Replicate	BR-B-15[a] 1	BR-B-15 2	BR-B-15 3	(%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	0.39 U	0.39 U	0.39 U	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.35 U	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.53 U	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.35 U	0.35 U	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	69	66	61	NA
PCB 198 (SIS)	78	76	91	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L) CL-A-7[a]	CL-A-7	RPD
Replicate	1	2	(%)
Heptachlor	0.47 U	0.47 U	NA
Aldrin	0.39 U	0.39 U	NA
Heptachlor Epoxide	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	NA
4,4'-DDE	2.51	3.19	24
Dieldrin	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.35 U	NA
PCB 49	1.23	0.53 U	NA
PCB 44	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	NA
PCB 87	0.36	0.35 U	NA
PCB 118	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	NA
PCB 138	0.38	0.34 U	NA
PCB 187	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	NA
PCB 180	0.32	0.27 U	NA
PCB 170	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	NA
Surrogate Recoveries (%)			
PCB 103 (SIS)	60	62	NA
PCB 198 (SIS)	100	101	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L)			
Replicate	CL-B-12[a] 1	CL-B-12 2	CL-B-12 3	RSD (%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	0.39 U	1.33	1.51	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.99	0.66	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.73	0.67	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.53 U	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.35 U	0.35 U	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	68	73	69	NA
PCB 198 (SIS)	77	78	75	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L)			RSD
Replicate	CL-C-24[a] 1	CL-C-24 2	CL-C-24 3	(%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	1.38	0.39 U	0.39 U	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.94	1.12	0.88	13
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.85	0.66	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.88	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.39	0.38	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	69	64	64	NA
PCB 198 (SIS)	73	74	72	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L)			RSD
Replicate	PJ-A-6[a] 1	PJ-A-6 2	PJ-A-6 3	(%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	0.39 U	0.39 U	0.84	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.43	0.56	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.53 U	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.35 U	0.38	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	74	71	66	NA
PCB 198 (SIS)	80	75	70	NA

Table B.8. (contd)

Sediment Treatment	Concentration (ng/L)			
Replicate	PJ-B-22[a] 1	PJ-B-22 2	PJ-B-22 3	RSD (%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	1.15	0.39 U	2.54	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.35 U	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.81	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.74	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.61	0.46	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	67	66	70	NA
PCB 198 (SIS)	75	76	77	NA

Table B.8. (contd)

Sediment Treatment Replicate	Concentration (ng/L) MDS[e] 1	MDS 2	MDS 3	RSD (%)
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	0.39 U	0.39 U	0.39 U	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA
Dieldrin	0.12 U	0.12 U	0.12 U	NA
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.00 U	1.00 U	1.00 U	NA
PCB 18	1.05 U	1.05 U	1.05 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.35 U	0.35 U	NA
PCB 49	0.53 U	0.53 U	0.53 U	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA
PCB 101	0.48 U	0.48 U	0.48 U	NA
PCB 87	0.35 U	0.35 U	0.35 U	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA
PCB 187	0.39 U	0.39 U	0.39 U	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	0.27 U	0.27 U	0.27 U	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	69	69	71	NA
PCB 198 (SIS)	72	74	73	NA

(a) Sample randomly selected for use as quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NA Not applicable.
(d) Outside QC criteria (≤30%) for replicate analysis.
(e) MDS Mud Dump Site.

Table B.9. Pesticides and Polychlorinated Biphenyls (PCBs) in Elutriate Samples, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (ng/L)				
Replicate	RH COMP 1	RH COMP 2	RH COMP 3	BR-A COMP 1	BR-A COMP 2
Heptachlor[a]	0.49 U[b]	0.47 U	0.47 U	0.56	0.47 U
Aldrin	3.27	2.78	5.50	0.39 U	0.39 U
Heptachlor Epoxide	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U
2,4'-DDE	0.24 U	0.23 U	0.23 U	0.23 U	0.23 U
Endosulfan I	0.49 U	0.46 U	0.47 U	0.46 U	0.47 U
α-Chlordane	0.87 U	0.83 U	0.83 U	0.83 U	0.83 U
Trans Nonachlor	1.17 U	1.11 U	1.12 U	1.11 U	1.12 U
4,4'-DDE	6.65	7.14	8.19	6.55	6.64
Dieldrin	2.36	4.87	5.10	0.12 U	0.13 U
2,4'-DDD	0.99 U	0.94 U	0.95 U	0.94 U	0.95 U
2,4'-DDT	0.46 U	0.44 U	0.44 U	0.44 U	0.44 U
4,4'-DDD	0.47 U	0.45 U	0.45 U	0.45 U	0.45 U
Endosulfan II	0.49 U	0.88	0.47 U	0.46 U	0.47 U
4,4'-DDT	7.95	7.72	8.21	8.35	7.74
Endosulfan Sulfate	0.49 U	0.46 U	0.47 U	0.46 U	0.47 U
PCB 8	1.05 U	1.00 U	1.01 U	1.00 U	1.01 U
PCB 18	8.53	8.56	11.8	1.05 U	1.06 U
PCB 28	5.10	4.99	8.85	0.71 U	0.71 U
PCB 52	3.65	0.35 U	0.36 U	0.35 U	0.36 U
PCB 49	2.37	2.30	6.74	1.30	1.49
PCB 44	0.32 U	0.31 U	0.31 U	0.31 U	0.31 U
PCB 66	0.40 U	0.38 U	0.39 U	0.38 U	0.39 U
PCB 101	1.54	1.82	0.49 U	1.23	1.40
PCB 87	0.37 U	0.35 U	1.63	0.35 U	0.36 U
PCB 118	1.44	1.52	4.73	1.00	1.16
PCB 184	0.56 U	0.53 U	0.54 U	0.53 U	0.54 U
PCB 153	1.16	1.33	0.40 U	1.15	1.34
PCB 105	0.31 U	0.30 U	0.30 U	0.30 U	0.30 U
PCB 138	1.23	1.42	1.78	1.30	1.47
PCB 187	0.41 U	0.39 U	0.39 U	0.39 U	0.61
PCB 183	0.56 U	0.53 U	0.54 U	0.53 U	0.54 U
PCB 128	0.25 U	0.24 U	0.24 U	0.24 U	0.24 U
PCB 180	0.92	1.04	1.23	1.00	1.14
PCB 170	0.21 U	0.20 U	0.20 U	0.20 U	0.20 U
PCB 195	0.29 U	0.27 U	0.28 U	0.27 U	0.28 U
PCB 206	0.40	0.39 U	0.39 U	0.39 U	0.39 U
PCB 209	0.29 U	0.27 U	0.28 U	0.27 U	0.28 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	67	68	69	68	70
PCB 198 (SIS)	61	61	61	60	63

Table B.9. (contd)

Sediment Treatment	Concentration (ng/L)			
	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	3	1	2	3
Heptachlor	0.47 U	0.48 U	0.46 U	0.48 U
Aldrin	0.39 U	7.49	8.27	8.25
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	0.11 U
2,4'-DDE	0.23 U	0.24 U	0.23 U	0.24 U
Endosulfan I	0.47 U	0.47 U	0.46 U	0.47 U
α-Chlordane	0.83 U	0.84 U	0.82 U	0.84 U
Trans Nonachlor	1.12 U	1.13 U	1.10 U	1.13 U
4,4'-DDE	7.28	26.8	31.6	29.8
Dieldrin	0.13 U	6.50	6.84	6.39
2,4'-DDD	0.95 U	6.25	7.84	5.92
2,4'-DDT	0.44 U	0.44 U	0.43 U	0.44 U
4,4'-DDD	0.45 U	13.1	14.0	13.9
Endosulfan II	0.47 U	0.47 U	0.46 U	1.12
4,4'-DDT	7.84	14.0	16.8	15.9
Endosulfan Sulfate	0.47 U	0.47 U	0.46 U	0.47 U
PCB 8	1.01 U	1.02 U	0.98 U	1.02 U
PCB 18	1.06 U	47.0	56.3	54.0
PCB 28	0.71 U	15.0	20.4	19.3
PCB 52	0.36 U	21.5	27.8	26.6
PCB 49	0.54 U	12.2	15.7	14.7
PCB 44	0.31 U	27.6	35.6	31.8
PCB 66	0.39 U	24.1	30.3	29.3
PCB 101	1.47	18.9	23.9	22.3
PCB 87	0.46	4.22	5.76	4.84
PCB 118	1.12	13.1	17.7	17.1
PCB 184	0.54 U	0.55 U	0.53 U	0.55 U
PCB 153	1.43	15.9	21.3	20.5
PCB 105	0.30 U	0.30 U	0.29 U	0.30 U
PCB 138	1.53	12.3	16.0	15.4
PCB 187	0.64	4.13	6.76	6.16
PCB 183	0.54 U	1.98	2.91	2.47
PCB 128	0.24 U	1.48	1.78	1.71
PCB 180	1.43	8.34	11.2	10.8
PCB 170	0.20 U	2.64	3.73	3.52
PCB 195	0.28 U	0.66	0.82	0.76
PCB 206	0.39 U	2.29	3.53	3.57
PCB 209	0.28 U	1.99	2.81	2.68
Surrogate Recoveries (%)				
PCB 103 (SIS)	74	72	65	68
PCB 198 (SIS)	68	70	66	68

(a) Target detection limits range from 0.5 ng/L to 100 ng/L for all analytes.
(b) U Undetected at or above given concentration.

Table B.10. Quality Control Data for Pesticide and Polychlorinated Biphenyl (PCB) Analysis of Elutriate Samples, Spike Recovery Results

Sediment Treatment	Concentration (ng/L)					
	Method Blank	Sequim Bay Water	Sequim Bay Water (MS)	Concentration Spiked	Concentration Recovered	Percent Recovery
Replicate	1	1	1			
Heptachlor	0.50 U[a]	0.50 U	17.7	25.0	17.7	71
Aldrin	0.41 U	0.41 U	17.3	25.0	17.3	69
Heptachlor Epoxide	0.12 U	0.12 U	23.2	25.0	23.2	93
2,4'-DDE	0.24 U	0.24 U	NS [b]	NS	NS	NA [c]
Endosulfan I	0.49 U	0.49 U	23.0	25.0	23.0	92
α-Chlordane	0.88 U	0.88 U	21.1	25.0	21.1	84
Trans Nonachlor	1.18 U	1.18 U	NS	NS	NS	NA
4,4'-DDE	0.29 U	0.29 U	24.8	25.0	24.8	99
Dieldrin	0.13 U	0.13 U	25.6	25.0	25.6	102
2,4'-DDD	1.00 U	1.00 U	NS	NS	NS	NA
2,4'-DDT	0.46 U	0.46 U	NS	NS	NS	NA
4,4'-DDD	0.48 U	0.48 U	28.6	25.0	28.6	114
Endosulfan II	0.49 U	0.49 U	29.0	25.0	29.0	116
4,4'-DDT	0.43 U	0.43 U	29.2	25.0	29.2	117 [d]
Endosulfan Sulfate	0.49 U	0.49 U	22.2	25.0	22.2	89
PCB 8	1.06 U	1.06 U	NS	NS	NS	NA
PCB 18	1.12 U	1.12 U	NS	NS	NS	NA
PCB 28	0.75 U	0.75 U	31.5	31.9	31.5	99
PCB 52	0.38 U	0.38 U	70.6	66.5	70.6	106
PCB 49	0.57 U	0.57 U	NS	NS	NS	NA
PCB 44	0.33 U	0.33 U	NS	NS	NS	NA
PCB 66	0.41 U	0.41 U	NS	NS	NS	NA
PCB 101	0.52 U	0.52 U	58.3	45.1	58.3	129
PCB 87	0.38 U	0.38 U	NS	NS	NS	NA
PCB 118	0.50 U	0.50 U	NS	NS	NS	NA
PCB 184	0.57 U	0.57 U	NS	NS	NS	NA
PCB 153	0.42 U	0.42 U	29.6	26.4	29.6	112
PCB 105	0.32 U	0.32 U	NS	NS	NS	NA
PCB 138	0.36 U	0.36 U	21.8	20.4	21.8	107
PCB 187	0.41 U	0.41 U	NS	NS	NS	NA
PCB 183	0.57 U	0.57 U	NS	NS	NS	NA
PCB 128	0.26 U	0.26 U	NS	NS	NS	NA
PCB 180	0.29 U	0.29 U	NS	NS	NS	NA
PCB 170	0.21 U	0.21 U	NS	NS	NS	NA
PCB 195	0.29 U	0.29 U	NS	NS	NS	NA
PCB 206	0.42 U	0.42 U	NS	NS	NS	NA
PCB 209	0.29 U	0.29 U	NS	NS	NS	NA
Surrogate Recoveries (%)						
PCB 103 (SIS)	44	61	57	NA	NA	NA
PCB 198 (SIS)	65	64	61	NA	NA	NA

(a) Undetected at or above given concentration.
(b) NS Not spiked.
(c) NA Not applicable.
(d) Outside quality control criteria (50-120%) for spike recovery.

Table B.11. Quality Control Data for Pesticide and Polychlorinated Biphenyl (PCB) Analysis of Elutriate Samples, Analytical Replicates

Sediment Treatment	Concentration (ng/L)			
Replicate	BR-B COMP[a] 1	BR-B COMP 2	BR-B COMP 3	RSD (%)
Heptachlor	0.48 U[b]	0.46 U	0.48 U	NA [c]
Aldrin	7.49	8.27	8.25	6
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.24 U	0.23 U	0.24 U	NA
Endosulfan I	0.47 U	0.46 U	0.47 U	NA
α-Chlordane	0.84 U	0.82 U	0.84 U	NA
Trans Nonachlor	1.13 U	1.10 U	1.13 U	NA
4,4'-DDE	26.8	31.6	29.8	8
Dieldrin	6.50	6.84	6.39	4
2,4'-DDD	6.25	7.84	5.92	15
2,4'-DDT	0.44 U	0.43 U	0.44 U	NA
4,4'-DDD	13.1	14.0	13.9	4
Endosulfan II	0.47 U	0.46 U	1.12	NA
4,4'-DDT	14.0	16.8	15.9	9
Endosulfan Sulfate	0.47 U	0.46 U	0.47 U	NA
PCB 8	1.02 U	0.98 U	1.02 U	NA
PCB 18	47.0	56.3	54.0	9
PCB 28	15.0	20.4	19.3	16
PCB 52	21.5	27.8	26.6	13
PCB 49	12.2	15.7	14.7	13
PCB 44	27.6	35.6	31.8	13
PCB 66	24.1	30.3	29.3	12
PCB 101	18.9	23.9	22.3	12
PCB 87	4.22	5.76	4.84	16
PCB 118	13.1	17.7	17.1	16
PCB 184	0.55 U	0.53 U	0.55 U	NA
PCB 153	15.9	21.3	20.5	15
PCB 105	0.30 U	0.29 U	0.30 U	NA
PCB 138	12.3	16.0	15.4	14
PCB 187	4.13	6.76	6.16	24
PCB 183	1.98	2.91	2.47	19
PCB 128	1.48	1.78	1.71	9
PCB 180	8.34	11.2	10.8	15
PCB 170	2.64	3.73	3.52	18
PCB 195	0.66	0.82	0.76	11
PCB 206	2.29	3.53	3.57	23
PCB 209	1.99	2.81	2.68	18
Surrogate Recoveries (%)				
PCB 103 (SIS)	72	65	68	NA
PCB 198 (SIS)	70	66	68	NA

Table B.11. (contd)

Sediment Treatment	Concentration (ng/L)			
Replicate	BR-A COMP[a] 1	BR-A COMP 2	BR-A COMP 3	RSD (%)
Heptachlor	0.56	0.47 U	0.47 U	NA
Aldrin	0.39 U	0.39 U	0.39 U	NA
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.47 U	0.47 U	NA
α-Chlordane	0.83 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.11 U	1.12 U	1.12 U	NA
4,4'-DDE	6.55	6.64	7.28	6
Dieldrin	0.12 U	0.13 U	0.13 U	NA
2,4'-DDD	0.94 U	0.95 U	0.95 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA
Endosulfan II	0.46 U	0.47 U	0.47 U	NA
4,4'-DDT	8.35	7.74	7.84	4
Endosulfan Sulfate	0.46 U	0.47 U	0.47 U	NA
PCB 8	1.00 U	1.01 U	1.01 U	NA
PCB 18	1.05 U	1.06 U	1.06 U	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA
PCB 52	0.35 U	0.36 U	0.36 U	NA
PCB 49	1.30	1.49	0.54 U	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.38 U	0.39 U	0.39 U	NA
PCB 101	1.23	1.40	1.47	9
PCB 87	0.35 U	0.36 U	0.46	NA
PCB 118	1.00	1.16	1.12	8
PCB 184	0.53 U	0.54 U	0.54 U	NA
PCB 153	1.15	1.34	1.43	11
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	1.30	1.47	1.53	8
PCB 187	0.39 U	0.61	0.64	NA
PCB 183	0.53 U	0.54 U	0.54 U	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA
PCB 180	1.00	1.14	1.43	18
PCB 170	0.20 U	0.20 U	0.20 U	NA
PCB 195	0.27 U	0.28 U	0.28 U	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA
PCB 209	0.27 U	0.28 U	0.28 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	68	70	74	NA
PCB 198 (SIS)	60	63	68	NA

Table B.11. (contd)

Sediment Treatment	Concentration (ng/L)			
Replicate	PJ-B COMP[a] 1	PJ-B COMP 2	PJ-B COMP 3	RSD (%)
Heptachlor	2.26	2.31	0.47 U	NA
Aldrin	6.25	6.21	6.33	1
Heptachlor Epoxide	0.12 U	0.11 U	0.11 U	NA
2,4'-DDE	0.24 U	0.23 U	0.23 U	NA
Endosulfan I	0.48 U	0.46 U	0.46 U	NA
α-Chlordane	0.86 U	0.82 U	0.83 U	NA
Trans Nonachlor	1.16 U	1.10 U	1.11 U	NA
4,4'-DDE	21.6	21.2	23.4	5
Dieldrin	5.69	5.66	7.45	16
2,4'-DDD	0.98 U	0.93 U	6.50	NA
2,4'-DDT	0.45 U	0.43 U	0.44 U	NA
4,4'-DDD	7.84	10.0	11.2	18
Endosulfan II	0.48 U	1.31	1.13	NA
4,4'-DDT	9.61	12.6	12.8	15
Endosulfan Sulfate	0.48 U	0.46 U	0.46 U	NA
PCB 8	1.04 U	0.98 U	1.00 U	NA
PCB 18	31.6	28.5	30.3	5
PCB 28	16.1	15.5	16.7	4
PCB 52	14.6	13.2	14.2	5
PCB 49	8.72	7.55	7.87	8
PCB 44	0.32 U	0.30 U	0.31 U	NA
PCB 66	0.40 U	16.9	17.7	NA
PCB 101	11.0	11.8	12.4	6
PCB 87	2.34	2.39	2.45	2
PCB 118	7.53	8.69	8.45	7
PCB 184	0.56 U	0.53 U	0.53 U	NA
PCB 153	7.85	9.48	9.05	10
PCB 105	0.31 U	0.29 U	0.30 U	NA
PCB 138	6.85	8.04	7.72	8
PCB 187	1.95	2.20	2.14	6
PCB 183	1.33	1.63	1.55	10
PCB 128	1.27	1.40	1.15	10
PCB 180	4.85	6.08	6.28	13
PCB 170	1.96	2.26	2.12	7
PCB 195	0.28 U	0.27 U	0.39	NA
PCB 206	1.34	1.43	1.43	4
PCB 209	1.14	1.20	1.06	6
Surrogate Recoveries (%)				
PCB 103 (SIS)	69	72	72	NA
PCB 198 (SIS)	62	64	67	NA

Table B.11. (contd)

Sediment Treatment Replicate	Concentration (ng/L) CL-B COMP[a] 1	CL-B COMP 2	CL-B COMP 3	RSD (%)
Heptachlor	0.46 U	0.46 U	0.49 U	NA
Aldrin	9.58	9.61	10.6	6
Heptachlor Epoxide	0.11 U	0.11 U	0.12 U	NA
2,4'-DDE	0.23 U	0.23 U	0.24 U	NA
Endosulfan I	0.46 U	0.46 U	0.48 U	NA
α-Chlordane	0.82 U	0.82 U	3.24	NA
Trans Nonachlor	1.10 U	1.10 U	1.16 U	NA
4,4'-DDE	32.0	30.9	35.7	8
Dieldrin	9.06	7.69	10.2	14
2,4'-DDD	5.97	7.03	7.78	13
2,4'-DDT	0.43 U	0.43 U	0.45 U	NA
4,4'-DDD	13.1	13.3	13.8	3
Endosulfan II	0.46 U	0.46 U	0.48 U	NA
4,4'-DDT	16.7	16.6	17.3	2
Endosulfan Sulfate	0.46 U	0.46 U	0.48 U	NA
PCB 8	7.13	5.78	7.87	15
PCB 18	62.3	54.5	67.8	11
PCB 28	37.7	37.0	42.6	8
PCB 52	36.0	34.4	37.2	4
PCB 49	20.9	20.3	22.4	5
PCB 44	44.9	36.6	34.6	14
PCB 66	37.6	36.5	41.0	6
PCB 101	27.2	24.7	27.0	5
PCB 87	7.65	6.54	6.74	8
PCB 118	20.6	17.9	19.3	7
PCB 184	0.53 U	0.53 U	0.56 U	NA
PCB 153	20.6	18.8	19.9	5
PCB 105	0.29 U	0.29 U	0.31 U	NA
PCB 138	17.2	15.5	16.8	5
PCB 187	6.15	5.81	6.30	4
PCB 183	2.80	2.52	2.63	5
PCB 128	2.24	2.02	2.23	6
PCB 180	10.8	11.3	11.4	3
PCB 170	4.12	4.18	4.39	3
PCB 195	0.81	0.27 U	0.94	NA
PCB 206	2.23	2.22	2.40	4
PCB 209	1.78	1.71	1.88	5
Surrogate Recoveries (%)				
PCB 103 (SIS)	75	74	69	NA
PCB 198 (SIS)	75	70	73	NA

Table B.11. (contd)

Sediment Treatment Replicate	Concentration (ng/L) CL-A COMP[a] 1	CL-A COMP 2	CL-A COMP 3	RSD (%)
Heptachlor	0.48 U	0.46 U	0.47 U	NA
Aldrin	8.05	10.9	11.9	19
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.24 U	0.23 U	0.23 U	NA
Endosulfan I	0.48 U	0.46 U	0.46 U	NA
α-Chlordane	1.21	0.82 U	0.83 U	NA
Trans Nonachlor	1.15 U	1.10 U	1.11 U	NA
4,4'-DDE	19.4	27.9	31.2	23
Dieldrin	5.49	5.70	5.52	2
2,4'-DDD	4.62	5.99	5.42	13
2,4'-DDT	0.45 U	0.43 U	0.44 U	NA
4,4'-DDD	9.28	11.7	10.4	12
Endosulfan II	0.48 U	0.46 U	0.46 U	NA
4,4'-DDT	13.4	15.9	14.3	9%
Endosulfan Sulfate	0.48 U	0.46 U	0.46 U	NA
PCB 8	1.03 U	0.98 U	1.00 U	NA
PCB 18	42.2	60.7	70.2	25
PCB 28	29.7	44.1	51.1	26
PCB 52	26.4	39.1	43.5	24
PCB 49	15.8	23.9	26.7	26
PCB 44	29.4	38.1	41.3	17
PCB 66	26.5	39.8	46.1	27
PCB 101	16.2	25.3	28.9	28
PCB 87	3.57	6.78	7.48	35 [d]
PCB 118	11.4	19.7	21.3	30
PCB 184	0.55 U	0.53 U	0.53 U	NA
PCB 153	10.3	19.4	20.4	33 [d]
PCB 105	0.31 U	0.29 U	0.30 U	NA
PCB 138	8.83	15.5	16.1	30
PCB 187	2.40	6.46	6.92	47 [d]
PCB 183	1.57	2.63	2.72	28
PCB 128	1.40	2.27	2.12	24
PCB 180	5.84	11.1	12.2	35 [d]
PCB 170	2.14	4.46	4.32	36 [d]
PCB 195	0.28 U	1.03	0.80	NA
PCB 206	2.46	4.83	5.42	37 [d]
PCB 209	2.10	3.21	3.99	31 [d]
Surrogate Recoveries (%)				
PCB 103 (SIS)	69	70	69	NA
PCB 198 (SIS)	65	68	77	NA

Table B.11. (contd)

Sediment Treatment	Concentration (ng/L)			
Replicate	PJ-A COMP[a] 1	PJ-A COMP 2	PJ-A COMP 3	RSD (%)
Heptachlor	0.48 U	0.88	0.48 U	NA
Aldrin	5.39	5.64	5.52	2
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.24 U	0.24 U	0.24 U	NA
Endosulfan I	0.47 U	0.47 U	0.47 U	NA
α-Chlordane	0.84 U	0.84 U	0.95	NA
Trans Nonachlor	1.13 U	1.13 U	1.13 U	NA
4,4'-DDE	8.51	9.24	9.21	5
Dieldrin	5.28	4.95	5.02	3
2,4'-DDD	0.96 U	0.96 U	0.96 U	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA
4,4'-DDD	0.46 U	0.46 U	0.46 U	NA
Endosulfan II	0.47 U	0.47 U	0.47 U	NA
4,4'-DDT	9.19	9.09	9.47	2
Endosulfan Sulfate	0.47 U	0.47 U	0.47 U	NA
PCB 8	1.02 U	1.02 U	1.02 U	NA
PCB 18	17.6	19.6	19.7	6
PCB 28	10.8	12.4	13.1	10
PCB 52	6.81	8.95	8.95	15
PCB 49	5.04	6.24	6.37	12
PCB 44	0.31 U	0.31 U	0.31 U	NA
PCB 66	0.39 U	0.39 U	0.39 U	NA
PCB 101	3.32	4.75	5.19	22
PCB 87	1.02	1.15	1.17	7
PCB 118	2.39	3.40	3.77	22
PCB 184	0.55 U	0.55 U	0.55 U	NA
PCB 153	2.51	3.47	3.59	19
PCB 105	0.30 U	0.30 U	0.30 U	NA
PCB 138	2.94	3.58	3.56	11
PCB 187	1.00	1.12	1.17	8
PCB 183	0.74	0.76	0.83	6
PCB 128	0.50	0.56	0.60	9
PCB 180	2.15	2.57	2.65	11
PCB 170	1.56	1.62	1.56	2
PCB 195	0.28 U	0.28 U	0.28 U	NA
PCB 206	0.40 U	0.40 U	0.40 U	NA
PCB 209	0.28 U	0.28 U	0.28 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	70	71	76	NA
PCB 198 (SIS)	61	64	66	NA

Table B.11. (contd)

Sediment Treatment Replicate	Concentration (ng/L) RH COMP[a] 1	RH COMP 2	RH COMP 3	RSD (%)
Heptachlor	0.49 U	0.47 U	0.47 U	NA
Aldrin	3.27	2.78	5.50	38 [d]
Heptachlor Epoxide	0.12 U	0.11 U	0.11 U	NA
2,4'-DDE	0.24 U	0.23 U	0.23 U	NA
Endosulfan I	0.49 U	0.46 U	0.47 U	NA
α-Chlordane	0.87 U	0.83 U	0.83 U	NA
Trans Nonachlor	1.17 U	1.11 U	1.12 U	NA
4,4'-DDE	6.65	7.14	8.19	11
Dieldrin	2.36	4.87	5.10	37 [d]
2,4'-DDD	0.99 U	0.94 U	0.95 U	NA
2,4'-DDT	0.46 U	0.44 U	0.44 U	NA
4,4'-DDD	0.47 U	0.45 U	0.45 U	NA
Endosulfan II	0.49 U	0.88	0.47 U	NA
4,4'-DDT	7.95	7.72	8.21	3
Endosulfan Sulfate	0.49 U	0.46 U	0.47 U	NA
PCB 8	1.05 U	1.00 U	1.01 U	NA
PCB 18	8.53	8.56	11.8	19
PCB 28	5.10	4.99	8.85	35 [d]
PCB 52	3.65	0.35 U	0.36 U	NA
PCB 49	2.37	2.30	6.74	67 [d]
PCB 44	0.32 U	0.31 U	0.31 U	NA
PCB 66	0.40 U	0.38 U	0.39 U	NA
PCB 101	1.54	1.82	0.49 U	NA
PCB 87	0.37 U	0.35 U	1.63	NA
PCB 118	1.44	1.52	4.73	73 [d]
PCB 184	0.56 U	0.53 U	0.54 U	NA
PCB 153	1.16	1.33	0.40 U	NA
PCB 105	0.31 U	0.30 U	0.30 U	NA
PCB 138	1.23	1.42	1.78	19
PCB 187	0.41 U	0.39 U	0.39 U	NA
PCB 183	0.56 U	0.53 U	0.54 U	NA
PCB 128	0.25 U	0.24 U	0.24 U	NA
PCB 180	0.92	1.04	1.23	15
PCB 170	0.21 U	0.20 U	0.20 U	NA
PCB 195	0.29 U	0.27 U	0.28 U	NA
PCB 206	0.40	0.39 U	0.39 U	NA
PCB 209	0.29 U	0.27 U	0.28 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	67	68	69	NA
PCB 198 (SIS)	61	61	61	NA

Table B.11. (contd)

Sediment Treatment Replicate	Concentration (ng/L) CL-C COMP[a] 1	CL-C COMP 2	CL-C COMP 3	RSD (%)
Heptachlor	1.08	6.57	1.26	105 [d]
Aldrin	5.26	7.34	6.38	16
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.23 U	0.24 U	0.23 U	NA
Endosulfan I	0.46 U	0.47 U	0.46 U	NA
α-Chlordane	0.83 U	1.53	0.82 U	NA
Trans Nonachlor	1.11 U	1.13 U	1.10 U	NA
4,4'-DDE	8.59	14.7	11.9	26
Dieldrin	5.37	7.25	5.86	16
2,4'-DDD	0.94 U	3.83	0.93 U	NA
2,4'-DDT	0.44 U	0.44 U	0.43 U	NA
4,4'-DDD	7.13	8.79	7.70	11
Endosulfan II	0.46 U	0.47 U	0.46 U	NA
4,4'-DDT	9.65	12.2	9.83	13
Endosulfan Sulfate	0.46 U	0.47 U	0.46 U	NA
PCB 8	1.00 U	1.02 U	0.98 U	NA
PCB 18	20.0	32.7	29.1	24
PCB 28	12.1	22.0	19.2	29
PCB 52	0.35 U	0.36 U	14.8	NA
PCB 49	5.94	18.3	9.26	57 [d]
PCB 44	0.31 U	0.31 U	0.30 U	NA
PCB 66	0.38 U	0.39 U	0.38 U	NA
PCB 101	4.63	12.8	9.26	46 [d]
PCB 87	1.25	2.01	0.35 U	NA
PCB 118	3.62	7.87	6.75	36 [d]
PCB 184	0.53 U	0.55 U	0.53 U	NA
PCB 153	2.41	7.26	6.56	48 [d]
PCB 105	0.30 U	0.30 U	0.29 U	NA
PCB 138	3.28	7.11	5.95	36 [d]
PCB 187	1.01	1.75	1.67	28
PCB 183	0.53 U	1.10	1.07	NA
PCB 128	0.24 U	0.25 U	0.98	NA
PCB 180	2.07	5.66	4.31	45 [d]
PCB 170	0.20 U	2.20	1.89	NA
PCB 195	0.27 U	0.28 U	0.27 U	NA
PCB 206	0.39 U	0.40 U	0.87	NA
PCB 209	0.27 U	0.28 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	82	75	69	NA
PCB 198 (SIS)	72	63	64	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NA Not applicable.
(d) Outside quality control criteria (≤30%) for replicate analysis.

Appendix C.

Benthic Acute Toxicity Test Data,
Red Hook and Bay Ridge Channels

Table C.1. Results of 10-Day, Static-Renewal, Benthic Acute Toxicity Test with *A. abdita*, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
Red Hook						
RH COMP	1	13	7	0.65		
RH COMP	2	14	6	0.70		
RH COMP	3	13	7	0.65		
RH COMP	4	10	10	0.50		
RH COMP	5	15	5	0.75	0.65	0.09
Bay Ridge Reach A						
BR-A COMP	1	20	0	1.00		
BR-A COMP	2	18	2	0.90		
BR-A COMP	3	18	2	0.90		
BR-A COMP	4	16	4	0.80		
BR-A COMP	5	19	1	0.95	0.91	0.07
Bay Ridge Reach B						
BR-B COMP	1	8	12	0.40		
BR-B COMP	2	4	16	0.20		
BR-B COMP	3	5	15	0.25		
BR-B COMP	4	12	8	0.60		
BR-B COMP	5	6	14	0.30	0.35	0.16
MDRS[b]	1	19	1	0.95		
MDRS	2	19	1	0.95		
MDRS	3	19	1	0.95		
MDRS	4	20	0	1.00		
MDRS	5	17	3	0.85	0.94	0.05
Ampelisca Control	1	20	0	1.00		
Ampelisca Control	2	20	0	1.00		
Ampelisca Control	3	20	0	1.00		
Ampelisca Control	4	20	0	1.00		
Ampelisca Control	5	20	0	1.00	1.00	0.00

(a) Survival based on initial exposure of 20 organisms per replicate.
(b) MDRS Mud Dump Reference Site.

Table C.2. Water Quality Data for 10-Day, Static-Renewal, Benthic Acute Toxicity Test with *A. abdita*, Red Hook and Bay Ridge Channels

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)		Total Ammonia[a] (mg/L)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	4.6	NA[b]	28.0	32.0	NA	30.0
Red Hook										
RH COMP	19.4	20.5	7.79	8.08	6.5	7.2	30.0	32.0	<1.0	<1.0
Bay Ridge Reach A										
BR-A COMP	19.3	20.4	8.02	8.59 [c]	6.3	7.5	30.0	31.0	<1.0	<1.0
Bay Ridge Reach B										
BR-B COMP	19.4	20.3	7.75	8.10	6.6	7.3	30.0	30.5	<1.0	<1.0
MDRS[d]	19.3	20.4	7.81	8.13	6.8	7.4	30.0	32.0	<1.0	<1.0
Ampelisca Control	19.5	20.3	7.76	8.50 [c]	6.3	7.4	30.0	31.5	<1.0	<1.0

(a) Ammonia measured in overlying water.
(b) NA Not applicable.
(c) Data point out of range.
(d) MDRS Mud Dump Reference Site.

Table C.3. Results of 96-Hour, Cadmium Reference Toxicant Test with *A. abdita*

Cadmium Concentration (mg/L)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
0.0	1	20	0	1.00		
0.0	2	20	0	1.00	1.00	0.00
0.0	3	20	0	1.00		
0.19	1	13	7	0.65		
0.19	2	17	3	0.85	0.80	0.13
0.19	3	18	2	0.90		
0.38	1	15	5	0.75		
0.38	2	13	7	0.65	0.68	0.06
0.38	3	13	7	0.65		
0.75	1	8	12	0.40		
0.75	2	7	13	0.35	0.38	0.03
0.75	3	8	12	0.40		
1.5	1	2	18	0.10		
1.5	2	1	19	0.05	0.07	0.03
1.5	3	1	19	0.05		

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

Table C.4. Water Quality Data for 96-Hour, Cadmium Reference Toxicant Test with *A. abdita*

Cadmium Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	4.6	NA[a]	28.0	32.0
0	19.5	20.0	8.12	8.18	7.0	7.2	30.5	31.0
0.19	19.5	20.0	8.09	8.17	7.0	7.3	30.5	31.5
0.38	19.5	20.0	8.10	8.16	6.9	7.3	30.5	31.5
0.75	19.5	20.0	8.10	8.15	6.8	7.2	31.0	32.0
1.5	19.4	19.9	8.07	8.12	7.0	7.3	31.0	31.5

(a) NA Not applicable.

Table C.5. Results of 10-day, Static-Renewal, Benthic Acute Toxicity Test with *M. bahia*, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
Red Hook						
RH COMP	1	13	7	0.65		
RH COMP	2	16	4	0.80		
RH COMP	3	16	4	0.80		
RH COMP	4	15	5	0.75		
RH COMP	5	17	3	0.85	0.77	0.08
Bay Ridge Reach A						
BR-A COMP	1	14	6	0.70		
BR-A COMP	2	16	4	0.80		
BR-A COMP	3	13	7	0.65		
BR-A COMP	4	16	4	0.80		
BR-A COMP	5	17	3	0.85	0.76	0.08
Bay Ridge Reach B						
BR-B COMP	1	16	4	0.80		
BR-B COMP	2	10	10	0.50		
BR-B COMP	3	17	3	0.85		
BR-B COMP	4	16	4	0.80		
BR-B COMP	5	15	5	0.75	0.74	0.14
MDRS[b]	1	20	0	1.00		
MDRS	2	20	0	1.00		
MDRS	3	19	1	0.95		
MDRS	4	19	1	0.95		
MDRS	5	17	3	0.85	0.95	0.06
Mysidopsis Control	1	19	1	0.95		
Mysidopsis Control	2	20	0	1.00		
Mysidopsis Control	3	20	0	1.00		
Mysidopsis Control	4	19	1	0.95		
Mysidopsis Control	5	19	1	0.95	0.97	0.03

(a) Survival based on initial exposure of 20 organisms per replicate.
(b) MDRS Mud Dump Reference Site.

Table C.6. Water Quality Summary for 10-Day, Static-Renewal, Benthic Acute Toxicity Test with *M. bahia*, Red Hook and Bay Ridge Channels

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)		Total Ammonia[a] (mg/L)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	3.0	NA [b]	28.0	32.0	NA	15.0
Red Hook										
RH COMP	19.4	20.3	7.50	8.07	5.4	6.9	30.0	31.0	<1.0	<1.0
Bay Ridge Reach A										
BR-A COMP	19.5	20.4	7.98	8.61 [c]	4.1	6.8	30.5	31.5	<1.0	<1.0
Bay Ridge Reach B										
BR-B COMP	19.4	20.3	7.44	8.10	5.3	7.0	30.0	32.0	<1.0	<1.0
MDRS[d]	19.3	20.3	7.48	8.12	5.5	7.1	30.0	31.5	<1.0	1.71
Mysidopsis Control	19.3	20.4	7.53	8.51 [c]	5.0	6.9	30.0	32.0	<1.0	<1.0

(a) Ammonia measured in overlying water.
(b) NA Not applicable.
(c) Data point out of range.
(d) MDRS Mud Dump Reference Site.

Table C.7. Results of 96-Hour, Copper Reference Toxicant Test with *M. bahia*

Copper Concentration (µg/L)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
0.0	1	10	0	1.00		
0.0	2	10	0	1.00		
0.0	3	10	0	1.00	1.00	0.00
100	1	10	0	1.00		
100	2	10	0	1.00		
100	3	9	1	0.90	0.97	0.06
150	1	10	0	1.00		
150	2	7	3	0.70		
150	3	8	2	0.80	0.83	0.15
200	1	7	3	0.70		
200	2	8	2	0.80		
200	3	5	5	0.50	0.67	0.15
300	1	1	9	0.10		
300	2	3	7	0.30		
300	3	1	9	0.10	0.17	0.12

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

Table C.8. Water Quality Data for 96-hour, Copper Reference Toxicant Test with *M. bahia*

Copper Concentration (µg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Acceptable Range:	18.0	22.0	7.30	8.30	3.0	NA[a]	28.0	32.0
0	18.6	19.1	7.55	8.21	4.5	7.7	29.5	32.0
100	18.6	19.1	7.65	8.19	5.0	7.4	29.5	32.0
150	18.6	19.1	7.81	8.19	5.4	8.2	29.5	32.0
200	18.6	19.1	7.92	8.21	7.0	7.9	29.5	32.0
300	18.6	19.1	7.95	8.18	6.6	8.2	29.5	32.0

(a) NA Not applicable.

Appendix D.

Water-Column Toxicity Test Data,
Red Hook and Bay Ridge Channels

Table D.1. Results of 96-Hour, Water-Column Toxicity Test with *M. beryllina*, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (% SPP)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
Red Hook							
RH COMP	0	1	10	0	1.00		
RH COMP	0	2	10	0	1.00		
RH COMP	0	3	9	1	0.90		
RH COMP	0	4	9	1	0.90		
RH COMP	0	5	9	1	0.90	0.94	0.05
RH COMP	10	1	10	0	1.00		
RH COMP	10	2	10	0	1.00		
RH COMP	10	3	9	1	0.90		
RH COMP	10	4	9	1	0.90		
RH COMP	10	5	7	3	0.70	0.90	0.12
RH COMP	50	1	5	5	0.50		
RH COMP	50	2	7	3	0.70		
RH COMP	50	3	7	3	0.70		
RH COMP	50	4	8	2	0.80		
RH COMP	50	5	7	3	0.70	0.68	0.11
RH COMP	100	1	0	10	0.00		
RH COMP	100	2	0	10	0.00		
RH COMP	100	3	1	9	0.10		
RH COMP	100	4	1	9	0.10		
RH COMP	100	5	1	9	0.10	0.06	0.05
Bay Ridge Reach A							
BR-A COMP	0	1	9	1	0.90		
BR-A COMP	0	2	9	1	0.90		
BR-A COMP	0	3	7	3	0.70		
BR-A COMP	0	4	9	1	0.90		
BR-A COMP	0	5	7	3	0.70	0.82	0.11
BR-A COMP	10	1	8	2	0.80		
BR-A COMP	10	2	6	4	0.60		
BR-A COMP	10	3	6	4	0.60		
BR-A COMP	10	4	7	3	0.70		
BR-A COMP	10	5	7	3	0.70	0.68	0.08

Table D.1. (contd)

Sediment Treatment	Concentration (% SPP)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
BR-A COMP	50	1	0	10	0.00		
BR-A COMP	50	2	0	10	0.00		
BR-A COMP	50	3	0	10	0.00		
BR-A COMP	50	4	0	10	0.00		
BR-A COMP	50	5	0	10	0.00	0.00	0.00
BR-A COMP	100	1	0	10	0.00		
BR-A COMP	100	2	0	10	0.00		
BR-A COMP	100	3	0	10	0.00		
BR-A COMP	100	4	0	10	0.00		
BR-A COMP	100	5	0	10	0.00	0.00	0.00
Bay Ridge Reach B							
BR-B COMP	0	1	10	0	1.00		
BR-B COMP	0	2	9	1	0.90		
BR-B COMP	0	3	9	1	0.90		
BR-B COMP	0	4	8	2	0.80		
BR-B COMP	0	5	8	2	0.80	0.88	0.08
BR-B COMP	10	1	9	1	0.90		
BR-B COMP	10	2	7	3	0.70		
BR-B COMP	10	3	9	1	0.90		
BR-B COMP	10	4	7	3	0.70		
BR-B COMP	10	5	6	4	0.60	0.76	0.13
BR-B COMP	50	1	3	7	0.30		
BR-B COMP	50	2	2	8	0.20		
BR-B COMP	50	3	4	6	0.40		
BR-B COMP	50	4	4	6	0.40		
BR-B COMP	50	5	2	8	0.20	0.30	0.10
BR-B COMP	100	1	0	10	0.00		
BR-B COMP	100	2	0	10	0.00		
BR-B COMP	100	3	0	10	0.00		
BR-B COMP	100	4	0	10	0.00		
BR-B COMP	100	5	0	10	0.00	0.00	0.00

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

Table D.2. Water Quality Data for 96-Hour, Water-Column Toxicity Test with *M. beryllina*, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (% SPP)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:		18.0	22.0	7.30	8.30	3.0	NA[a]	28.0	32.0
Red Hook									
RH COMP	0	19.0	20.1	7.98	8.14	6.8	9.4	32.0	32.0
RH.COMP	10	18.8	20.1	7.95	8.16	6.5	8.2	32.0	32.0
RH COMP	50	18.9	20.1	7.86	8.28	6.8	7.2	31.0	32.0
RH COMP	100	19.1	20.2	7.86	8.44 [b]	6.8	7.2	30.0	30.5
Bay Ridge Reach A									
BR-A COMP	0	19.3	20.2	7.99	8.15	6.9	7.5	31.0	32.0
BR-A COMP	10	19.4	20.3	7.78	8.23	3.6	7.3	31.0	32.0
BR-A COMP	50	19.3	20.2	7.63	8.44 [b]	6.1	7.1	30.0	31.5
BR-A COMP	100	19.6	19.6	7.70	7.88	6.2	6.9	29.5	29.5
Bay Ridge Reach B									
BR-B COMP	0	19.3	20.2	7.99	8.26	6.7	7.5	31.0	32.0
BR-B COMP	10	19.3	20.2	7.95	8.18	6.7	7.4	31.0	32.0
BR-B COMP	50	19.4	20.2	7.82	8.38 [b]	6.2	7.1	29.5	31.5
BR-B COMP	100	19.4	19.6	7.83	8.42 [b]	6.0	7.4	29.0	30.5

(a) NA Not applicable.
(b) Data point out of range.

Table D.3. Results of 96-Hour, Copper Reference Toxicant Test with *M. beryllina*

Copper Concentration (µg/L)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
0	1	9	1	0.90		
0	2	8	2	0.80		
0	3	10	0	1.00	0.90	0.10
16	1	9	1	0.90		
16	2	8	2	0.80		
16	3	8	2	0.80	0.83	0.06
64	1	7	3	0.70		
64	2	7	3	0.70		
64	3	5	5	0.50	0.63	0.12
160	1	1	9	0.10		
160	2	1	9	0.10		
160	3	1	9	0.10	0.10	0.00
400	1	0	10	0.00		
400	2	0	10	0.00		
400	3	0	10	0.00	0.00	0.00

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

Table D.4. Water Quality Data for 96-Hour, Copper Reference Toxicant Test with *M. beryllina*

Copper Concentration (µg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	3.0	NA	28.0	32.0
0	18.4	18.9	7.92	8.16	7.0	8.0	30.5	31.5
16	18.2	18.9	7.92	8.18	7.2	7.8	30.5	31.0
64	18.3	18.9	7.82	8.19	7.2	7.9	30.0	31.0
160	18.3	19.0	7.87	8.19	7.0	8.0	30.5	31.0
400	18.2	18.7	7.81	8.10	7.2	8.1	30.5	30.5

(a) NA Not applicable.

Table D.5. Results of 96-Hour, Water-Column Toxicity Test, with *M. bahia*, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (% SPP)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
Red Hook							
RH COMP	0	1	10	0	1.00		
RH COMP	0	2	10	0	1.00		
RH COMP	0	3	9	1	0.90		
RH COMP	0	4	10	0	1.00		
RH COMP	0	5	10	0	1.00	0.98	0.04
RH COMP	10	1	10	0	1.00		
RH COMP	10	2	9	1	0.90		
RH COMP	10	3	9	1	0.90		
RH COMP	10	4	10	0	1.00		
RH COMP	10	5	10	0	1.00	0.96	0.05
RH COMP	50	1	9	1	0.90		
RH COMP	50	2	9	1	0.90		
RH COMP	50	3	10	0	1.00		
RH COMP	50	4	10	0	1.00		
RH COMP	50	5	9	1	0.90	0.94	0.05
RH COMP	100	1	7	3	0.70		
RH COMP	100	2	8	2	0.80		
RH COMP	100	3	8	2	0.80		
RH COMP	100	4	9	1	0.90		
RH COMP	100	5	6	4	0.60	0.76	0.11
Bay Ridge Reach A							
BR-A COMP	0	1	10	0	1.00		
BR-A COMP	0	2	10	0	1.00		
BR-A COMP	0	3	10	0	1.00		
BR-A COMP	0	4	10	0	1.00		
BR-A COMP	0	5	10	0	1.00	1.00	0.00
BR-A COMP	10	1	9	1	0.90		
BR-A COMP	10	2	10	0	1.00		
BR-A COMP	10	3	10	0	1.00		
BR-A COMP	10	4	10	0	1.00		
BR-A COMP	10	5	9	1	0.90	0.96	0.05

Table D.5. (contd)

Sediment Treatment	Concentration (% SPP)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
BR-A COMP	50	1	9	1	0.90		
BR-A COMP	50	2	8	2	0.80		
BR-A COMP	50	3	8	2	0.80		
BR-A COMP	50	4	9	1	0.90		
BR-A COMP	50	5	9	1	0.90	0.86	0.05
BR-A COMP	100	1	0	10	0.00		
BR-A COMP	100	2	0	10	0.00		
BR-A COMP	100	3	0	10	0.00		
BR-A COMP	100	4	0	10	0.00		
BR-A COMP	100	5	0	10	0.00	0.00	0.00
Bay Ridge Reach B							
BR-B COMP	0	1	10	0	1.00		
BR-B COMP	0	2	10	0	1.00		
BR-B COMP	0	3	10	0	1.00		
BR-B COMP	0	4	9	1	0.90		
BR-B COMP	0	5	10	0	1.00	0.98	0.04
BR-B COMP	10	1	10	0	1.00		
BR-B COMP	10	2	10	0	1.00		
BR-B COMP	10	3	10	0	1.00		
BR-B COMP	10	4	10	0	1.00		
BR-B COMP	10	5	9	1	0.90	0.98	0.04
BR-B COMP	50	1	10	0	1.00		
BR-B COMP	50	2	9	1	0.90		
BR-B COMP	50	3	7	3	0.70		
BR-B COMP	50	4	9	1	0.90		
BR-B COMP	50	5	10	0	1.00	0.90	0.12
BR-B COMP	100	1	2	8	0.20		
BR-B COMP	100	2	0	10	0.00		
BR-B COMP	100	3	0	10	0.00		
BR-B COMP	100	4	0	10	0.00		
BR-B COMP	100	5	1	9	0.10	0.06	0.09

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

Table D.6. Water Quality Data for 96-Hour, Water-Column Toxicity Test with *M. bahia*, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (% SPP)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
		Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:		18.0	22.0	7.30	8.30	3.0	NA[a]	28.0	32.0
Red Hook									
RH COMP	0	18.0	19.1	7.98	8.15	6.7	8.4	32.0	32.5 [b]
RH COMP	10	18.0	19.0	7.95	8.19	6.9	8.4	32.0	32.5 [b]
RH COMP	50	18.1	19.0	7.86	8.33 [b]	6.2	7.3	31.0	32.0
RH COMP	100	18.3	19.0	7.89	8.40 [b]	6.5	7.6	30.0	31.5
Bay Ridge Reach A									
BR-A COMP	0	18.6	19.1	8.01	8.20	6.9	7.8	30.0	32.5 [b]
BR-A COMP	10	18.6	19.0	7.91	8.29	7.1	7.5	30.0	32.0
BR-A COMP	50	18.6	19.0	7.68	8.50 [b]	6.4	7.6	29.0	32.0
BR-A COMP	100	18.7	19.0	7.84	8.65 [b]	7.1	7.4	28.0	32.0
Bay Ridge Reach B									
BR-B COMP	0	18.6	19.0	7.92	8.14	6.5	7.7	30.0	32.5 [b]
BR-B COMP	10	18.6	19.0	7.97	8.22	7.0	7.6	30.0	32.0
BR-B COMP	50	18.6	18.9	7.86	8.35 [b]	6.8	7.4	29.0	32.0
BR-B COMP	100	18.6	19.0	7.95	8.53 [b]	7.0	7.4	28.0	30.5

(a) NA Not applicable.
(b) Data point out of range.

Table D.7. Results of 96-Hour, Copper Reference Toxicant Test with *M. bahia*,

Copper Concentration (µg/L)	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
0	1	10	0	1.00		
0	2	10	0	1.00		
0	3	10	0	1.00	1.00	0.00
100	1	9	1	0.90		
100	2	10	0	1.00		
100	3	10	0	1.00	0.97	0.06
150	1	8	2	0.80		
150	2	9	1	0.90		
150	3	10	0	1.00	0.90	0.10
200	1	8	2	0.80		
200	2	7	3	0.70		
200	3	7	3	0.70	0.73	0.06
300	1	3	7	0.30		
300	2	2	8	0.20		
300	3	1	9	0.10	0.20	0.10

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

Table D.8. Water Quality Data for 96-Hour, Copper Reference Toxicant Test with *M. bahia*

Copper Concentration (µg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	3.0	NA[a]	28.0	32.0
0	18.3	19.0	7.96	8.19	6.7	8.2	30.5	32.0
100	18.1	19.1	7.94	8.19	6.9	8.1	30.5	32.0
150	18.1	19.1	7.92	8.18	6.9	8.2	30.0	32.0
200	18.1	19.1	7.90	8.18	7.0	8.1	30.5	32.0
300	18.0	19.1	7.85	8.21	7.0	8.3	30.0	32.0

(a) NA Not applicable.

Table D.9. Results of 48-Hour, Water-Column Toxicity Test with *M. galloprovincialis*, Red Hook and Bay Ridge Channels

Sediment Treatment	Conc. (% SPP)	Replicate	Mean Stocking Density	Number Normal	Number Abnormal	Number Other	Number Surviving	Proportion Normal[a]	Mean Proportion Normal	Proportion Surviving[b]	Mean Proportion Surviving	Standard Deviation[c]
Red Hook												
RH COMP	0	1	280	211	0	9	220	0.75		0.79		
RH COMP	0	2	280	221	0	18	239	0.79		0.85		
RH COMP	0	3	280	206	0	19	225	0.74		0.80		
RH COMP	0	4	280	259	0	5	264	0.93		0.94		
RH COMP	0	5	280	223	0	15	238	0.80	0.80	0.85	0.85	0.06
RH COMP	10	1	280	266	0	13	279	0.95		1.00		
RH COMP	10	2	280	204	0	14	218	0.73		0.78		
RH COMP	10	3	280	274	0	14	288	0.98		1.00 [d]		
RH COMP	10	4	280	220	0	10	230	0.79		0.82		
RH COMP	10	5	280	210	0	10	220	0.75	0.84	0.79	0.88	0.11
RH COMP	50	1	280	1	0	265	266	0.00		0.95		
RH COMP	50	2	280	2	0	262	264	0.01		0.94		
RH COMP	50	3	280	0	0	285	285	0.00		1.00 [d]		
RH COMP	50	4	280	1	0	224	225	0.00		0.80		
RH COMP	50	5	280	0	0	248	248	0.00	0.00	0.89	0.92	0.08
RH COMP	100	1	280	0	0	102	102	0.00		0.36		
RH COMP	100	2	280	0	0	127	127	0.00		0.45		
RH COMP	100	3	280	0	0	115	115	0.00		0.41		
RH COMP	100	4	280	0	0	106	106	0.00		0.38		
RH COMP	100	5	280	0	0	132	132	0.00	0.00	0.47	0.41	0.05

Table D.9. (contd)

Sediment Treatment	Conc. (% SPP)	Replicate	Mean Stocking Density	Number Normal	Number Abnormal	Number Other	Number Surviving	Proportion Normal[a]	Mean Proportion Normal	Proportion Surviving[b]	Mean Proportion Surviving	Standard Deviation[c]
Bay Ridge Reach A												
BR-A COMP	0	1	280	235	0	14	249	0.84		0.89		
BR-A COMP	0	2	280	263	0	10	273	0.94		0.98		
BR-A COMP	0	3	280	284	0	12	296	1.00 [d]		1.00 [d]		
BR-A COMP	0	4	280	225	0	9	234	0.80		0.84		
BR-A COMP	0	5	280	295	0	12	307	1.00 [d]	0.92	1.00 [d]	0.94	0.07
BR-A COMP	10	1	280	273	0	16	289	0.98		1.00 [d]		
BR-A COMP	10	2	280	224	0	21	245	0.80		0.88		
BR-A COMP	10	3	280	256	0	37	293	0.91		1.00 [d]		
BR-A COMP	10	4	280	254	0	26	280	0.91		1.00		
BR-A COMP	10	5	280	168	0	7	175	0.60	0.84	0.63	0.90	0.16
BR-A COMP	50	1	280	0	0	163	163	0.00		0.58		
BR-A COMP	50	2	280	0	0	220	220	0.00		0.79		
BR-A COMP	50	3	280	0	0	136	136	0.00		0.49		
BR-A COMP	50	4	280	0	0	185	185	0.00		0.66		
BR-A COMP	50	5	280	0	0	270	270	0.00	0.00	0.96	0.70	0.18
BR-A COMP	100	1	280	0	0	46	46	0.00		0.16		
BR-A COMP	100	2	280	0	0	78	78	0.00		0.28		
BR-A COMP	100	3	280	0	0	64	64	0.00		0.23		
BR-A COMP	100	4	280	0	0	6	6	0.00		0.02		
BR-A COMP	100	5	280	0	0	71	71	0.00	0.00	0.25	0.19	0.10

Table D.9. (contd)

Sediment Treatment	Conc. (% SPP)	Replicate	Mean Stocking Density	Number Normal	Number Abnormal	Number Other	Number Surviving	Proportion Normal[a]	Mean Proportion Normal	Proportion Surviving[b]	Mean Proportion Surviving	Standard Deviation[c]
Bay Ridge Reach B												
BR-B COMP	0	1	280	303	0	11	314	1.00 [d]		1.00 [d]		
BR-B COMP	0	2	280	243	0	10	253	0.87		0.90		
BR-B COMP	0	3	280	302	0	10	312	1.00 [d]		1.00 [d]		
BR-B COMP	0	4	280	293	0	8	301	1.00 [d]		1.00 [d]		
BR-B COMP	0	5	280	239	0	6	245	0.85	0.94	0.88	0.96	0.06
BR-B COMP	10	1	280	251	0	18	269	0.90		0.96		
BR-B COMP	10	2	280	215	1	7	223	0.77		0.80		
BR-B COMP	10	3	280	290	0	13	303	1.00 [d]		1.00 [d]		
BR-B COMP	10	4	280	227	0	12	239	0.81		0.85		
BR-B COMP	10	5	280	269	0	17	286	0.96	0.89	1.00 [d]	0.92	0.09
BR-B COMP	50	1	280	0	0	248	248	0.00		0.89		
BR-B COMP	50	2	280	0	0	226	226	0.00		0.81		
BR-B COMP	50	3	280	0	0	249	249	0.00		0.89		
BR-B COMP	50	4	280	0	0	234	234	0.00		0.84		
BR-B COMP	50	5	280	0	0	270	270	0.00	0.00	0.96	0.88	0.06
BR-B COMP	100	1	280	0	0	35	35	0.00		0.13		
BR-B COMP	100	2	280	0	0	28	28	0.00		0.10		
BR-B COMP	100	3	280	0	0	45	45	0.00		0.16		
BR-B COMP	100	4	280	1	4	66	71	0.00		0.25		
BR-B COMP	100	5	280	0	0	13	13	0.00	0.00	0.05	0.14	0.07

(a) Proportion normal = number normal / mean stocking density.
(b) Proportion surviving = number surviving / mean stocking density.
(c) Standard deviation is based on proportion surviving.
(d) When number normal or number surviving exceeded the mean stocking density, a proportion normal and/or proportion surviving of 1.00 was used for mean calculations and statistical analysis.

Table D.10. Water Quality Data for 48-Hour, Water-Column Toxicity Test with *M. galloprovincialis*, Red Hook and Bay Ridge Channels

Sediment Treatment	Concentration (% SPP)	Temperature (°C) Min	Temperature (°C) Max	pH Min	pH Max	Dissolved Oxygen (mg/L) Min	Dissolved Oxygen (mg/L) Max	Salinity (‰) Min	Salinity (‰) Max
Acceptable Range:		14.0	18.0	7.30	8.30	4.9	NA[a]	28.0	32.0
Red Hook									
RH COMP	0	15.8	16.5	7.96	8.13	7.5	8.5	31.5	33.0
RH COMP	10	15.8	16.5	7.82	8.18	7.5	9.5	31.5	32.5
RH COMP	50	15.8	16.6	7.82	8.33 [b]	7.4	8.0	30.5	32.0
RH COMP	100	15.8	16.6	7.60	8.43 [b]	4.9	7.9	30.0	32.0
Bay Ridge Reach A									
BR-A COMP	0	15.8	16.6	7.95	8.14	7.3	9.4	32.0	32.5
BR-A COMP	10	15.8	16.6	7.85	8.24	7.2	9.0	30.0	32.5
BR-A COMP	50	15.8	16.6	7.55	8.45 [b]	7.5	7.9	31.0	32.5
BR-A COMP	100	15.8	16.7	7.35	8.61 [b]	5.6	7.8	30.0	32.0
Bay Ridge Reach B									
BR-B COMP	0	15.8	16.6	7.98	8.14	7.4	9.2	30.5	32.0
BR-B COMP	10	15.8	16.7	7.93	8.20	7.6	9.0	31.0	32.0
BR-B COMP	50	15.9	16.7	7.79	8.39 [b]	7.5	7.8	30.5	32.0
BR-B COMP	100	15.8	16.8	7.68	8.49 [b]	5.3	7.8	30.0	30.5

(a) NA Not applicable.
(b) Data point out of range.

Table D.11. Results of 48-Hour, Copper Reference Toxicant Test with *M. galloprovincialis*

Copper Concentration (µg/L)	Replicate	Mean Stocking Density	Number Normal	Number Abnormal	Number Other	Number Surviving	Proportion Normal[a]	Mean Proportion Normal	Proportion Surviving[b]	Mean Proportion Surviving	Standard Deviation[c]
0	1	280	250	0	11	261	0.89		0.93		
0	2	280	293	0	7	300	1.00 [d]		1.00 [d]		
0	3	280	286	0	9	295	1.00 [d]	0.96	1.00 [d]	0.98	0.04
1	1	280	203	0	10	213	0.73		0.76		
1	2	280	280	0	0	280	1.00		1.00		
1	3	280	214	0	9	223	0.76	0.83	0.80	0.85	0.13
4	1	280	243	0	10	253	0.87		0.90		
4	2	280	274	0	8	282	0.98		1.00 [d]		
4	3	280	264	0	8	272	0.94	0.93	0.97	0.96	0.05
16	1	280	9	93	123	225	0.03		0.80		
16	2	280	3	0	202	205	0.01		0.73		
16	3	280	5	105	110	220	0.02	0.02	0.79	0.77	0.04
64	1	280	0	0	22	22	0.00		0.08		
64	2	280	0	0	70	70	0.00		0.25		
64	3	280	0	0	46	46	0.00	0.00	0.16	0.16	0.09

(a) Proportion normal = number normal / mean stocking density.
(b) Proportion surviving = number surviving / mean stocking density.
(c) Standard deviation is based on proportion surviving.
(d) When number normal or number surviving exceeded the mean stocking density, a proportion normal and/or proportion surviving of 1.00 was used for mean calculations and statistical analysis.

Table D.12. Water Quality Data for 48-Hour, Copper Reference Toxicant Test with *M. galloprovincialis*

Copper Concentration (µg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	14.0	18.0	7.30	8.30	4.9	NA[a]	28.0	32.0
0	15.8	16.8	7.99	8.13	7.5	8.7	30.0	31.5
1	15.8	16.8	8.01	8.12	7.5	8.6	30.0	30.5
4	15.9	16.8	8.02	8.14	7.5	8.6	30.0	30.5
16	15.8	16.8	8.00	8.14	7.6	8.6	30.0	30.5
64	15.9	16.8	8.00	8.14	7.5	8.9	30.0	31.0

(a) NA Not applicable.

Appendix E.

Bioaccumulation Test Data,
Red Hook and Bay Ridge Channels

Table E.1. Results of 28-Day Bioaccumulation Test with *M. nasuta*, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
Red Hook						
RH COMP	1	19	6	0.76		
RH COMP	2	21	4	0.84		
RH COMP	3	21	4	0.84		
RH COMP	4	23	2	0.92		
RH COMP	5	22	3	0.88	0.85	0.06
Bay Ridge Reach A						
BR-A COMP	1	25	0	1.00		
BR-A COMP	2	24	1	0.96		
BR-A COMP	3	24	1	0.96		
BR-A COMP	4	24	1	0.96		
BR-A COMP	5	22	3	0.88	0.95	0.04
Bay Ridge Reach B						
BR-B COMP	1	20	5	0.80		
BR-B COMP	2	21	4	0.84		
BR-B COMP	3	20	5	0.80		
BR-B COMP	4	20	5	0.80		
BR-B COMP	5	24	1	0.96	0.84	0.07
MDRS[b]	1	22	3	0.88		
MDRS	2	22	3	0.88		
MDRS	3	18	7	0.72		
MDRS	4	21	4	0.84		
MDRS	5	19	6	0.76	0.82	0.07
Macoma Control	1	23	2	0.92		
Macoma Control	2	22	3	0.88		
Macoma Control	3	22	3	0.88		
Macoma Control	4	22	3	0.88		
Macoma Control	5	24	1	0.96	0.90	0.04

(a) Survival based on initial exposure of 25 organisms per replicate.
(b) MDRS Mud Dump Reference Site.

Table E.2. Water Quality Data for 28-Day Bioaccumulation Test with *M. nasuta*, Red Hook and Bay Ridge Channels

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	13.0	17.0	7.30	8.30	5.0	NA[a]	28.0	32.0
Red Hook								
RH COMP	15.6	17.0	7.57	8.11	6.6	7.8	30.0	31.0
Bay Ridge Reach A								
BR-A COMP	15.7	16.9	7.60	8.12	6.5	7.8	30.0	31.0
Bay Ridge Reach B								
BR-B COMP	15.7	17.1 [b]	7.64	8.14	6.5	7.8	30.0	31.0
MDRS[c]	15.7	17.1 [b]	7.66	8.14	7.3	7.9	30.0	31.0
Macoma Control	15.7	17.0	7.61	8.12	6.5	7.7	30.0	31.0

(a) NA Not applicable.
(b) Data point out of range.
(c) MDRS Mud Dump Reference Site.

Table E.3. Results of 96-Hour, Copper Reference Toxicant Test with *M. nasuta*

Copper Concentration (µ/L)	Live[a]	Dead or Missing	Proportion Surviving
0	10	0	1.00
250	10	0	1.00
500	9	1	0.90
750	9	1	0.90
1000	8	2	0.80
1500	10	0	1.00
2500	7	3	0.70

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

Table E.4. Water Quality Data for 96-Hour, Copper Reference Toxicant Test with *M. nasuta*

Copper Concentration (µg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	13.0	17.0	7.30	8.30	5.0	NA[a]	28.0	32.0
0	15.6	16.7	7.71	8.04	7.3	7.8	30.0	31.5
250	15.6	16.7	7.69	8.05	7.3	8.0	30.0	31.0
500	15.6	16.7	7.66	8.07	7.0	8.5	30.0	31.0
750	15.6	16.6	7.67	8.07	6.0	8.2	30.0	31.5
1000	15.6	16.6	7.56	8.05	5.2	8.3	30.0	31.5
1500	15.7	16.6	7.67	8.05	5.7	8.2	30.5	31.5
2500	15.6	16.6	7.21[b]	7.94	4.3[b]	8.0	30.5	31.0

(a) NA Not applicable.
(b) Data point out of range.

Table E.5. Results of 28-Day Bioaccumulation Test with *N. virens*, Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Live[a]	Dead or Missing	Proportion Surviving	Mean Proportion Surviving	Standard Deviation
Red Hook						
RH COMP	6	16	4	0.80		
RH COMP	7	14	6	0.70		
RH COMP	8	19	1	0.95		
RH COMP	9	19	1	0.95		
RH COMP	10	16	4	0.80	0.84	0.11
Bay Ridge Reach A						
BR-A COMP	6	13	7	0.65		
BR-A COMP	7	13	7	0.65		
BR-A COMP	8	12	8	0.60		
BR-A COMP	9	19	1	0.95		
BR-A COMP	10	16	4	0.80	0.73	0.14
Bay Ridge Reach B						
BR-B COMP	6	13	7	0.65		
BR-B COMP	7	20	0	1.00		
BR-B COMP	8	18	2	0.90		
BR-B COMP	9	17	3	0.85		
BR-B COMP	10	16	4	0.80	0.84	0.13
MDRS[b]	6	12	8	0.60		
MDRS	7	16	4	0.80		
MDRS	8	19	1	0.95		
MDRS	9	17	3	0.85		
MDRS	10	18	2	0.90	0.82	0.14
Nereis Control	6	14	6	0.70		
Nereis Control	7	15	5	0.75		
Nereis Control	8	10	10	0.50		
Nereis Control	9	9	11	0.45		
Nereis Control	10	14	6	0.70	0.62	0.14

(a) Survival based on initial exposure of 20 organisms per replicate.
(b) MDRS Mud Dump Reference Site.

Table E.6. Water Quality Data for 28-Day Bioaccumulation Test with *N. virens*, Red Hook and Bay Ridge Channels

Sediment Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	4.6	NA[a]	28.0	32.0
Red Hook								
RH COMP	18.8	20.1	5.60 [b]	8.13	5.8	7.1	30.0	31.0
Bay Ridge Reach A								
BR-A COMP	19.3	20.2	7.51	8.13	6.0	7.1	30.0	30.5
Bay Ridge Reach B								
BR-B COMP	19.2	20.1	7.55	8.14	5.6	7.1	30.0	30.5
MDRS[c]	19.3	20.2	7.57	8.13	5.6	7.6	30.0	30.5
Nereis Control	19.3	20.3	7.54	8.11	5.8	7.1	30.0	31.0

(a) NA Not applicable.
(b) Data point out of range.
(c) MDRS Mud Dump Reference Site.

Table E.7. Results of 96-Hour, Copper Reference Toxicant Test with *N. virens*

Copper Concentration (µg/L)	Live[a]	Dead or Missing	Proportion Surviving
0	10	0	1.00
50	10	0	1.00
75	10	0	1.00
150	0	10	0.00
200	0	10	0.00
250	0	10	0.00
300	0	10	0.00

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

Table E.8. Water Quality Data for 96-Hour, Copper Reference Toxicant Test with *N. virens*

Copper Concentration (µg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (‰)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range:	18.0	22.0	7.30	8.30	4.6	NA[a]	28.0	32.0
0	18.7	20.0	7.81	8.08	5.6	8.0	30.0	31.0
50	18.6	20.0	7.81	8.11	5.9	8.5	30.0	31.0
75	18.7	20.1	7.80	8.12	5.8	8.2	30.0	31.0
150	18.5	20.1	7.31	8.10	0.7[b]	8.6	30.0	31.0
200	18.9	20.0	7.28[b]	7.96	0.9[b]	7.6	30.0	31.0
250	18.5	20.1	7.25[b]	8.04	0.6[b]	8.5	30.0	31.0
300	18.3	20.1	7.68	8.05	5.7	8.6	30.0	31.0

(a) NA Not applicable.
(b) Data point out of range.

Appendix F.

Quality Assurance/Quality Control Data for Chemical Analyses of *Macoma nasuta* Tissues, Red Hook and Bay Ridge Channels

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Metals

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

	Reference Method	Range of Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (mg/kg dry wt)
Arsenic	ICP/MS	75-125%	≤20%	≤20%	1.0
Cadmium	ICP/MS	75-125%	≤20%	≤20%	0.1
Chromium	ICP/MS	75-125%	≤20%	≤20%	0.2
Copper	ICP/MS	75-125%	≤20%	≤20%	1.0
Lead	ICP/MS	75-125%	≤20%	≤20%	0.1
Mercury	CVAA	75-125%	≤20%	≤20%	0.02
Nickel	ICP/MS	75-125%	≤20%	≤20%	0.1
Silver	ICP/MS	75-125%	≤20%	≤20%	0.1
Zinc	ICP/MS	75-125%	≤20%	≤20%	1.0

SAMPLE CUSTODY

Twenty-one *Macoma nasuta* tissue samples were received on 5/30/95 in good condition, logged into the Battelle system, frozen to -20°C ± 10°C and subsequently freeze dried within approximately seven days of sample receipt.

METHOD

Nine (9) metals were analyzed for the New York 4 Program: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Hg was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). The remaining metals were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following a procedure based on EPA method 200.8 (EPA 1991)

To prepare tissue for analysis, samples were freeze-dried and blended in a Spex mixer-mill. Approximately 5 g of mixed sample was ground in a ceramic ball mill. For ICP/MS and CVAA analyses, 0.2- to 0.5-g aliquots of dried homogenous sample were digested using a mixture of nitric acid and hydrogen peroxide following a modified version of EPA Method 200.3 (EPA 1991).

QA/QC SUMMARY METALS (contd)

HOLDING TIMES

Samples were analyzed within 180 days of collection. Tissue samples were digested in a single batch. The following table summarizes the analysis dates:

Task	*Macoma nasutas*
Sample Digestion	6/14/95
ICP-MS	7/26/95
CVAA-Hg	6/22/95

DETECTION LIMITS

Target Detection limits were met for all metals except As, Cu, Ni and Zn; however, all sample values for Cu, Ni and Zn were above the achieved method detection limit (MDL) . MDLs were determined by spiking seven replicates of the reagent blank and multiplying standard deviation of the resulting analyses by the student t value at the 99th percentile(3.142).

An MDL verification study was performed by spiking four aliqouts of a background *Macoma nasuta* sample with all metals and analyzing them as four separate replicates. The standard deviation of these results were multiplied by 4.54 to determine the method verification detection limit. Target detection limits were exceeded for all metals.

METHOD BLANKS

One procedural blank was analyzed per 20 samples. No metals were detected in the blanks above the MDLs.

MATRIX SPIKES

One sample was spiked with all metals at a frequency of 1 per 20 samples. All recoveries were within the QC limits of 75% to 125%.

REPLICATES

One sample was analyzed in triplicate. In addition, the background sample was analyzed in triplicate. Precision for triplicate analyses is reported by calculating the relative standard deviation (RSD) between the replicate results. RSDs were within the QC limits of ±20% for all metals.

SRMs

SRM, 1566a (Oyster tissue from the National Institute of Standards and Technology, NIST), was analyzed twice for all metals. Results for all metals were within ±20 % of mean certified value with the exception of Hg in one replicate and Ni in two replicates. This may have happened because a total digestion method was not used.

REFERENCES

Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Mar. Chem.* 14:49-59.

U.S. Environmental Protection Agency (EPA). 1991. Methods for the Determination of Metals in Environmental Samples. EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch, Washington D.C.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Chlorinated Pesticides/PCB Congeners

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	MS Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (ug/kg wet wt)
GC/MS/SIM	30 to 150%	30-120%	≤30%	≤30%	0.4

SAMPLE CUSTODY Twenty-one samples were received on 5/30/95 in good condition, logged into the Battelle system, and stored frozen at -20°C ± 10°C until extraction.

METHOD Tissues were homogenized wet using a stainless steel blade. An aliquot of tissue sample was extracted with methylene chloride using the roller technique under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (NOAA 1993). Samples were then cleaned using Silica/Alumina (5% deactivated) chromatography followed by HPLC cleanup (NOAA 1993). Extracts were analyzed for 15 chlorinated pesticides and 22 PCB congeners using Gas Chromatography/Electron Capture Detection (GC/ECD) following a procedure based on EPA method 8080 (EPA 1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.). All detections were quantitatively confirmed on the second column.

HOLDING TIMES Samples were initially extracted in one batch. Due to low surrogate recoveries, three samples were re-extracted in a separate batch. All extracts were analyzed by GC/ECD. The following summarizes the extraction and analysis dates:

Batch	Species	Extraction	Analysis
1	*M. nasuta*	6/5/95	6/9 through 6/11/95
2	3 samples + MDL study	6/19/95	7/5/95

DETECTION LIMITS Target detection limits of 0.4 ng/g wet weight were met for most pesticides and PCB congeners. Three samples that were re-extracted due to low initial surrogate recoveries, have higher detection limits for all analytes. These elevated detection limits are due to the limited amount of tissue that was available for re-extraction. Method detection limits (MDLs) reported were determined from multiplying the standard deviation of seven spiked replicates of *Macoma nasuta* tissue by the Student t value (99 percentile)(3.142). MDLs were reported corrected for individual sample wet weight extracted.

QA/QC SUMMARY/PCBs and PESTICIDES (contd)

Method detection limit verification was performed by analyzing four replicate spike *Macoma nasuta* samples and multiplying the standard deviation of the result by 4.54. All detection limits calculated in this manner were below the target detection limit except for five pesticides and five PCB congeners which were below 1.7 ng/g wet weight.

METHOD BLANKS One method blank was extracted with each extraction batch. No pesticides or PCBs were detected in any of the method blanks.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries were all within the QC guidelines of 30% to 150% with the exception of one sample in Batch 1 involving a high recovery of PCB 198 (162%). This was probably due to matrix interferences with the Internal Standard octachloronaphthalene (OCN), which is used to quantify the recovery of surrogate PCB 198. Since no sample data are corrected for OCN, sample results should not be affected. Sample results were quantified using the surrogate internal standard method.

MATRIX SPIKES Eleven Eleven (11) out of the 15 pesticides and 5 of the 22 PCB congeners analyzed were spiked into one sample. Matrix spike recoveries in batch 1 were within the control limit range of 50% to 120% for all Pesticides and PCBs with the exception of 4,4'-DDD (121%) and PCB 28 (134%). The samples in batch 2 were analyzed in the same batch as the spiked sample used to determine the MDL verification. This sample was spiked at a concentration near the detection limit. Because of this low spiking concentration, matrix spike recoveries were poor but do not necessarily compromise data accuracy.

REPLICATES One sample was analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. RSDs for all detectable values were below the target precision goal of ≤30%.

SRMs Not available.

MISCELLANEOUS All pesticide and PCB congener results are confirmed using a second dissimilar column. RPDs between the primary and confirmation values must be less than 75% to be considered a confirmed value.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* SW-846. U.S. Document No. 955-001-00000, U.S. EPA, Washington D. C.

QA/QC SUMMARY

PROGRAM: New York /New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH) and 1,4-Dichlorobenzene

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: *Macoma nasuta* Tissue

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	MS Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (ug/kg wet wt)
GC/MS/SIM	50-120%	30-150%	≤30%	≤30%	4.0

SAMPLE CUSTODY Twenty-one samples were received on 5/30/95 in good condition, logged into the Battelle system, and stored frozen at -20°C ± 10°C until extraction.

METHOD Tissue samples were extracted with methylene chloride using a roller under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (NOAA 1993). Samples were then cleaned using Silica/Alumina (5% deactivated) chromatography followed by HPLC cleanup.

Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) in the selected ion mode (SIM) following a procedure based on EPA method 8270 (EPA 1986).

HOLDING TIMES Samples were initially extracted in one batch. Due to low surrogate recoveries, three samples were re-extracted in a separate batch. All extracts were analyzed by GC/ECD. The following summarizes the extraction and analysis dates:

Batch	Species	Extraction	Analysis
1	*M. nasuta*	6/5/95	6/9 through 6/11/95
2	3 samples + MDL study	6/19/95	7/5/95

DETECTION LIMITS Target detection limits of 4 ng/g wet weight were met for all PAH compounds except for fluoranthene and pyrene, which had method detection limits (MDL) between 4 and 6 ng/g wet weight. MDLs were determined by multiplying the standard deviation of seven spiked replicates of a background *Macoma nasuta* sample by the student's t value (99 percentile, 3.142). These MDLs were based on a wet weight of 20 g of tissue sample. Aliquots of samples that were analyzed in triplicate, used for spiking, or were re-extracted, were generally less than 20 g due to limited quantities of tissue available. Because MDLs reported are corrected for sample weight, the MDLs reported for these samples appear elevated and in some cases may exceed the target detection limit.

In addition, a method detection limit verification study was performed, which consisted of analyzing four spiked aliquots of a background *Macoma nasuta* sample. The standard deviation of the result of the replicate analysis was multiplied by the student t

value (4.54). Detection limits calculated in this way were all less than the target detection limit of 4 ng/g wet weight.

METHOD BLANKS One method blank was extracted with each extraction batch. No PAHs were detected in the blanks.

SURROGATES Five isotopically labeled compounds were added prior to extraction to assess the efficiency of the method. These were d8-naphthalene, d10-acenaphthene, d12-chrysene, d14-dibenz[a,h]anthracene and d4-1,4 dichlorobenzene. Recoveries of all surrogates were within the quality control limits of 30% to 150% with the exception of d14-dibenz[a,h]anthracene in six samples and d4-1,4-dichlorobenzene recovery in two samples.

MATRIX SPIKES One sample was spiked with all PAH compounds. Matrix spike recoveries were within QC limits of 50% to 120%, with some exceptions. Spike recoveries for a number of PAH compounds were not calculated due to high native levels, relative to the levels spiked. Spike concentrations were from two to thirty times lower than native concentrations.

REPLICATES One sample from each batch was extracted and analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. All RSDs were within ±30%.

SRMs Not available.

MISCELLANEOUS Some of the compounds are flagged to indicate that the ion ratio for that compound was outside of the QC range. This is due primarily to low levels of the compound of interest. Because the confirmation ion is present at only a fraction of the level of the parent ion, when the native level of the compound is low, the amount of error in the concentration measurement of the confirmation ion goes up. The compound is actually quantified from the parent ion only so most likely this will not affect the quality of the data. For sample values that are relatively high (>5 times the MDL) it may be an indication of some sort of interference.

Benzo[b]- and benzo[k]fluoranthene values were reported in some samples as the sum of the two compounds and in some as individual values. Due to the poor resolution of these two compounds, the ability to separate them for quantitation was variable.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846.* U.S. Document No. 955-001-00000, EPA, Washington D.C.

Table F.1. Metals in Tissue of *M. nasuta* (Wet Weight), Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Replicat	Analytical Batch	% Dry Weight	Concentration (mg/kg wet wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
RH COMP	1		1	14.2	0.0627	4.66	0.0263	0.313	4.41	0.0205	0.633	0.717	12.2
RH COMP	2		1	13.3	0.0294	3.34	0.0256	0.285	2.03	0.0220	0.491	0.562	12.0
RH COMP	3		1	12.9	0.0283 U[a]	3.79	0.0244	0.261	1.97	0.0156	0.387	0.457	12.4
RH COMP	4		1	12.9	0.0370	3.13	0.0330	0.337	2.25	0.0181	0.445	0.756	10.3
RH COMP	5		1	16.4	0.0625	4.70	0.0375	0.444	3.29	0.0214	0.635	1.008	14.6
BR-A COMP	1		1	14.0	0.0692	3.85	0.0454	0.528	2.77	0.0191	0.630	0.800	18.2
BR-A COMP	2	1	1	14.2	0.0778	3.45	0.0323	0.586	4.00	0.0163	0.644	0.770	14.9
BR-A COMP	2	2	1	14.2	0.0761	3.30	0.0315	0.574	3.80	0.0167	0.594	0.750	14.5
BR-A COMP	2	3	1	14.2	0.0769	3.35	0.0323	0.573	3.76	0.0162	0.607	0.839	14.6
BR-A COMP	3		1	13.0	0.0453	3.38	0.0229	0.436	2.23	0.0168	0.378	0.614	11.1
BR-A COMP	4		1	13.0	0.0603	2.50	0.0330	0.718	2.41	0.0210	0.638	0.960	11.7
BR-A COMP	5		1	13.9	0.0701	4.08	0.0332	0.598	3.50	0.0199	0.635	0.756	13.4
BR-B COMP	1		1	13.9	0.0639	3.49	0.0404	0.585	3.24	0.0180	0.515	0.820	15.6
BR-B COMP	2		1	12.3	0.0751	3.74	0.0385	0.393	2.08	0.0159	0.487	0.591	10.2
BR-B COMP	3		1	13.4	0.101	3.76	0.0361	0.634	5.88	0.0223	0.531	0.971	17.5
BR-B COMP	4		1	12.9	0.0587	3.89	0.0326	0.388	2.10	0.0156	0.494	0.593	15.7
BR-B COMP	5		1	12.6	0.0588	2.83	0.0273	0.409	2.62	0.0179	0.374	0.606	8.18
MDRS[b]	1		1	12.7	0.0657	2.84	0.0236	0.222	3.20	0.0163	0.268	0.350	14.8
MDRS	2		1	14.1	0.0309 U	2.71	0.0237	0.212	1.85	0.0167	0.242	0.236	11.3
MDRS	3		1	12.9	0.0467	3.60	0.0368	0.267	1.95	0.0116	0.312	0.351	11.5
MDRS	4		1	12.5	0.0339	2.76	0.0198	0.250	3.30	0.0204	0.384	0.370	12.5
MDRS	5		1	12.7	0.0676	3.73	0.0322	0.181	3.59	0.0166	0.302	0.372	14.9
Macoma Bkgd. Tissue	1	1	1	14.4	0.0599	4.27	0.0503	0.523	2.82	0.0131	0.935	0.224	22.4
Macoma Bkgd. Tissue	1	2	1	14.4	0.0434	3.16	0.0407	0.379	2.49	0.0108	0.789	0.175	18.6
Macoma Bkgd. Tissue	1	3	1	14.4	0.0421	3.12	0.0352	0.458	2.17	0.0104	0.754	0.171	16.2

(a) U Undetected at or above given concentration.
(b) MDRS Mud Dump Reference Site.

Table F.2. Metals in Tissue of *M. nasuta* (Dry Weight), Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Replicate	Analytical Batch	% Dry Weight	Concentration (mg/kg dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Target Detection Limit:					0.1	1.0	0.1	0.2	1.0	0.02	0.1	0.1	1.0
Method Detection Limit:					0.22	0.83	0.081	0.08	1.20	0.0011	0.25	0.08	1.37
RH COMP	1		1	14.2	0.441	32.8	0.185	2.20	31.0	0.144	4.45	5.04	85.5
RH COMP	2		1	13.3	0.222	25.2	0.193	2.15	15.3	0.166	3.70	4.24	90.4
RH COMP	3		1	12.9	0.220 U[a]	29.5	0.190	2.03	15.3	0.121	3.01	3.56	96.4
RH COMP	4		1	12.9	0.286	24.2	0.255	2.61	17.4	0.140	3.44	5.85	79.9
RH COMP	5		1	16.4	0.380	28.6	0.228	2.70	20.0	0.130	3.86	6.13	89.0
BR-A COMP	1		1	14.0	0.494	27.5	0.324	3.77	19.8	0.136	4.50	5.71	130
BR-A COMP	2	1	1	14.2	0.549	24.3	0.228	4.13	28.2	0.115	4.54	5.43	105
BR-A COMP	2	2	1	14.2	0.537	23.3	0.222	4.05	26.8	0.118	4.19	5.29	102
BR-A COMP	2	3	1	14.2	0.542	23.6	0.228	4.04	26.5	0.114	4.28	5.92	103
BR-A COMP	3		1	13.0	0.350	26.1	0.177	3.37	17.2	0.130	2.92	4.74	85.6
BR-A COMP	4		1	13.0	0.463	19.2	0.253	5.51	18.5	0.161	4.90	7.37	89.9
BR-A COMP	5		1	13.9	0.503	29.3	0.238	4.29	25.1	0.143	4.56	5.43	96.3
BR-B COMP	1		1	13.9	0.459	25.1	0.290	4.20	23.3	0.129	3.70	5.89	112
BR-B COMP	2		1	12.3	0.610	30.4	0.313	3.19	16.9	0.129	3.96	4.80	82.7
BR-B COMP	3		1	13.4	0.754	28.1	0.270	4.74	44.0	0.167	3.97	7.26	131
BR-B COMP	4		1	12.9	0.454	30.1	0.252	3.00	16.2	0.121	3.82	4.58	121
BR-B COMP	5		1	12.6	0.467	22.5	0.217	3.25	20.8	0.142	2.97	4.81	65.0
MDRS[b]	1		1	12.7	0.516	22.3	0.185	1.74	25.1	0.128	2.10	2.75	116
MDRS	2		1	14.1	0.220 U	19.3	0.169	1.51	13.2	0.119	1.72	1.68	80.7
MDRS	3		1	12.9	0.363	28.0	0.286	2.08	15.2	0.0902	2.43	2.73	89.1
MDRS	4		1	12.5	0.270	22.0	0.158	1.99	26.3	0.162	3.06	2.95	99.5
MDRS	5		1	12.7	0.531	29.3	0.253	1.42	28.2	0.131	2.37	2.92	117
Macoma Bkgd. Tissue	1	1	1	14.4	0.417	29.7	0.350	3.64	19.6	0.0913	6.51	1.56	156
Macoma Bkgd. Tissue	1	2	1	14.4	0.302	22.0	0.283	2.64	17.3	0.0749	5.49	1.22	130
Macoma Bkgd. Tissue	1	3	1	14.4	0.293	21.7	0.245	3.19	15.1	0.0727	5.25	1.19	113

(a) U Undetected at or above given concentration.
(b) MDRS Mud Dump Reference Site.

Table F.3. Quality Control Data for Metals Analysis of *M. nasuta* Tissue (Dry Weight)

Sediment Treatment	Replicate	Analytical Batch	Concentration (mg/kg dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Blank	1	1	0.22 U[a]	0.83 U	0.081 U	0.08 U	NA [b]	0.0011 U	0.25 U	0.08 U	NA
Blank	2	1	0.22 U	0.83 U	0.081 U	0.08 U	1.20 U	NA	0.25 U	0.08 U	1.37 U
Matrix Spike Results											
Macoma Bkgd. Tiss.	Mean	1	0.337	NA	0.293	NA	NA	0.0796	NA	NA	NA
Macoma Bkgd. Tiss.+ MS	1		1.16	NA	1.21	NA	NA	1.07	NA	NA	NA
Concentration Spiked			1.00	NS [c]	1.00	NS	NS	1.00	NS	NS	NS
Concentration Recovered			0.823	NA	0.917	NA	NA	0.986	NA	NA	NA
Percent Recovery			82	NA	92	NA	NA	99	NA	NA	NA
Macoma Bkgd. Tiss.	Mean	1	NA	24.5	NA	3.16	17.3	NA	5.75	1.32	133
Macoma Bkgd. Tiss.+ MS	2	1	NA	47.0	NA	27.9	39.3	NA	30.2	23.6	136
Concentration Spiked			NS	25.0	NS	25.0	25.0	NS	25.0	25.0	25.0
Concentration Recovered			NA	22.5	NA	24.7	22.0	NA	24.5	22.3	3.0
Percent Recovery			NA	90	NA	99	88	NA	98	89	12 [d]
Standard Reference Material											
1566a	1	1	1.56	13.9	3.99	1.14	67.7	0.0482	2.83	0.299	830
1566a	2	1	1.63	14.5	4.05	1.22	69.7	0.0585	2.90	0.333	856
1566a	3	1	1.62	14.3	4.08	1.15	68.8	0.0615	2.36	0.370	846
Mean			1.60	14.2	4.04	1.17	68.7	0.0561	2.70	0.334	844
Certified Value			1.68	14.0	4.15	1.43	66.3	0.0642	2.25	0.371	830
Range			±0.15	±1.2	±0.38	±0.46	±4.3	±0.0067	±0.44	±0.014	±57
Percent Difference	1		7	1	4	20	2	25 [e]	26 [e]	19	0
	2		3	4	2	15	5	9	29 [e]	10	3
	3		4	2	2	20	4	4	5	0	2

Table F.3. (contd)

Sediment Treatment	Replicate	Analytical Batch	Concentration (mg/kg dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Analytical Replicates											
BR-A COMP[f]	1	1	0.549	24.3	0.228	4.13	28.2	0.115	4.54	5.43	105
BR-A COMP	2	1	0.537	23.3	0.222	4.05	26.8	0.118	4.19	5.29	102
BR-A COMP	3	1	0.542	23.6	0.228	4.04	26.5	0.114	4.28	5.92	103
RSD (%)			1	2	2	1	3	1	4	6	1
Macoma Bkgd. Tissue	1	1	0.417	29.7	0.350	3.64	19.6	0.0913	6.51	1.56	156
Macoma Bkgd. Tissue	2	1	0.302	22.0	0.283	2.64	17.3	0.0749	5.49	1.22	130
Macoma Bkgd. Tissue	3	1	0.293	21.7	0.245	3.19	15.1	0.0727	5.25	1.19	113
RSD (%)			20	19	18	16	13	13	12	16	16

(a) U Undetected at or above given concentration.
(b) NA Not applicable.
(c) NS Not spiked.
(d) Outside quality control criteria (75-125%) for spike recovery.
(e) Outside SRM quality control criteria (≤20%).
(f) Sample randomly selected for use as a quality control sample in analytical batch.

Table F.4. Method Detection Limit Verification Study for Metals in *M. nasuta* Tissue

Sediment Treatment	Analytical Replicate	Analytical Batch	Concentration (mg/kg dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Macoma Bkgd. Tissue + Spike	1	1	1.11	21.5	1.20	2.95	14.8	1.07	5.30	2.08	109
Macoma Bkgd. Tissue + Spike	2	1	1.13	22.8	1.24	3.72	16.4	1.06	6.52	2.17	120
Macoma Bkgd. Tissue + Spike	3	1	1.14	22.4	1.25	3.31	15.7	1.07	6.97	2.08	114
Macoma Bkgd. Tissue + Spike	4	1	1.10	21.8	1.19	4.22	15.5	1.04	5.79	2.13	107
Detection Limit[a]			0.0829	2.66	0.134	2.48	2.99	0.0642	3.38	0.198	26.3

(a) Detection limit determined by multiplying the standard deviation of the four replicates by Students-t (4.54).

Table F.5. Pesticides and Polychlorinated Biphenyls (PCBs) in Tissue of *M. nasuta* (Wet Weight), Red Hook and Bay Ridge Channels

	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	3	4	5
Analytical Replicate					
Percent Dry Weight	14.2	13.3	12.9	12.9	16.4
Analytical Batch	2	2	1	1	2
Heptachlor[a]	0.97 U[b]	0.36 U	0.26 U	0.19 U	0.30 U
Aldrin	0.66 U	0.25 U	1.89	1.24	1.53
Heptachlor Epoxide	0.69 U	0.26 U	0.19 U	0.13 U	0.22 U
2,4'-DDE	1.36 U	0.51 U	0.37 U	0.26 U	0.43 U
Endosulfan I	0.94 U	0.35 U	0.59	0.18 U	0.30 U
α-Chlordane	0.99	0.62	0.30	0.10 U	0.69
Trans Nonachlor	0.76 U	0.28 U	0.20 U	0.15 U	0.24 U
4,4'-DDE	6.95	3.89	3.56	2.36	3.12
Dieldrin	2.69 U	1.00 U	1.74	1.24	1.48
2,4'-DDD	1.32 U	1.89	1.46	0.25 U	1.21
2,4'-DDT	0.93 U	0.35 U	0.25 U	0.18 U	0.29 U
4,4'-DDD	4.62	2.81	1.89	1.47	1.64
Endosulfan II	0.94 U	0.35 U	0.25 U	0.18 U	0.30 U
4,4'-DDT	4.49	1.90	1.45	0.15 U	1.24
Endosulfan Sulfate	1.32 U	0.49 U	0.35 U	0.25 U	0.41 U
PCB 8	1.84 U	0.68 U	0.49 U	0.35 U	0.58 U
PCB 18	5.46	1.84	4.69	3.06	2.41
PCB 28	7.58	6.30	6.86	5.28	5.09
PCB 52	1.69 U	5.30	6.40	4.41	4.97
PCB 49	0.96 U	2.88	3.86	2.44	2.78
PCB 44	0.37 U	0.14 U	0.10 U	0.07 U	0.12 U
PCB 66	0.79 U	4.72	5.87	3.83	4.35
PCB 101	2.71	2.65	3.39	2.20	2.54
PCB 87	1.31 U	1.05	1.21	0.77	0.81
PCB 118	1.59	1.56	2.38	1.53	1.36
PCB 184	0.96 U	0.36 U	0.26 U	0.18 U	0.30 U
PCB 153	2.29 U	1.79	1.54	1.06	0.96
PCB 105	1.51	0.32 U	1.22	0.99	1.01
PCB 138	1.39 U	0.87	1.35	0.95	0.75
PCB 187	1.08 U	0.40 U	0.29 U	0.21 U	0.34 U
PCB 183	0.96 U	0.36 U	0.26 U	0.18 U	0.30 U
PCB 128	0.55 U	0.20 U	0.27	0.19	0.17 U
PCB 180	1.96 U	0.73 U	0.53 U	0.38 U	0.62 U
PCB 170	0.92 U	0.34 U	0.25 U	0.18 U	0.29 U
PCB 195	0.66 U	0.25 U	0.18 U	0.13 U	0.21 U
PCB 206	1.12 U	0.42 U	0.21 U	0.21 U	0.35 U
PCB 209	1.02 U	0.38 U	0.20 U	0.20 U	0.32 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	57	64	75	51	67
PCB 198 (SIS)	52	61	67	88	70

Table F.5. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COMP
Replicate	1	1	1	2	3
Analytical Replicate	1	2	3		
Percent Dry Weight	14.0	NA	NA	14.2	13.0
Analytical Batch	1	1	1	1	1
Heptachlor	0.28 U	0.31 U	0.31 U	0.42	0.18 U
Aldrin	2.20	2.06	1.92	2.03	1.61
Heptachlor Epoxide	0.20 U	0.22 U	0.23 U	0.13 U	0.13 U
2,4'-DDE	0.40 U	0.43 U	0.44 U	0.26 U	0.26 U
Endosulfan I	0.28 U	0.30 U	0.31 U	0.18 U	0.18 U
α-Chlordane	0.77	0.93	0.70	0.76	0.59
Trans Nonachlor	0.22 U	0.24 U	0.25 U	0.15 U	0.14 U
4,4'-DDE	5.21	4.70	5.13	4.56	3.81
Dieldrin	1.95	1.80	1.61	0.83	0.67
2,4'-DDD	0.39 U	0.42 U	0.43 U	0.25 U	0.25 U
2,4'-DDT	0.28 U	0.30 U	0.30 U	0.18 U	0.18 U
4,4'-DDD	2.11	2.02	2.38	2.06	1.54
Endosulfan II	0.28 U	0.30 U	0.31 U	0.18 U	0.18 U
4,4'-DDT	1.85	1.72	2.17	1.51	1.25
Endosulfan Sulfate	0.39 U	0.42 U	0.43 U	0.25 U	0.25 U
PCB 8	0.54 U	1.03	0.60 U	0.69	0.34 U
PCB 18	2.37	2.13	2.14	2.75	2.41
PCB 28	5.58	5.04	4.98	6.16	4.46
PCB 52	6.20	5.39	5.03	6.14	4.65
PCB 49	4.46	3.89	3.76	4.43	3.26
PCB 44	0.11 U	0.12 U	0.12 U	3.39	0.07 U
PCB 66	6.33	5.81	5.50	6.54	4.51
PCB 101	4.57	4.00	3.85	4.54	3.39
PCB 87	0.77	0.90	0.96	1.17	0.77
PCB 118	3.40	2.79	3.07	3.23	2.48
PCB 184	0.28 U	0.31 U	0.31 U	0.18 U	0.18 U
PCB 153	3.46	2.70	3.20	3.21	2.54
PCB 105	0.26 U	0.28 U	0.28 U	1.05	0.16 U
PCB 138	2.48	2.02	2.29	2.33	1.82
PCB 187	0.32 U	0.41	0.35 U	0.71	0.52
PCB 183	0.28 U	0.31 U	0.31 U	0.32	0.22
PCB 128	0.16 U	0.29	0.18 U	0.37	0.23
PCB 180	0.69	0.62 U	0.70	0.72	0.57
PCB 170	0.31	0.29 U	0.30 U	0.20	0.19
PCB 195	0.20 U	0.21 U	0.22 U	0.13 U	0.12 U
PCB 206	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
PCB 209	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	47	74	43	74	75
PCB 198 (SIS)	39	64	35	124	129

Table F.5. (contd)

Sediment Treatment	Concentration (µg/kg wet wt)				
	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	13.0	13.9	13.9	12.3	13.4
Analytical Batch	1	1	1	1	1
Heptachlor	0.19 U	0.18 U	0.20 U	0.19 U	0.18 U
Aldrin	2.09	2.20	2.07	1.63	1.90
Heptachlor Epoxide	0.13 U	0.13 U	0.14 U	0.13 U	0.13 U
2,4'-DDE	0.26 U	0.26 U	0.28 U	0.26 U	0.26 U
Endosulfan I	0.18 U	0.18 U	0.19 U	0.18 U	0.18 U
α-Chlordane	0.76	0.86	0.85	0.84	0.80
Trans Nonachlor	0.23	0.27	0.16 U	0.15 U	0.14 U
4,4'-DDE	4.97	4.94	7.99	6.85	7.07
Dieldrin	1.77	0.91	2.17	1.23	1.89
2,4'-DDD	1.10	0.25 U	1.31	0.25 U	1.24
2,4'-DDT	0.18 U	0.18 U	0.19 U	0.18 U	0.18 U
4,4'-DDD	2.42	2.05	4.14	2.80	3.45
Endosulfan II	0.18 U	0.18 U	0.17	0.51	0.24
4,4'-DDT	0.15 U	1.65	0.16 U	1.42	1.40
Endosulfan Sulfate	0.25 U	0.25 U	0.27 U	0.25 U	0.25 U
PCB 8	0.35 U	0.34 U	0.38 U	0.35 U	0.89
PCB 18	2.19	3.18	6.01	5.16	6.27
PCB 28	6.75	6.69	7.29	6.36	7.86
PCB 52	6.17	6.97	8.55	7.04	7.82
PCB 49	4.57	4.97	4.73	3.60	4.40
PCB 44	3.00	3.11	4.65	3.19	4.03
PCB 66	7.20	7.33	8.48	6.38	7.79
PCB 101	4.89	5.22	5.56	4.50	4.82
PCB 87	1.34	1.17	1.85	1.46	1.62
PCB 118	3.44	3.61	4.16	3.27	3.68
PCB 184	0.18 U	0.18 U	0.20 U	0.18 U	0.18 U
PCB 153	3.37	3.42	3.16	2.65	2.76
PCB 105	1.12	1.17	1.50	0.17 U	1.34
PCB 138	2.48	2.52	2.63	2.14	2.34
PCB 187	0.79	0.80	0.70	0.57	0.60
PCB 183	0.18 U	0.34	0.20 U	0.30	0.38
PCB 128	0.42	0.45	0.46	0.39	0.41
PCB 180	0.80	0.76	0.77	0.60	0.67
PCB 170	0.35	0.27	0.25	0.18 U	0.24
PCB 195	0.13 U	0.12 U	0.14 U	0.13 U	0.12 U
PCB 206	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
PCB 209	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	49	54	47	80	57
PCB 198 (SIS)	80	91	74	129	95

Table F.5. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	BR-B COMP	BR-B COMP	MDRS[c]	MDRS	MDRS
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	12.9	12.6	12.7	14.1	12.9
Analytical Batch	1	1	1	1	1
Heptachlor	0.18 U	0.18 U	0.19 U	0.18 U	0.20
Aldrin	1.91	1.90	0.53	0.12 U	0.44
Heptachlor Epoxide	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
2,4'-DDE	0.26 U	0.26 U	0.55	0.66	0.60
Endosulfan I	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
α-Chlordane	0.93	1.04	0.10 U	0.09 U	0.36
Trans Nonachlor	0.14 U	0.14 U	0.15 U	0.14 U	0.15 U
4,4'-DDE	7.32	7.39	0.19 U	1.32	0.78
Dieldrin	2.19	1.35	0.52 U	0.70	1.29
2,4'-DDD	1.63	1.05	0.25 U	0.25 U	0.25 U
2,4'-DDT	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
4,4'-DDD	2.98	4.27	0.26 U	0.26 U	0.26 U
Endosulfan II	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
4,4'-DDT	0.15 U	1.93	0.15 U	0.15 U	0.15 U
Endosulfan Sulfate	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB 8	0.34 U	0.34 U	0.45	0.46	0.35 U
PCB 18	6.29	5.92	0.10 U	0.10 U	0.10 U
PCB 28	7.97	7.90	0.31	0.39	0.27
PCB 52	7.95	8.29	0.71	0.32 U	0.38
PCB 49	4.52	4.61	0.18 U	0.18 U	0.18 U
PCB 44	3.66	4.22	0.07 U	0.07 U	0.07 U
PCB 66	7.73	7.68	0.15 U	0.15 U	0.15 U
PCB 101	5.12	5.00	0.13 U	0.24	0.23
PCB 87	1.72	1.60	0.25 U	0.25 U	0.25 U
PCB 118	3.61	3.42	0.19 U	0.19 U	0.21
PCB 184	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
PCB 153	2.65	2.60	0.44 U	0.43 U	0.44 U
PCB 105	1.30	1.22	0.17 U	0.16 U	0.17 U
PCB 138	2.24	2.16	0.27 U	0.26 U	0.27 U
PCB 187	0.57	0.20 U	0.21 U	0.20 U	0.21 U
PCB 183	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
PCB 128	0.43	0.60	0.11 U	0.10 U	0.11 U
PCB 180	0.66	0.37 U	0.38 U	0.37 U	0.38 U
PCB 170	0.20	0.19	0.18 U	0.17 U	0.18 U
PCB 195	0.12 U	0.12 U	0.13 U	0.12 U	0.13 U
PCB 206	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
PCB 209	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	51	76	94	58	51
PCB 198 (SIS)	85	121	162 [d]	101	86

Table F.5. (contd)

	Concentration (µg/kg wet wt)		
Sediment Treatment	MDRS	MDRS	*Macoma* Bkgd. Tissue
Replicate	4	5	1
Analytical Replicate			
Percent Dry Weight	12.5	12.7	14.4
Analytical Batch	1	1	1
Heptachlor	0.19 U	0.20 U	0.18 U
Aldrin	0.13 U	0.57	0.12 U
Heptachlor Epoxide	0.13 U	0.14 U	0.13 U
2,4'-DDE	0.26 U	0.28 U	0.26 U
Endosulfan I	0.18 U	0.19 U	0.18 U
α-Chlordane	0.10 U	0.49	0.09 U
Trans Nonachlor	0.15 U	0.15 U	0.14 U
4,4'-DDE	0.85	0.90	0.18 U
Dieldrin	0.52 U	0.72	0.97
2,4'-DDD	0.25 U	0.27 U	0.25 U
2,4'-DDT	0.18 U	0.19 U	0.18 U
4,4'-DDD	0.26 U	0.28 U	0.26 U
Endosulfan II	0.18 U	0.19 U	0.18 U
4,4'-DDT	0.15 U	0.16 U	0.15 U
Endosulfan Sulfate	0.25 U	0.27 U	0.25 U
PCB 8	0.35 U	0.67	0.34 U
PCB 18	0.10 U	0.11 U	0.10 U
PCB 28	0.11 U	0.12 U	0.11 U
PCB 52	0.32 U	0.52	0.32 U
PCB 49	0.18 U	0.19 U	0.18 U
PCB 44	0.07 U	0.07 U	0.07 U
PCB 66	0.15 U	0.16 U	0.15 U
PCB 101	0.13 U	0.24	0.13 U
PCB 87	0.25 U	0.27 U	0.25 U
PCB 118	0.19 U	0.20 U	0.19 U
PCB 184	0.18 U	0.19 U	0.18 U
PCB 153	0.44 U	0.46 U	0.43 U
PCB 105	0.17 U	0.18 U	0.16 U
PCB 138	0.27 U	0.29	0.26 U
PCB 187	0.21 U	0.22 U	0.20 U
PCB 183	0.18 U	0.19 U	0.18 U
PCB 128	0.11 U	0.11 U	0.10 U
PCB 180	0.38 U	0.40 U	0.37 U
PCB 170	0.18 U	0.19 U	0.17 U
PCB 195	0.13 U	0.13 U	0.12 U
PCB 206	0.21 U	0.21 U	0.21 U
PCB 209	0.20 U	0.20 U	0.20 U
Surrogate Recoveries (%)			
PCB 103 (SIS)	61	47	47
PCB 198 (SIS)	108	74	74

(a) Target detection limits are 0.4 µg/kg for all analytes.
(b) U Undetected at or above given concentration.
(c) MDRS Mud Dump Reference Site.
(d) Outside quality control criteria (30-150%) for surrogate recovery.

Table F.6. Pesticides and Polychlorinated Biphenyls (PCBs) in Tissue of *M. nasuta* (Dry Weight), Red Hook and Bay Ridge Channels

	Concentration (µg/kg dry wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	3	4	5
Analytical Replicate					
Percent Dry Weight	14.2	13.3	12.9	12.9	16.4
Analytical Batch	2	2	1	1	2
Heptachlor	6.8 U[(a)]	2.7 U	2.0 U	1.5 U	1.8 U
Aldrin	4.6 U	1.9 U	14.7	9.61	9.33
Heptachlor Epoxide	4.9 U	2.0 U	1.5 U	1.0 U	1.3 U
2,4'-DDE	9.58 U	3.8 U	2.9 U	2.0 U	2.6 U
Endosulfan I	6.6 U	2.6 U	4.6	1.4 U	1.8 U
α-Chlordane	7.0	4.7	2.3	0.78 U	4.2
Trans Nonachlor	5.4 U	2.1 U	1.6 U	1.2 U	1.5 U
4,4'-DDE	48.9	29.2	27.6	18.3	19.0
Dieldrin	18.9 U	7.52 U	13.5	9.61	9.02
2,4'-DDD	9.30 U	14.2	11.3	1.9 U	7.38
2,4'-DDT	6.5 U	2.6 U	1.9 U	1.4 U	1.8 U
4,4'-DDD	32.5	21.1	14.7	11.4	10.0
Endosulfan II	6.6 U	2.6 U	1.9 U	1.4 U	1.8 U
4,4'-DDT	31.6	14.3	11.2	1.2 U	7.56
Endosulfan Sulfate	9.30 U	3.7 U	2.7 U	1.9 U	2.5 U
PCB 8	13.0 U	5.1 U	3.8 U	2.7 U	3.5 U
PCB 18	38.5	13.8	36.4	23.7	14.7
PCB 28	53.4	47.4	53.2	40.9	31.0
PCB 52	11.9 U	39.8 U	49.6	34.2	30.3
PCB 49	6.8 U	21.7	29.9	18.9	17.0
PCB 44	2.6 U	1.1 U	0.78 U	0.5 U	0.73 U
PCB 66	5.6 U	35.5	45.5	29.7	26.5
PCB 101	19.1	19.9	26.3	17.1	15.5
PCB 87	9.23 U	7.89	9.38	6.0	4.9
PCB 118	11.2	11.7	18.4	11.9	8.29
PCB 184	6.8 U	2.7 U	2.0 U	1.4 U	1.8 U
PCB 153	16.1 U	13.5	11.9	8.22	5.9
PCB 105	10.6	2.4 U	9.46	7.7	6.16
PCB 138	9.79 U	6.5	10.5	7.4	4.6
PCB 187	7.61 U	3.0 U	2.2 U	1.6 U	2.1 U
PCB 183	6.8 U	2.7 U	2.0 U	1.4 U	1.8 U
PCB 128	3.9 U	1.5 U	2.1	1.5	1.0 U
PCB 180	13.8 U	5.5 U	4.1 U	2.9 U	3.8 U
PCB 170	6.5 U	2.6 U	1.9 U	1.4 U	1.8 U
PCB 195	4.6 U	1.9 U	1.4 U	1.0 U	1.3 U
PCB 206	7.89 U	3.2 U	1.6 U	1.6 U	2.1 U
PCB 209	7.18 U	2.9 U	1.6 U	1.6 U	2.0 U

Table F.6. (contd)

	Concentration (µg/kg dry wt)				
ediment Treatment	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COMP
Replicate	1	1	1	2	3
Analytical Replicate	1	2	3		
Percent Dry Weight	14.0	NA	NA	14.2	13.0
Analytical Batch	1	1		1	1
Heptachlor	2.0 U	2.2 U	2.2 U	3.0	1.4 U
Aldrin	15.7	14.7	13.7	14.3	12.4
Heptachlor Epoxide	1.4 U	1.6 U	1.6 U	0.92 U	1.0 U
2,4'-DDE	2.9 U	3.1 U	3.1 U	1.8 U	2.0 U
Endosulfan I	2.0 U	2.1 U	2.2 U	1.3 U	1.4 U
α-Chlordane	5.5	6.6	5.0	5.35	4.5
Trans Nonachlor	1.6 U	1.7 U	1.8 U	1.1 U	1.1 U
4,4'-DDE	37.2	33.6	36.6	32.1	29.3
Dieldrin	13.9	12.9	11.5	5.8	5.2
2,4'-DDD	2.8 U	3.0 U	3.1 U	1.8 U	1.9 U
2,4'-DDT	2.0 U	2.1 U	2.1 U	1.3 U	1.4 U
4,4'-DDD	15.1	14.4	17.0	14.5	11.8
Endosulfan II	2.0 U	2.1 U	2.2 U	1.3 U	1.4 U
4,4'-DDT	13.2	12.3	15.5	10.6	9.62
Endosulfan Sulfate	2.8 U	3.0 U	3.1 U	1.8 U	1.9 U
PCB 8	3.9 U	7.36	4.3 U	4.9	2.6 U
PCB 18	16.9	15.2	15.3	19.4	18.5
PCB 28	39.9	36.0	35.6	43.4	34.3
PCB 52	44.3	38.5	35.9	43.2	35.8
PCB 49	31.9	27.8	26.9	31.2	25.1
PCB 44	0.79 U	0.86 U	0.86 U	23.9	0.5 U
PCB 66	45.2	41.5	39.3	46.1	34.7
PCB 101	32.6	28.6	27.5	32.0	26.1
PCB 87	5.5	6.4	6.9	8.24	5.9
PCB 118	24.3	19.9	21.9	22.7	19.1
PCB 184	2.0 U	2.2 U	2.2 U	1.3 U	1.4 U
PCB 153	24.7	19.3	22.9	22.6	19.5
PCB 105	1.86 U	2.0 U	2.0 U	7.39	1.2 U
PCB 138	17.7	14.4	16.4	16.4	14.0
PCB 187	2.3 U	2.9	2.5 U	5.0	4.0
PCB 183	2.0 U	2.2 U	2.2 U	2.3	1.7
PCB 128	1.1 U	2.1	1.29 U	2.6	1.8
PCB 180	4.9	4.4 U	5.0	5.1	4.4
PCB 170	2.2	2.1 U	2.1 U	1.4	1.5
PCB 195	1.4 U	1.5 U	1.6 U	0.92 U	0.92 U
PCB 206	1.5 U	1.5 U	1.5 U	1.5 U	1.6 U
PCB 209	1.4 U	1.4 U	1.4 U	1.4 U	1.5 U

Table F.6. (contd)

	Concentration (µg/kg dry wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	13.0	13.9	13.9	12.3	13.4
Analytical Batch	1	1	1	1	1
Heptachlor	1.5 U	1.3 U	1.4 U	1.5 U	1.3 U
Aldrin	16.1	15.8	14.9	13.3	14.2
Heptachlor Epoxide	1.0 U	0.94 U	1.0 U	1.1 U	0.97 U
2,4'-DDE	2.0 U	1.87 U	2.0 U	2.1 U	1.9 U
Endosulfan I	1.4 U	1.3 U	1.4 U	1.5 U	1.3 U
α-Chlordane	5.8	6.2	6.1	6.8	6.0
Trans Nonachlor	1.8	1.9	1.2 U	1.2 U	1.0 U
4,4'-DDE	38.2	35.5	57.5	55.7	52.8
Dieldrin	13.6	6.5	15.6	10.0	14.1
2,4'-DDD	8.46	1.8 U	9.42	2.0 U	9.25
2,4'-DDT	1.4 U	1.3 U	1.4 U	1.5 U	1.3 U
4,4'-DDD	18.6	14.7	29.8	22.8	25.7
Endosulfan II	1.4 U	1.3 U	1.2	4.1	1.8
4,4'-DDT	1.2 U	11.9	1.2 U	11.5	10.4
Endosulfan Sulfate	1.9 U	1.8 U	1.9 U	2.0 U	1.9 U
PCB 8	2.7 U	2.5 U	2.7 U	2.8 U	6.6
PCB 18	16.8	22.9	43.2	42.0	46.8
PCB 28	51.9	48.1	52.4	51.7	58.7
PCB 52	47.5	50.1	61.5	57.2	58.4
PCB 49	35.2	35.8	34.0	29.3	32.8
PCB 44	23.1	22.4	33.5	25.9	30.1
PCB 66	55.4	52.7	61.0	51.9	58.1
PCB 101	37.6	37.6	40.0	36.6	36.0
PCB 87	10.3	8.42	13.3	11.9	12.1
PCB 118	26.5	26.0	29.9	26.6	27.5
PCB 184	1.4 U	1.3 U	1.4 U	1.5 U	1.3 U
PCB 153	25.9	24.6	22.7	21.5	20.6
PCB 105	8.62	8.42	10.8	1.4 U	10.0
PCB 138	19.1	18.1	18.9	17.4	17.5
PCB 187	6.1	5.8	5.0	4.6	4.5
PCB 183	1.4 U	2.4	1.44 U	2.4	2.8
PCB 128	3.2	3.2	3.3	3.2	3.1
PCB 180	6.2	5.5	5.5	4.9	5.0
PCB 170	2.7	1.9	1.8	1.5 U	1.8
PCB 195	1.0 U	0.86 U	1.0 U	1.1 U	0.90 U
PCB 206	1.6 U	1.5 U	1.5 U	1.7 U	1.6 U
PCB 209	1.5 U	1.4 U	1.4 U	1.6 U	1.5 U

Table F.6. (contd)

	Concentration (µg/kg dry wt)				
ediment Treatment	BR-B COMP	BR-B COMP	MDRS[b]	MDRS	MDRS
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	12.9	12.6	12.7	14.1	12.9
Analytical Batch	1	1		1	1
Heptachlor	1.4 U	1.4 U	1.5 U	1.3 U	1.6
Aldrin	14.8	15.1	4.2	0.85 U	3.4
Heptachlor Epoxide	1.0 U	1.0 U	1.0 U	0.92 U	1.0 U
2,4'-DDE	2.0 U	2.1 U	4.3	4.7	4.7
Endosulfan I	1.4 U	1.4 U	1.4 U	1.3 U	1.4 U
α-Chlordane	7.2	8.25	0.79 U	0.64 U	2.8
Trans Nonachlor	1.1 U	1.1 U	1.2 U	0.99 U	1.2 U
4,4'-DDE	56.7	58.7	1.50 U	9.36	6.0
Dieldrin	17.0	10.7	4.1 U	5.0	10.0
2,4'-DDD	12.6	8.33	2.0 U	1.8 U	1.9 U
2,4'-DDT	1.4 U	1.4 U	1.4 U	1.3 U	1.4 U
4,4'-DDD	23.1	33.9	2.0 U	1.8 U	2.0 U
Endosulfan II	1.4 U	1.4 U	1.4 U	1.3 U	1.40 U
4,4'-DDT	1.2 U	15.30	1.2 U	1.1 U	1.16 U
Endosulfan Sulfate	1.9 U	2.0 U	2.0 U	1.8 U	1.94 U
PCB 8	2.6 U	2.7 U	3.5	3.3	2.7 U
PCB 18	48.8	47.0	0.79 U	0.71 U	0.78 U
PCB 28	61.8	62.7	2.4	2.8	2.1
PCB 52	61.6	65.8	5.6	2.3 U	2.9
PCB 49	35.0	36.6	1.4 U	1.3 U	1.4 U
PCB 44	28.4	33.5	0.6 U	0.5 U	0.5 U
PCB 66	59.9	61.0	1.2 U	1.1 U	1.2 U
PCB 101	39.7	39.7	1.0 U	1.7	1.8
PCB 87	13.3	12.7	2.0 U	1.8 U	1.9 U
PCB 118	28.0	27.1	1.5 U	1.4 U	1.6
PCB 184	1.4 U	1.4 U	1.4 U	1.3 U	1.4 U
PCB 153	20.5	20.6	3.5 U	3.0 U	3.4 U
PCB 105	10.1	9.68	1.3 U	1.1 U	1.3 U
PCB 138	17.4	17.1	2.1 U	1.8 U	2.1 U
PCB 187	4.4	1.6 U	1.7 U	1.4 U	1.6 U
PCB 183	1.40 U	1.4 U	1.4 U	1.3 U	1.4 U
PCB 128	3.3	4.8	0.87 U	0.71 U	0.85 U
PCB 180	5.1	2.9 U	3.0 U	2.6 U	2.9 U
PCB 170	1.6	1.5	1.4 U	1.2 U	1.4 U
PCB 195	0.93 U	0.95 U	1.0 U	0.85 U	1.0 U
PCB 206	1.6 U	1.7 U	1.7 U	1.5 U	1.6 U
PCB 209	1.6 U	1.6 U	1.6 U	1.4 U	1.6 U

Table F.6. (contd)

	Concentration (µg/kg dry wt)		
Sediment Treatment	MDRS	MDRS	*Macoma* Bkgd. Tissue
Replicate	4	5	1
Analytical Replicate			
Percent Dry Weight	12.5	12.7	14.4
Analytical Batch	1	1	1
Heptachlor	1.5 U	1.6 U	1.3 U
Aldrin	1.0 U	4.5	0.83 U
Heptachlor Epoxide	1.0 U	1.1 U	0.90 U
2,4'-DDE	2.1 U	2.2 U	1.81 U
Endosulfan I	1.4 U	1.5 U	1.3 U
α-Chlordane	0.80 U	3.9	0.63 U
Trans Nonachlor	1.2 U	1.2 U	0.97 U
4,4'-DDE	6.8	7.1	1.3 U
Dieldrin	4.2 U	5.7	6.7
2,4'-DDD	2.0 U	2.1 U	1.7 U
2,4'-DDT	1.4 U	1.5 U	1.3 U
4,4'-DDD	2.1 U	2.2 U	1.8 U
Endosulfan II	1.4 U	1.5 U	1.3 U
4,4'-DDT	1.2 U	1.3 U	1.0 U
Endosulfan Sulfate	2.0 U	2.1 U	1.7 U
PCB 8	2.8 U	5.3	2.4 U
PCB 18	0.80 U	0.87 U	0.69 U
PCB 28	0.88 U	0.94 U	0.76 U
PCB 52	2.6 U	4.1	2.2 U
PCB 49	1.4 U	1.5 U	1.3 U
PCB 44	0.6 U	0.6 U	0.5 U
PCB 66	1.2 U	1.3 U	1.0 U
PCB 101	1.0 U	1.9	0.90 U
PCB 87	2.0 U	2.1 U	1.7 U
PCB 118	1.5 U	1.6 U	1.3 U
PCB 184	1.4 U	1.5 U	1.3 U
PCB 153	3.5 U	3.6 U	3.0 U
PCB 105	1.4 U	1.4 U	1.1 U
PCB 138	2.2 U	2.3	1.8 U
PCB 187	1.7 U	1.7 U	1.4 U
PCB 183	1.4 U	1.5 U	1.3 U
PCB 128	0.88 U	0.87 U	0.69 U
PCB 180	3.0 U	3.1 U	2.6 U
PCB 170	1.4 U	1.5 U	1.2 U
PCB 195	1.0 U	1.0 U	0.83 U
PCB 206	1.7 U	1.7 U	1.5 U
PCB 209	1.6 U	1.6 U	1.4 U

(a) U Undetected at or above given concentration.
(b) MDRS Mud Dump Reference Site.

Table F.7. Quality Control Data for Pesticide and Polychlorinated Biphenyl (PCB) Analysis of *M. nasuta* Tissue (Wet Weight)

Matrix Spike Results	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP[a]	RH COMP (MS)	Concentration		Percent
Replicate	3	3	Spiked	Recovered	Recovery
Analytical Replicate	1	1			
Analytical Batch	1	1	1		
Heptachlor	0.26 U[b]	3.45	3.30	3.45	105
Aldrin	1.89	4.53	3.30	2.64	80
Heptachlor Epoxide	0.19 U	2.90	3.30	2.90	88
2,4'-DDE	0.37 U	NA [c]	NS[d]	NA	NA
Endosulfan I	0.59	3.28	3.30	2.69	82
α-Chlordane	0.30	2.94	NS	NA	NA
Trans Nonachlor	0.20 U	NA	NS	NA	NA
4,4'-DDE	3.56	5.20	3.30	1.64	50
Dieldrin	1.74	4.48	3.30	2.74	83
2,4'-DDD	1.46	NA	NS	NA	NA
2,4'-DDT	0.25 U	NA	NS	NA	NA
4,4'-DDD	1.89	5.89	3.30	4.00	121 [e]
Endosulfan II	0.25 U	3.21	3.30	3.21	97
4,4'-DDT	1.45	3.49	3.30	2.04	62
Endosulfan Sulfate	0.35 U	3.25	3.30	3.25	98
PCB 8	0.49 U	NA	NS	NA	NA
PCB 18	4.69	3.81	NS	NA	NA
PCB 28	6.86	12.5	4.21	5.64	134 [e]
PCB 52	6.40	15.1	8.78	8.70	99
PCB 49	3.86	3.21	NS	NA	NA
PCB 44	0.10 U	NA	NS	NA	NA
PCB 66	5.87	4.89	NS	NA	NA
PCB 101	3.39	9.03	5.96	5.64	95
PCB 87	1.21	0.95	NS	NA	NA
PCB 118	2.38	2.08	NS	NA	NA
PCB 184	0.26 U	NS	NS	NA	NA
PCB 153	1.54	5.41	3.48	3.87	111
PCB 105	1.22	1.12	NS	NA	NA
PCB 138	1.35	4.45	2.69	3.10	115
PCB 187	0.29 U	NS	NS	NA	NA
PCB 183	0.26 U	NS	NS	NA	NA
PCB 128	0.27	0.26	NS	NA	NA
PCB 180	0.53 U	NS	NS	NA	NA
PCB 170	0.25 U	NS	NS	NA	NA
PCB 195	0.18 U	NS	NS	NA	NA
PCB 206	0.21 U	NS	NS	NA	NA
PCB 209	0.20 U	NS	NS	NA	NA
Surrogate Recoveries (%)					
PCB 103 (SIS)	75	81	NA	NA	NA
PCB 198 (SIS)	67	69	NA	NA	NA

Table F.7. (contd)

Matrix Spike Results	Concentration (µg/kg wet wt)				
Sediment Treatment	*Macoma* Bkgd.	*Macoma* Bkgd.(MS)	Concentration		Percent
Replicate	1	1	Spiked	Recovered	Recovery
Analytical Replicate	1	1			
Analytical Batch	2	2	2		
Heptachlor	0.19 U	0.50	0.472	0.50	106
Aldrin	0.13 U	0.78	0.472	0.78	165 (e)
Heptachlor Epoxide	0.13 U	0.52	0.472	0.52	110
2,4'-DDE	0.26 U	0.63	0.472	0.63	133 (e)
Endosulfan I	0.18 U	0.18 U	NS	NA	NA
α-Chlordane	0.10 U	0.71	0.472	0.71	150 (e)
Trans Nonachlor	0.15 U	0.30	0.472	0.30	64
4,4'-DDE	0.75	1.12	0.472	0.37	78
Dieldrin	0.67	0.91	0.472	0.24	51
2,4'-DDD	0.25 U	0.73	0.472	0.73	155 (e)
2,4'-DDT	0.18 U	0.62	0.472	0.62	131 (e)
4,4'-DDD	0.79	0.87	0.472	0.08	17 (e)
Endosulfan II	0.18 U	0.18 U	NS	0.18	NA
4,4'-DDT	0.15 U	0.94	0.472	0.94	199 (e)
Endosulfan Sulfate	0.25 U	0.25 U	NS	NA	NA
PCB 8	0.86	1.05	0.816	0.19	23
PCB 18	0.10 U	1.02	0.816	1.02	125 (e)
PCB 28	0.11 U	1.38	0.816	1.38	169 (e)
PCB 52	0.32 U	1.09	0.816	1.09	134 (e)
PCB 49	0.18 U	0.18 U	NS	NA	NA
PCB 44	0.07 U	2.28	0.816	2.28	279 (e)
PCB 66	0.15 U	1.17	0.816	1.17	143 (e)
PCB 101	0.13 U	0.88	0.816	0.88	108
PCB 87	0.25 U	1.10	0.816	1.10	135 (e)
PCB 118	0.19 U	0.93	0.816	0.93	114
PCB 184	0.18 U	0.18 U	NS	NA	NA
PCB 153	0.43 U	0.73	0.816	0.73	89
PCB 105	0.16 U	0.79	0.816	0.79	97
PCB 138	0.26 U	0.81	0.816	0.81	99
PCB 187	0.20 U	0.76	0.816	0.76	93
PCB 183	0.18 U	0.18 U	NS	NA	NA
PCB 128	0.10 U	0.72	0.816	0.72	88
PCB 180	0.37 U	0.76	0.816	0.76	93
PCB 170	0.17 U	0.70	0.816	0.70	86
PCB 195	0.12 U	0.73	0.816	0.73	89
PCB 206	0.21 U	0.62	0.816	0.62	76
PCB 209	0.19 U	0.59	0.816	0.59	72
Surrogate Recoveries (%)					
PCB 103 (SIS)	75	89	NA	NA	NA
PCB 198 (SIS)	62	73	NA	NA	NA

Table F.7. (contd)

Analytical Replicates	Concentration (µg/kg wet wt)			
Sediment Treatment	BR-A COMP[a]	BR-A COMP	BR-A COMP	RSD
Replicate	1	1	1	(%)
Analytical Replicate	1	2	3	
Analytical Batch	1	1	1	
Heptachlor	0.28 U	0.31 U	0.31 U	NA
Aldrin	2.20	2.06	1.92	7
Heptachlor Epoxide	0.20 U	0.22 U	0.23 U	NA
2,4'-DDE	0.40 U	0.43 U	0.44 U	NA
Endosulfan I	0.28 U	0.30 U	0.31 U	NA
α-Chlordane	0.77	0.93	0.70	15
Trans Nonachlor	0.22 U	0.24 U	0.25 U	NA
4,4'-DDE	5.21	4.70	5.13	5
Dieldrin	1.95	1.80	1.61	10
2,4'-DDD	0.39 U	0.42 U	0.43 U	NA
2,4'-DDT	0.28 U	0.30 U	0.30 U	NA
4,4'-DDD	2.11	2.02	2.38	9
Endosulfan II	0.28 U	0.30 U	0.31 U	NA
4,4'-DDT	1.85	1.72	2.17	12
Endosulfan Sulfate	0.39 U	0.42 U	0.43 U	NA
PCB 8	0.54 U	1.03	0.60 U	NA
PCB 18	2.37	2.13	2.14	6
PCB 28	5.58	5.04	4.98	6
PCB 52	6.20	5.39	5.03	11
PCB 49	4.46	3.89	3.76	9
PCB 44	0.11 U	0.12 U	0.12 U	NA
PCB 66	6.33	5.81	5.50	7
PCB 101	4.57	4.00	3.85	9
PCB 87	0.77	0.90	0.96	11
PCB 118	3.40	2.79	3.07	10
PCB 184	0.28 U	0.31 U	0.31 U	NA
PCB 153	3.46	2.70	3.20	12
PCB 105	0.26 U	0.28 U	0.28 U	NA
PCB 138	2.48	2.02	2.29	10
PCB 187	0.32 U	0.41	0.35 U	NA
PCB 183	0.28 U	0.31 U	0.31 U	NA
PCB 128	0.16 U	0.29	0.18 U	NA
PCB 180	0.69	0.62 U	0.70	NA
PCB 170	0.31	0.29 U	0.30 U	NA
PCB 195	0.20 U	0.21 U	0.22 U	NA
PCB 206	0.21 U	0.21 U	0.21 U	NA
PCB 209	0.20 U	0.20 U	0.20 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	47	74	43	NA
PCB 198 (SIS)	39	64	35	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NA Not applicable.
(d) NS Not spiked.
(e) Outside quality control criteria (50-120%) for spike recovery.

Table F.8. Method Detection Limit Verification Study for Pesticides and Polychlorinated Biphenyls (PCBs) in *M. nasuta* Tissue

Sediment Treatment	Concentration (µg/kg wet wt) *Macoma* Bkgd + Spike	*Macoma* Bkgd + Spike	*Macoma* Bkgd + Spike	*Macoma* Bkgd + Spike			
Analytical Replicate	1	2	3	4	Mean	Standard Deviation	MDL[a]
Analytical Batch	2	2	2	2			
Heptachlor	0.38	0.50	0.52	0.53	0.48	0.07	0.32
Aldrin	0.81	0.78	0.61	0.79	0.75	0.09	0.41
Heptachlor Epoxide	0.59	0.52	0.56	0.56	0.56	0.03	0.14
2,4'-DDE	0.87	0.63	0.83	0.83	0.79	0.11	0.50
Endosulfan I	ND[b]	ND	ND	ND	NA[c]	NA	NA
a-Chlordane	0.56	0.71	0.43	0.56	0.57	0.11	0.50
Trans Nonachlor	0.28	0.30	0.31	0.31	0.30	0.01	0.05
4,4'-DDE	1.02	1.12	1.25	1.13	1.13	0.09	0.41
Dieldrin	0.97	0.91	1.67	1.44	1.25	0.37	1.68
2,4'-DDD	0.68	0.73	0.55	0.57	0.63	0.09	0.41
2,4'-DDT	0.61	0.62	0.69	0.64	0.64	0.04	0.18
4,4'-DDD	0.93	0.87	0.94	1.00	0.94	0.05	0.23
Endsulfan II	ND	ND	ND	ND	NA	NA	NA
4,4'-DDT	1.01	0.94	0.90	0.95	0.95	0.05	0.23
Endosulfan Sulfate	ND	ND	ND	ND	NA	NA	NA
PCB 8	1.11	1.05	1.56	1.08	1.20	0.24	1.09
PCB 18	1.05	1.02	1.04	1.06	1.04	0.02	0.09
PCB 28	1.13	1.38	1.37	1.53	1.35	0.17	0.77
PCB 52	1.07	1.09	0.84	0.95	0.99	0.12	0.54
PCB 49	ND	ND	0.19	ND	NA	NA	NA
PCB 44	1.90	2.28	2.31	2.04	2.13	0.20	0.91
PCB 66	1.19	1.17	1.24	1.20	1.20	0.03	0.14
PCB 101	0.99	0.88	0.93	0.96	0.94	0.05	0.23
PCB 87	0.84	1.10	1.19	1.09	1.06	0.15	0.68
PCB 118	0.99	0.93	0.94	0.91	0.94	0.03	0.14
PCB 184	ND	ND	ND	ND	NA	NA	NA
PCB 153	0.78	0.73	0.77	0.69	0.74	0.04	0.18
PCB 105	0.85	0.79	0.84	0.81	0.82	0.03	0.14
PCB 138	0.88	0.81	0.83	0.80	0.83	0.04	0.18
PCB 187	0.87	0.76	0.77	0.75	0.79	0.06	0.27
PCB 183	ND	ND	ND	ND	NA	NA	NA
PCB 128	0.68	0.72	0.65	0.64	0.67	0.04	0.18
PCB 180	0.81	0.76	0.76	0.78	0.78	0.02	0.09
PCB 170	0.76	0.70	0.73	0.69	0.72	0.03	0.14
PCB 195	0.73	0.73	0.77	0.74	0.74	0.02	0.09
PCB 206	0.69	0.62	0.67	0.64	0.66	0.03	0.14
PCB 209	0.62	0.59	0.64	0.60	0.61	0.02	0.09

(a) Method detection limit calculated by multiplying the standard deviation of the four replicates by Students-t (4.54).
(b) ND Not detected.
(c) NA Not applicable.

Table F.9. Polynuclear Aromatic Hydrocarbons (PAHs) in Tissue of *M. nasuta* (Wet Weight), Red Hook and Bay Ridge Channels

	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	3	4	5
Analytical Replicate					
Percent Dry Weight	14.2	13.3	12.9	12.9	16.4
Analytical Batch	2	2	1	1	2
1,4-Dichlorobenzene[a]	9.73 U[b]	3.62 U	2.61	1.86 U	3.06 U
Naphthalene	14.8	9.92	7.80	4.78	6.19
Acenaphthylene	6.20 [c]	3.99 [c]	4.00	2.77 [c]	3.05 [c]
Acenaphthene	18.9	28.3	39.5	11.5	26.0
Fluorene	31.5	31.3	48.4	18.0	35.3
Dibenzothiophene	35.0	28.3	41.3	20.2	32.6
Phenanthrene	489	365	601	305	440
Anthracene	244	182	287	164	217
Fluoranthene	801	609	930	604	637
Pyrene	1060	752	1170	791	806
Benzo[a]anthracene	711	508	693	455	518
Chrysene	757	593	788	524	492
Benzo[b]fluoranthene	271	230	398 [d]	254 [d]	194
Benzo[k]fluoranthene	81.4 [c]	56.8 [c]	– [d]	– [d]	44.8 [c]
Benzo[e]pyrene	191	172	227	146	140
Benzo[a]pyrene	269	232	317	202	188
Perylene	33.0	29.2	35.9	22.8	24.7
Indeno[123-cd]pyrene	66.2	47.7	39.3	25.3	37.2
Dibenzo[a,h]anthracene	21.6	14.0	12.4	7.73	12.5
Benzo[g,h,i]perylene	74.0	59.7	51.3	34.2	49.0
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	95	102	62	45	95
d8 Naphthalene	103	119	72	54	112
d10 Acenaphthene	107	132	74	57	121
d12 Chrysene	122	151 [e]	73	62	134
d14 Dibenzo(a,h)anthracene	168 [e]	194 [e]	48	46	181 [e]

Table F.9. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COM	BR-A COMP
Replicate	1	1	1	2	3
Analytical Replicate	1	2	3		
Percent Dry Weight	14.0	14.0	14.0	14.2	13.0
Analytical Batch	1	1	1	1	1
1,4-Dichlorobenzene	2.87 U	3.09 U	3.17 U	1.86 U	1.83 U
Naphthalene	5.14 (c)	5.82 (c)	7.49 (c)	3.23	2.98 (c)
Acenaphthylene	2.35 (c)	2.61 (c)	2.47 (c)	1.83 (c)	1.67 (c)
Acenaphthene	2.01 U	3.11	2.22 U	2.45	2.31
Fluorene	3.49 (c)	3.39	2.10 U	2.64 (c)	1.21 U
Dibenzothiophene	2.58 (c)	2.41 (c)	2.22 (c)	2.27	1.96 (c)
Phenanthrene	14.5	13.1	14.6	11.2	10.5
Anthracene	10.2	8.66	9.10	8.49	8.09
Fluoranthene	72.0	62.9	64.4	67.5	55.7
Pyrene	112	99.0	104	102	85.8
Benzo[a]anthracene	54.6	48.5	49.1	53.7	43.2
Chrysene	72.6	62.3	65.1	65.2	52.6
Benzo[b]fluoranthene	84.0 (d)	77.5 (d)	78.9 (d)	74.3 (d)	58.9 (d)
Benzo[k]fluoranthene	– (d)	– (d)	– (d)	– (d)	– (d)
Benzo[e]pyrene	46.0	42.2	44.8	41.0	32.6
Benzo[a]pyrene	45.7	43.0	44.1	42.5	33.8
Perylene	14.4	12.8	12.6	12.8	10.1
Indeno[123-cd]pyrene	14.0	13.8	17.4	9.53	9.44
Dibenzo[a,h]anthracene	5.25 (b)	5.52	6.08 (c)	3.53	3.30 (c)
Benzo[g,h,i]perylene	16.5	17.2	19.4	12.6	11.1
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	28 (e)	47	21 (e)	54	32
d8 Naphthalene	33	87	26 (e)	68	37
d10 Acenaphthene	37	61	32	74	41
d12 Chrysene	39	63	34	74	42
d14 Dibenzo(a,h)anthracene	26 (e)	52	38	38	26 (e)

Table F.9. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	13.0	13.9	13.9	12.3	13.4
Analytical Batch	1	1	1	1	1
1,4-Dichlorobenzene	1.86 U	1.83 U	2.01 U	1.86 U	1.83 U
Naphthalene	4.81	4.05 (c)	9.91	6.62	6.47
Acenaphthylene	1.96 (c)	2.14 (c)	5.24	3.27 (c)	3.53 (c)
Acenaphthene	2.51	2.27	59.9	30.5	49.8
Fluorene	2.91 (c)	3.14	50.0	30.3	43.8
Dibenzothiophene	2.28 (c)	2.82	42.6	31.1	39.8
Phenanthrene	12.3	15.0	376	280	366
Anthracene	9.41	11.0	156	124	156
Fluoranthene	71.0	81.9	438	333	416
Pyrene	109	126	577	443	550
Benzo[a]anthracene	55.7	62.0	257	216	242
Chrysene	68.4	75.1	307	247	272
Benzo[b]fluoranthene	58.0	86.6 (d)	176 (d)	107	149 (d)
Benzo[k]fluoranthene	20.4	-- (d)	-- (d)	30.1	-- (d)
Benzo[e]pyrene	43.4	47.0	100	74.4	78.2
Benzo[a]pyrene	44.2	47.0	135	103	108
Perylene	14.7	15.3	23.2	16.5	17.8
Indeno[123-cd]pyrene	10.2	12.2	17.8	16.4	12.8
Dibenzo[a,h]anthracene	3.73	4.39	5.17	4.91	4.36
Benzo[g,h,i]perylene	13.6	16.1	21.3	18.8	16.1
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	35	36	52	35	38
d8 Naphthalene	42	44	64	41	46
d10 Acenaphthene	46	53	67	45	50
d12 Chrysene	46	63	66	46	49
d14 Dibenzo(a,h)anthracene	25 (e)	43	31	26 (e)	23 (e)

Table F.9. (contd)

Sediment Treatment	BR-B COMP	BR-B COMP	MDRS[f]	MDRS	MDRS
	Concentration (µg/kg wet wt)				
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	12.9	12.6	12.7	14.1	12.9
Analytical Batch	1	1	1	1	1
1,4-Dichlorobenzene	1.83 U	1.86 U	1.86 U	1.83 U	1.86 U
Naphthalene	10.9	5.40	2.12 [c]	2.63 [c]	2.44 [c]
Acenaphthylene	4.37	4.21	0.73 U	0.71 U	0.73 U
Acenaphthene	89.2	48.2	1.30 U	1.28 U	1.30 U
Fluorene	67.0	41.3	1.24 U	1.21 U	1.24 U
Dibenzothiophene	52.9	34.2	0.50 U	0.49 U	0.50 U
Phenanthrene	485	335	2.56 U	3.23	2.56 U
Anthracene	192	143	2.24 U	2.19 U	2.80 [c]
Fluoranthene	458	377	5.36 U	5.26 U	5.36 U
Pyrene	603	497	4.57 U	4.48 U	4.57 U
Benzo[a]anthracene	246	230	1.15 [c]	1.91	1.26 [c]
Chrysene	277	264	2.27 U	2.29	2.27 U
Benzo[b]fluoranthene	148 [d]	110	2.63 [c]	3.99 [d]	3.60 [d]
Benzo[k]fluoranthene	– [d]	25.7	1.67 U	– [d]	– [d]
Benzo[e]pyrene	82.4	78.8	1.56 [c]	2.31 [c]	1.87 [c]
Benzo[a]pyrene	106	103	1.49 U	1.56 [c]	1.49 U
Perylene	18.3	17.6	1.40 U	1.38 U	1.40 U
Indeno[123-cd]pyrene	17.9	14.3	1.76 U	1.73 U	1.96 [b]
Dibenzo[a,h]anthracene	5.77	4.62	1.26 U	1.24 U	1.26 U
Benzo[g,h,i]perylene	23.8	17.3	1.40 U	1.37 U	1.40 U
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	57	52	45	47	53
d8 Naphthalene	65	67	56	56	67
d10 Acenaphthene	69	79	60	59	70
d12 Chrysene	67	77	62	58	72
d14 Dibenzo(a,h)anthracene	75	41	50	25 [e]	78

Table F.9. (contd)

	Concentration (µg/kg wet wt)		
Sediment Treatment	MDRS	MDRS	*Macoma* Bkgrd. Tissue
Replicate	4	5	
Analytical Replicate			
Percent Dry Weight	12.5	12.7	14.4
Analytical Batch	1	1	1
1,4-Dichlorobenzene	1.86 U	1.98 U	1.83 U
Naphthalene	2.23 (c)	2.78 (c)	2.10 (c)
Acenaphthylene	0.73 U	0.77 U	0.71 U
Acenaphthene	1.30 U	1.38 U	1.28 U
Fluorene	1.24 U	1.31 U	1.21 U
Dibenzothiophene	0.50 U	0.53 U	0.49 U
Phenanthrene	2.56 U	2.71 U	2.51 U
Anthracene	2.24 U	2.37 U	2.19 U
Fluoranthene	5.36 U	5.69 U	5.38
Pyrene	4.57 U	4.84 U	4.48 U
Benzo[a]anthracene	1.66 (c)	1.89	1.57
Chrysene	3.05	2.40 U	2.22 U
Benzo[b]fluoranthene	4.14 (d)	5.30 (d)	3.07 (d)
Benzo[k]fluoranthene	-- (d)	-- (d)	-- (d)
Benzo[e]pyrene	2.25 (c)	2.78 (b)	1.52 U
Benzo[a]pyrene	1.89 (c)	2.11	1.46 U
Perylene	1.40 U	1.49 U	1.38 U
Indeno[123-cd]pyrene	2.05 (c)	2.22 (c)	1.86 (c)
Dibenzo[a,h]anthracene	1.26 U	1.34 U	1.24 U
Benzo[g,h,i]perylene	1.40 U	2.84 (c)	1.37 U
Surrogate Recoveries (%)			
d4 1,4-Dichlorobenzene	39	60	63
d8 Naphthalene	43	73	72
d10 Acenaphthene	47	75	72
d12 Chrysene	47	72	72
d14 Dibenzo(a,h)anthracene	27 (e)	34	35

(a) Target detection limits are 4.0 µg/kg for all analytes.
(b) U Undetected at or above given concentration.
(c) Ion ratio out or confirmation ion not detected.
(d) Benzo(b)fluoranthene is the sum of benzo(b)fluoranthene and benzo(k)fluoranthene. Benzo(k)fluoranthene is present but could not be quantified due to co-eluting peak.
(e) Outside quality control criteria (30-150%) for surrogate recovery.
(f) MDRS Mud Dump Reference Site.

Table F.10. Polynuclear Aromatic Hydrocarbons (PAHs) in Tissue of *M. nasuta* (Dry Weight), Red Hook and Bay Ridge Channels

	Concentration (µg/kg dry wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	3	4	5
Analytical Replicate					
Percent Dry Weight	14.2	13.3	12.9	12.9	16.4
Analytical Batch	2	2	1	1	2
1,4-Dichlorobenzene	68.4 U[a]	27.3 U	20.3	14.4 U	18.6 U
Naphthalene	104	74.8	60.7	37.0	37.7
Acenaphthylene	43.6 [b]	30.1 [b]	31.1	21.4 [b]	18.6 [b]
Acenaphthene	133	213	308	88.7	158
Fluorene	221	236	377	139.1	215
Dibenzothiophene	246	213	322	156.1	198
Phenanthrene	3440	2750	4680	2360	2670
Anthracene	1710	1380	2240	1270	1320
Fluoranthene	5630	4590	7240	4670	3880
Pyrene	7450	5670	9100	6110	4900
Benzo[a]anthracene	5000	3830	5400	3520	3150
Chrysene	5320	4470	6130	4050	3000
Benzo[b]fluoranthene	1910	1740	3090 [c]	1970 [c]	1180
Benzo[k]fluoranthene	572 [b]	429 [b]	– [c]	– [c]	273 [b]
Benzo[e]pyrene	1340	1300	1770	1130	853
Benzo[a]pyrene	1890	1750	2460	1560	1140
Perylene	232	220	279	176	150
Indeno[123-cd]pyrene	465	360	306	196	226
Dibenzo[a,h]anthracene	152	106	96.2	59.8	76.0
Benzo[g,h,i]perylene	520	450	399	264	298

Table F.10. (contd)

	Concentration (µg/kg dry wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COMP	BR-A COMP
Replicate	1	1	1	2	3
Analytical Replicate	1	2	3		
Percent Dry Weight	14.0	14.0	14.0	14.2	13.0
Analytical Batch	1	1	1	1	1
1,4-Dichlorobenzene	20.5 U	22.1 U	22.6 U	13.1 U	14.1 U
Naphthalene	36.7 [b]	41.5 [b]	53.5 [b]	22.8	23.0 [b]
Acenaphthylene	16.8 [b]	18.6 [b]	17.6 [b]	12.9 [b]	12.9 [b]
Acenaphthene	14.3 U	22.2	15.8 U	17.3	17.8
Fluorene	24.9 [b]	24.2	15.0 U	18.6 [b]	9.34 U
Dibenzothiophene	18.4 [b]	17.2 [b]	15.8 [b]	16.0	15.1 [b]
Phenanthrene	104	93.2	104	79.0	81.2
Anthracene	72.9	61.8	65.0	59.9	62.5
Fluoranthene	514	449	459	476	430
Pyrene	802	707	744	717	662
Benzo[a]anthracene	389	346	350	379	333
Chrysene	518	444	465	460	406
Benzo[b]fluoranthene	600 [c]	553 [c]	563 [c]	524 [c]	455 [c]
Benzo[k]fluoranthene	_ [c]	_ [c]	_ [c]	_ [c]	_ [c]
Benzo[e]pyrene	328	301	319	289	252
Benzo[a]pyrene	326	307	315	300	261
Perylene	103	91.6	89.7	89.9	77.6
Indeno[123-cd]pyrene	100	98.2	124	67.2	72.9
Dibenzo[a,h]anthracene	37.5 [b]	39.4	43.4 [b]	24.9	25.5 [b]
Benzo[g,h,i]perylene	117	123	139	89.1	85.9

Table F.10. (contd)

	Concentration (µg/kg dry wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	13.0	13.9	13.9	12.3	13.4
Analytical Batch	1	1	1	1	1
1,4-Dichlorobenzene	14.3 U	13.1 U	14.4 U	15.1 U	13.7 U
Naphthalene	36.9	29.1 [b]	71.2	53.8	48.4
Acenaphthylene	15.0 [b]	15.4 [b]	37.6	26.6 [b]	26.4 [b]
Acenaphthene	19.3	16.3	430	248	372
Fluorene	22.3 [b]	22.5	359	246	328
Dibenzothiophene	17.5 [b]	20.2	306	253	298
Phenanthrene	94.2	108	2700	2270	2740
Anthracene	72.2	78.9	1120	1010	1170
Fluoranthene	545	588	3150	2700	3110
Pyrene	838	904	4140	3500	4110
Benzo[a]anthracene	428	445	1840	1760	1810
Chrysene	525	539	2210	2000	2030
Benzo[b]fluoranthene	445	622 [c]	1260 [c]	866	1110 [c]
Benzo[k]fluoranthene	157	-- [c]	-- [c]	244	-- [c]
Benzo[e]pyrene	333	338	721	604	585
Benzo[a]pyrene	339	337	971	835	804
Perylene	113	110	167	134	133
Indeno[123-cd]pyrene	78.4	87.4	128	133	95.8
Dibenzo[a,h]anthracene	28.6	31.5	37.1	39.9	32.6
Benzo[g,h,i]perylene	105	116	153	152	121

Table F.10. (contd)

	Concentration (µg/kg dry wt)				
Sediment Treatment	BR-B COMP	BR-B COMP	MDRS[d]	MDRS	MDRS
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Weight	12.9	12.6	12.7	14.1	12.9
Analytical Batch	1	1	1	1	1
1,4-Dichlorobenzene	14.1 U	14.8 U	14.6 U	13.0 U	14.5 U
Naphthalene	84.2	42.9	16.6 [b]	18.7 [b]	19.0 [b]
Acenaphthylene	33.8	33.4	5.7 U	5.1 U	5.7 U
Acenaphthene	689	383	10.2 U	9.11 U	10.1 U
Fluorene	518	328	9.73 U	8.61 U	9.64 U
Dibenzothiophene	409	272	3.9 U	3.5 U	3.9 U
Phenanthrene	3750	2660	20.1 U	23.0	19.9 U
Anthracene	1480	1140	17.6 U	15.6 U	21.8 [b]
Fluoranthene	3540	2990	42.1 U	37.4 U	41.7 U
Pyrene	4660	3950	35.9 U	31.9 U	35.5 U
Benzo[a]anthracene	1900	1820	9.03 [b]	13.6	9.80 [b]
Chrysene	2140	2090	17.8 U	16.3	17.7 U
Benzo[b]fluoranthene	1140 [c]	877	20.6 [b]	28.4 [c]	28.0 [c]
Benzo[k]fluoranthene	-- [c]	204	13.11 U	-- [c]	-- [c]
Benzo[e]pyrene	637	626	12.2 [b]	16.4 [b]	14.5 [b]
Benzo[a]pyrene	819	819	11.7 U	11.1 [b]	11.6 U
Perylene	141	140	11.0 U	9.82 U	10.9 U
Indeno[123-cd]pyrene	138	114	13.8 U	12.3 U	15.2 [b]
Dibenzo[a,h]anthracene	44.6	36.7	9.89 U	8.83 U	9.80 U
Benzo[g,h,i]perylene	184	138	11.0 U	9.75 U	10.9 U

Table F.10. (contd)

Sediment Treatment	Concentration (µg/kg dry wt) MDRS	MDRS	*Macoma* Bkgrd. Tissue
Replicate	4	5	
Analytical Replicate			
Percent Dry Weight	12.5	12.7	14.4
Analytical Batch	1	1	1
1,4-Dichlorobenzene	14.8 U	15.6 U	12.7 U
Naphthalene	17.8 (b)	21.8 (b)	14.6 (b)
Acenaphthylene	5.8 U	6.0 U	4.9 U
Acenaphthene	10.4 U	10.8 U	8.91 U
Fluorene	9.89 U	10.3 U	8.42 U
Dibenzothiophene	4.0 U	4.2 U	3.4 U
Phenanthrene	20.4 U	21.3 U	17.5 U
Anthracene	17.9 U	18.6 U	15.2 U
Fluoranthene	42.7 U	44.7 U	37.4
Pyrene	36.4 U	38.0 U	31.2 U
Benzo[a]anthracene	13.2 (b)	14.8	10.9
Chrysene	24.3	18.9 U	15.4 U
Benzo[b]fluoranthene	33.0 (c)	41.6 (c)	21.4 (c)
Benzo[k]fluoranthene	_ (c)	_ (c)	_ (c)
Benzo[e]pyrene	17.9 (b)	21.8 (b)	10.6 U
Benzo[a]pyrene	15.1 (b)	16.6	10.2 U
Perylene	11.2 U	11.7 U	9.60 U
Indeno[123-cd]pyrene	16.3 (b)	17.4 (b)	12.9 (b)
Dibenzo[a,h]anthracene	10.0 U	10.5 U	8.63 U
Benzo[g,h,i]perylene	11.2 U	22.3 (b)	9.53 U

(a) U Undetected at or above given concentration.
(b) Ion ratio out or confirmation ion not detected.
(c) Benzo(b)fluoranthene is the sum of benzo(b)fluoranthene and benzo(k)fluoranthene. Benzo(k)fluoranthene is present but could not be quantified due to co-eluting peak.
(d) MDRS Mud Dump Reference Site.

Table F.11. Quality Control Data for Polynuclear Aromatic Hydrocarbon (PAH) Analysis of *M. nasuta* Tissue (Wet Weight)

Matrix Spike Results	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP[a]	RH COMP (MS	Concentration		Percent
Replicate	3		Spiked	Recovered	Recovery
Analytical Replicate					
Percent Moisture	74.3	NA	NA	NA	NA
Analytical Batch	1	1			
1,4-Dichlorobenzene	2.61	2.46 U[b]	NS[c]	NA[d]	NA
Naphthalene	7.80	42.9	33.0	35.1	106
Acenaphthylene	4.00	38.6	33.0	34.6	105
Acenaphthene	39.5	70.4	33.0	30.8	93
Fluorene	48.4	79.9	33.0	31.5	95
Dibenzothiophene	41.3	35.0	NS	NA	NA
Phenanthrene	601	551	33.0	US[e]	NC [f]
Anthracene	287	281	33.0	US	NC
Fluoranthene	930	828	33.0	US	NC
Pyrene	1170	1030	33.0	US	NC
Benzo[a]anthracene	693	622	33.0	US	NC
Chrysene	788	717	33.0	US	NC
Benzo[b]fluoranthene	398 [g]	308	66[g]	US	NC
Benzo[k]fluoranthene	-- [g]	109	--[g]	--[g]	--
Benzo[e]pyrene	227	197	NS	NA	NA
Benzo[a]pyrene	317	309	33.0	US	NA
Perylene	35.9	31.2	NS	NA	NA
Indeno[123-cd]pyrene	39.3	69.1	33.0	29.8	90
Dibenzo[a,h]anthracene	12.4	42.6	33.0	30.3	92
Benzo[g,h,i]perylene	51.3	78.5	33.0	27.2	82
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	62	54	NA	NA	NA
d8 Naphthalene	72	60	NA	NA	NA
d10 Acenaphthene	74	69	NA	NA	NA
d10 Phenanthene	NA	NA	NA	NA	NA
d12 Chrysene	73	72	NA	NA	NA
d12 Perylene	NA	NA	NA	NA	NA
d14 Dibenzo(a,h)anthracene	48	48	NA	NA	NA

Table F.11. (contd)

Matrix Spike Results	Concentration (µg/kg wet wt)				
Sediment Treatment	Macoma Bkgd.	Macoma Bkgd. (MS)	Concentration		Percent
Replicate	1	1	Spiked	Recovered	Recovery
Analytical Replicate					
Percent Moisture		NA	NA	NA	NA
Analytical Batch	2	2			
1,4-Dichlorobenzene	1.83 U	1.83 U	NS	NA	NA
Naphthalene	2.32	17.8	15.6	15.5	99
Acenaphthylene	0.71 U	15.7	15.0	15.7	105
Acenaphthene	1.28 U	16.8	16.2	16.8	104
Fluorene	1.21 U	16.8	15.5	16.8	108
Dibenzothiophene	0.49 U	0.49 U	NS	NA	NA
Phenanthrene	2.51 U	17.4	15.6	17.4	112
Anthracene	2.19 U	11.1	11.8	11.1	94
Fluoranthene	5.26 U	16.9	15.6	16.9	108
Pyrene	4.48 U	15.5	15.6	15.5	99
Benzo[a]anthracene	1.07 U	13.4	13.5	13.4	99
Chrysene	2.22 U	17.0	15.7	17.0	108
Benzo[b]fluoranthene	2.19	16.6	15.6	14.4	92
Benzo[k]fluoranthene	1.64 U	15.2	15.5	15.2	98
Benzo[e]pyrene	1.52 U	16.6	NS	16.6	NA
Benzo[a]pyrene	1.61	13.8	14.0	12.2	87
Perylene	1.38 U	11.5	NS	11.5	NA
Indeno[123-cd]pyrene	1.73 U	18.9	13.8	18.9	137 (h)
Dibenzo[a,h]anthracene	1.24 U	15.9	11.7	15.9	136 (h)
Benzo[g,h,i]perylene	1.37 U	19.1	13.9	19.1	137 (h)
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	NA	NA	NA	NA	NA
d8 Naphthalene	54	62	NA	NA	NA
d10 Acenaphthene	58	66	NA	NA	NA
d10 Phenanthene	54	63	NA	NA	NA
d12 Chrysene	64	76	NA	NA	NA
d12 Perylene	56	65	NA	NA	NA
d14 Dibenzo(a,h)anthracene	79	97	NA	NA	NA

Table F.11. (contd)

Analytical Replicates	Concentration (µg/kg wet wt)			
Sediment Treatment	BR-A[a]	BR-A	BR-A	RSD
Replicate	1	1	1	(%)
Analytical Replicate	1	2	3	
Percent Moisture	72.0	NA	NA	NA
Analytical Batch	1	1	1	
1,4-Dichlorobenzene	2.87 U	3.09 U	3.17 U	NA
Naphthalene	5.14 (i)	5.82 (i)	7.49 (i)	20
Acenaphthylene	2.35 (i)	2.61 (i)	2.47 (i)	5
Acenaphthene	2.01 U	3.11	2.22 U	NA
Fluorene	3.49 (i)	3.39	2.10 U	NA
Dibenzothiophene	2.58 (i)	2.41 (i)	2.22 (i)	7
Phenanthrene	14.5	13.1	14.6	6
Anthracene	10.2	8.66	9.10	9
Fluoranthene	72.0	62.9	64.4	7
Pyrene	112	99.0	104	6
Benzo[a]anthracene	54.6	48.5	49.1	7
Chrysene	72.6	62.3	65.1	8
Benzo[b]fluoranthene	84.0 (g)	77.5 (g)	78.9 (g)	4
Benzo[k]fluoranthene	_ (g)	_ (g)	_ (g)	_
Benzo[e]pyrene	46.0	42.2	44.8	4
Benzo[a]pyrene	45.7	43.0	44.1	3
Perylene	14.4	12.8	12.6	7
Indeno[123-cd]pyrene	14.0	13.8	17.4	13
Dibenzo[a,h]anthracene	5.25 (i)	5.52	6.08 (i)	8
Benzo[g,h,i]perylene	16.5	17.2	19.4	9
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	28 (j)	47	21 (j)	NA
d8 Naphthalene	33	87	26 (j)	NA
d10 Acenaphthene	37	61	32	NA
d10 Phenanthene	NA	NA	NA	NA
d12 Chrysene	39	63	34	NA
d12 Perylene	NA	NA	NA	NA
d14 Dibenzo(a,h)anthracene	26 (j)	52	38	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NS Not spiked.
(d) NA Not applicable.
(e) US Under spiked.
(f) NC Not calculated.
(g) Benzo(b)fluoranthene is the sum of benzo(b)fluoranthene and benzo(k)fluoranthene. Benzo(k)fluoranthene is present but could not be quantified due to co-eluting peak.
(h) Outside quality control criteria (50-120%) for spike recovery.
(i) Ion ratio out or confirmation ion not detected.
(j) Outside quality control criteria (30-150%) for surrogate recovery.

Table F.12. Method Detection Limit Verification Study for Polynuclear Aromatic Hydrocarbons (PAHs) in *M. nasuta* Tissue

	Concentration (µg/kg wet wt)						
Sediment Treatment	*Macoma* Bkgd. + Spike	*Macoma* Bkgd. + Spike	*Macoma* Bkgd. + Spike	*Macoma* Bkgd. + Spike		Standard	
Analytical Replicate	1	2	3	4	Mean	Deviation	MDL[a]
Analytical Batch	2	2	2	2			
1,4-Dichlorobenzene	ND[b]	ND	ND	ND	NA[c]	NA	NA
Naphthalene	18.8	17.8	17.9	17.9	18.1	0.47	2.13
Acenaphthylene	14.4	15.7	15.4	15.1	15.2	0.56	2.54
Acenaphthene	17.6	16.8	17.4	16.8	17.2	0.41	1.86
Fluorene	16.6	16.8	16.9	16.6	16.7	0.15	0.68
Dibenzothiophene	ND	ND	ND	ND	NA	NA	NA
Phenanthrene	17.7	17.4	17.6	17.3	17.5	0.18	0.82
Anthracene	11.0	11.1	11.2	11.1	11.1	0.08	0.36
Fluoranthene	17.4	16.9	17.4	17.9	17.4	0.41	1.86
Pyrene	16.2	15.5	15.9	16.0	15.9	0.29	1.32
Benzo(a)anthracene	13.4	13.4	13.9	13.7	13.6	0.24	1.09
Chrysene	17.4	17.0	17.0	17.0	17.1	0.20	0.91
Benzo(b)fluoranthene	16.1	16.6	17.8	16.9	16.9	0.71	3.22
Benzo(k)fluoranthene	14.9	15.2	16.6	15.5	15.6	0.74	3.36
Benzo(e)pyrene	16.8	16.6	17.6	16.9	17.0	0.43	1.95
Benzo(a)pyrene	14.0	13.8	14.3	13.8	14.0	0.24	1.09
Perylene	11.5	11.5	11.2	11.0	11.3	0.24	1.09
Indeno(123-cd)pyrene	18.6	18.9	19.8	19.4	19.2	0.53	2.41
Dibenzo(a,h)anthracene	16.3	15.9	17.0	16.3	16.4	0.46	2.09
Benzo(g,h,i)perylene	18.5	19.1	20.1	19.6	19.3	0.68	3.09

(a) Method detection limit calculated by multiplying the standard deviation of the four replicates by Students-t (4.54).
(b) ND Not detected.
(c) NA Not applicable.

Table F.13. Lipids in Tissue of *M. nasuta*

Sample ID	% Dry Weight	% Lipid (wet wt)	% Lipid (dry wt)
Macoma Bkgd. Tissue	15.12	0.64	4.23
Macoma Bkgd. Tissue	15.12	0.85	5.62
Macoma Bkgd. Tissue	15.12	0.63	4.17

Appendix G.

Quality Assurance/Quality Control Data for Chemical Analyses of *Nereis virens* Tissues, Red Hook and Bay Ridge Channels

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Metals

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: *Nereis virens* Tissue

QA/QC DATA QUALITY OBJECTIVES

	Reference Method	Range of Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (mg/kg dry wt)
Arsenic	ICP/MS	75-125%	≤20%	≤20%	1.0
Cadmium	ICP/MS	75-125%	≤20%	≤20%	0.1
Chromium	ICP/MS	75-125%	≤20%	≤20%	0.2
Copper	ICP/MS	75-125%	≤20%	≤20%	1.0
Lead	ICP/MS	75-125%	≤20%	≤20%	0.1
Mercury	CVAA	75-125%	≤20%	≤20%	0.02
Nickel	ICP/MS	75-125%	≤20%	≤20%	0.1
Silver	ICP/MS	75-125%	≤20%	≤20%	0.1
Zinc	ICP/MS	75-125%	≤20%	≤20%	1.0

SAMPLE CUSTODY Twenty-one *Nereis virens* tissue samples were received on 5/30/95 in good condition, logged into the Battelle system, frozen to -20°C ± 10°C and subsequently freeze dried within approximately seven days of sample receipt.

METHOD Nine (9) metals were analyzed for the New York 4 Program: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Hg was analyzed using cold-vapor atomic absorption spectroscopy (CVAA) according to the method of Bloom and Crecelius (1983). The remaining metals were analyzed by inductively coupled plasma mass spectrometry (ICP/MS) following a procedure based on EPA method 200.8 (EPA 1991)

To prepare tissue for analysis, samples were freeze-dried and blended in a Spex mixer-mill. Approximately 5 g of mixed sample was ground in a ceramic ball mill. For ICP/MS and CVAA analyses, 0.2- to 0.5-g aliquots of dried homogenous sample were digested using a mixture of nitric acid and hydrogen peroxide following a modified version of EPA Method 200.3 (EPA 1991).

QA/QC SUMMARY METALS (contd)

HOLDING TIMES Samples were analyzed within 180 days of collection. Tissue samples were digested in a single batch. The following table summarizes the analysis dates:

Task	Worms
Sample Digestion	6/14/95
ICP-MS	7/26/95
CVAA-Hg	6/21/95

DETECTION LIMITS Target Detection limits were met for all metals except As, Cu, Ni and Zn, however, all sample values for Cu, Ni and Zn were above the achieved method detection limit (MDL) . MDLs were determined by spiking seven replicates of the reagent blank and multiplying standard deviation of the resulting analyses by the student t value at the 99th percentile(3.142).

An MDL verification study was performed by spiking four aliqouts of a background *Nereis virens* sample with all metals and analyzing them as four separate replicates. The standard deviation of these results were multiplied by 4.54 to determine the method verification detection limit. Target detection limits were exceeded for all metals.

METHOD BLANKS One procedural blank was analyzed per 20 samples. No metals were detected in the blanks above the MDLs.

MATRIX SPIKES One sample was spiked with all metals at a frequency of 1 per 20 samples. All recoveries were within the QC limits of 75% to 125%.

REPLICATES One sample was analyzed in triplicate. In addition, the background sample was also analyzed in triplicate. Precision for triplicate analyses is reported by calculating the relative standard deviation (RSD) between the replicate results. RSDs were within the QC limits of ±20% for all metals.

SRMs SRM, 1566a (Oyster tissue from the National Institute of Standards and Technology, NIST), was analyzed twice for all metals. Results for all metals were within ±20 % of mean certified value with the exception of Hg in one replicate and Ni in two replicates. This may have happened because a total digestion method was not used.

REFERENCES

Bloom, N.S., and E.A. Crecelius. 1983. "Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels." *Mar. Chem.* 14:49-59.

U.S. Environmental Protection Agency (EPA). 1991 Methods for the Determination of Metals in Environmental Samples. EPA-600/4-91-010. Environmental Services Division, Monitoring Management Branch, Washington D.C.

QA/QC SUMMARY

PROGRAM: New York/New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Chlorinated Pesticides/PCB Congeners

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: *Nereis virens* Tissue

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	MS Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (ug/kg wet wt)
GC/MS/SIM	30 to 150%	30-120%	≤30%	≤30%	0.4

SAMPLE CUSTODY Twenty-one samples were received on 5/30/95 in good condition, logged into the Battelle system, and stored frozen at -20°C ± 10°C until extraction.

METHOD Tissues were homogenized wet using a stainless steel blade. An aliquot of tissue sample was extracted with methylene chloride using the roller technique under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (NOAA 1993). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup (NOAA 1993). Extracts were analyzed for 15 chlorinated pesticides and 22 PCB congeners using gas chromatography/electron capture detection (GC/ECD) following a procedure based on EPA method 8080 (EPA 1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.). All detections were quantitatively confirmed on the second column.

HOLDING TIMES Samples were initially extracted in one batch. Due to low surrogate recoveries, three samples were re-extracted in a separate batch. All extracts were analyzed by GC/ECD. The following summarizes the extraction and analysis dates:

Batch	Species	Extraction	Analysis
1	*N. virens*	6/5/95	6/9 through 6/11/95
2	MDL verification	6/19/95	7/5/95

DETECTION LIMITS Target detection limits of 0.4 ng/g wet weight were met for most pesticides and PCB congeners. Three samples that were re-extracted due to low initial surrogate recoveries, have higher detection limits for all analytes. These elevated detection limits are due to the limited amount of tissue that was available for re-extraction. Method detection limits (MDLs) reported were determined from multiplying the standard deviation of seven spiked replicates of *Nereis virens* tissue by the student t value (99 percentile, 3.142). MDLs were reported corrected for individual sample wet weight extracted.

Method detection limit verification was performed by analyzing four replicate spike *Macoma nasuta* samples and multiplying the standard deviation of the result by 4.54. All detection limits calculated in this manner were below the target detection limit except for six pesticides and five PCB congeners which were below 1.7 ng/g wet weight.

METHOD BLANKS One method blank was extracted with each extraction batch. No pesticides or PCBs were detected in any of the method blanks.

SURROGATES Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries were all within the QC guidelines of 30% to 150% with the exception of one sample in Batch 1 involving a high recovery of PCB 198 (162%). This was probably due to matrix interferences with the Internal Standard octachloronaphthalene (OCN), which is used to quantify the recovery of surrogate PCB 198. Since no sample data are corrected for OCN, sample results should not be affected. Sample results were quantified using the surrogate internal standard method.

MATRIX SPIKES Eleven out of the 15 pesticides and 5 of the 22 PCB congeners analyzed were spiked into one sample. Matrix spike recoveries were within the quality control range of 50% to 120% for all Pesticides and PCBs with the exception of 4,4'-DDD (121%) and PCB 28 (134%).

REPLICATES One sample was analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) among the replicate results. RSDs for all detectable values were below the target precision goal of ≤30%.

SRMs Not available.

MISCELLANEOUS All pesticide and PCB congener results are confirmed using a second dissimilar column. RPDs between the primary and confirmation values must be less than 75% to be considered a confirmed value.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* SW-846. U.S. Document No. 955-001-00000, U.S. EPA, Washington D. C.

QA/QC SUMMARY

PROGRAM: New York /New Jersey Red Hook/Bay Ridge Projects

PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH) and 1,4-Dichlorobenzene

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: *Nereis virens* Tissue

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	MS Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (ug/kg wet wt)
GC/MS/SIM	50-120%	30-150%	≤30%	≤30%	4.0

SAMPLE CUSTODY Twenty-one samples were received on 5/30/95 in good condition, logged into the Battelle system, and stored frozen at -20°C ± 10°C until extraction.

METHOD Tissue samples were extracted with methylene chloride using a roller under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (NOAA 1993). Samples were then cleaned using silica/alumina (5% deactivated) chromatography followed by HPLC cleanup.

Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) in the selected ion mode (SIM) following a procedure based on EPA method 8270 (EPA 1986).

HOLDING TIMES Samples were initially extracted in one batch. Due to low surrogate recoveries, three samples were re-extracted in a separate batch. All extracts were analyzed by GC/ECD. The following summarizes the extraction and analysis dates:

Batch	Species	Extraction	Analysis
1	*N. virens*	6/5/95	6/9 through 6/11/95
2	3 samples + MDL study	6/19/95	7/5/95

DETECTION LIMITS Target detection limits of 4 ng/g wet weight were met for all PAH compounds except for fluoranthene and pyrene, which had method detection limits (MDL) between 4 and 6 ng/g wet weight. MDLs were determined by multiplying the standard deviation of seven spiked replicates of a background *Nereis virens* sample by the student's t value (99 percentile, 3.142). These MDLs were based on a wet weight of 20 g of tissue sample. Aliquots of samples that were analyzed in triplicate, used for spiking, or were re-extracted, were generally less than 20 g due to limited quantities of tissue available. Because MDLs reported are corrected for sample weight, they appear elevated and in some cases may exceed the target detection limit.

In addition, an MDL verification study was performed which consisted of analyzing four spiked aliquots of a background *Macoma nasuta* sample. The standard deviation of the result of the replicate analysis was multiplied by the student t value (4.54). Detection limits calculated in this way were all less than the target detection limit of 4 ng/g wet weight.

QA/QC SUMMARY/PAHs (contd)

METHOD BLANKS One method blank was extracted with each extraction batch. No PAHs were detected in the blanks.

SURROGATES Five isotopically labeled compounds were added prior to extraction to assess the efficiency of the method. These were d8-naphthalene, d10-acenaphthene, d12-chrysene, d14-dibenz[a,h]anthracene and d4-1,4 dichlorobenzene. Recoveries of all surrogates were within the quality control limits of 30% to 150% with the exception of d4-1,4-dichlorobenzene and d8-naphthalene which were recovered below 30% in the majority of the samples. No additional sample was available for re-extraction, however, since sample results were quantified using the surrogate internal standard method, these low recoveries should not affect the actual results.

MATRIX SPIKES One sample was spiked with all PAH compounds. Matrix spike recoveries were within QC limits of 50% to 120%, with some exceptions. Spike recoveries for a number of PAH compounds were not calculated due to high native levels, relative to the levels spiked. Spike concentrations were from two to ten times lower than native concentrations.

REPLICATES One sample from each batch was extracted and analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. All RSDs were within ±30% with the exception of naphthalene.

SRMs Not available.

MISCELLANEOUS Some of the compounds are flagged to indicate that the ion ratio for that compound was outside of the QC range. This is due primarily to low levels of the compound of interest. Because the confirmation ion is present at only a fraction of the level of the parent ion, when the native level of the compound is low, the amount of error in the concentration measurement of the confirmation ion goes up. The compound is actually quantified from the parent ion only so most likely this will not affect the quality of the data. For sample values that are relatively high (>5 times the MDL) it may be an indication of some sort of interference.

REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 1993. *Sampling and Analytical Methods for the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume IV. Comprehensive Descriptions of Trace Organic Analytical Methods.* G.G. Lauenstein and A.Y. Cantillo, eds. NOAA Technical Memorandum NOS ORCA 71. National Oceanic and Atmospheric Administration, Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, Silver Spring, Maryland.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846.* U.S. Document No. 955-001-00000, EPA, Washington D.C.

Table G.1. Metals in Tissue of *N. virens* (Wet Weight), Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Replicate	Analytical Batch	% Dry Weight	Concentration (µg/g wet wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
RH COMP	1		1	14.7	0.0323 U[a]	1.92	0.0404	0.170	1.38	0.0204	0.225	0.189	13.1
RH COMP	2		1	13.9	0.0307 U	2.33	0.0411	0.184	1.29	0.0152	0.188	0.215	26.8
RH COMP	3		1	15.5	0.0340 U	1.99	0.0442	0.229	1.48	0.0319	0.235	0.192	20.3
RH COMP	4		1	14.9	0.0328 U	2.52	0.0346	0.158	1.40	0.00866	0.090	0.243	64.6
RH COMP	5		1	14.2	0.0312 U	2.02	0.0329	0.169	1.64	0.0209	0.232	0.197	21.7
BR-A COMP	1		1	14.3	0.0402	2.09	0.0317	0.146	1.27	0.00709	0.177	0.217	20.9
BR-A COMP	2		1	14.9	0.0327 U	2.06	0.0303	0.15	1.29	0.0157	0.159	0.160	17.5
BR-A COMP	3		1	14.5	0.0318 U	1.82	0.0392	0.233	1.39	0.0140	0.214	0.205	13.9
BR-A COMP	4		1	15.7	0.0346 U	2.11	0.0344	0.175	1.37	0.0191	0.175	0.159	19.3
BR-A COMP	5	1	1	15.7	0.0352	2.39	0.0407	0.160	1.31	0.00723	0.148	0.244	13.9
BR-A COMP	5	2	1	15.7	0.0346 U	2.42	0.0533	0.159	1.34	0.00786	0.146	0.286	35.5
BR-A COMP	5	3	1	15.7	0.0346 U	2.33	0.0344	0.145	1.23	0.00772	0.139	0.250	19.5
BR-B COMP	1		1	14.3	0.0315 U	1.65	0.0402	0.179	1.41	0.0210	0.165	0.162	8.49
BR-B COMP	2		1	13.6	0.0300 U	1.94	0.0372	0.151	1.26	0.0167	0.210	0.211	33.6
BR-B COMP	3		1	14.2	0.0311 U	2.12	0.0372	0.198	1.49	0.0146	0.226	0.214	25.0
BR-B COMP	4		1	14.6	0.0321 U	1.96	0.0406	0.175	1.33	0.0190	0.188	0.164	10.2
BR-B COMP	5		1	15.7	0.0392	1.97	0.0312	0.197	1.74	0.00836	0.194	0.186	23.3
MDRS[b]	1		1	14.4	0.0317 U	2.24	0.0296	0.205	1.56	0.0185	0.102	0.160	16.0
MDRS	2		1	13.5	0.0297 U	2.26	0.0366	0.180	1.29	0.0312	0.098	0.142	22.6
MDRS	3		1	15.3	0.0370	2.03	0.0588	0.166	1.33	0.0160	0.162	0.140	12.2
MDRS	4		1	14.1	0.0311 U	2.90	0.0297	0.157	1.33	0.0179	0.0967	0.181	19.4
MDRS	5		1	16.2	0.0357 U	3.40	0.0438	0.172	1.52	0.0144	0.0859	0.160	8.70
Nereis Bkgd. Tissue	1	1	1	15.6	0.0343 U	2.65	0.0429	0.141	1.65	0.0144	0.0833	0.112	13.0
Nereis Bkgd. Tissue	1	2	1	15.6	0.0343 U	2.65	0.0424	0.165	1.62	0.0145	0.0775	0.129	11.7
Nereis Bkgd. Tissue	1	3	1	15.6	0.0343 U	2.64	0.0495	0.175	1.62	0.0143	0.0850	0.144	9.81

(a) U Undetected at or above given concentration.
(b) MDRS Mud Dump Reference Site.

Table G.2. Metals in Tissue of *N. virens* (Dry Weight), Red Hook and Bay Ridge Channels

Sediment Treatment	Replicate	Analytical Replicate	Analytical Batch	% Dry Weight	Concentration (µg/g dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Target Detection Limit:					0.1	1.0	0.1	0.2	1.0	0.02	0.1	0.1	1.0
Method Detection Limit:					0.22	0.83	0.081	0.08	1.20	0.0011	0.25	0.08	1.37
RH COMP	1		1	14.7	0.220 U[a]	13.1	0.275	1.16	9.42	0.139	1.53	1.29	89.1
RH COMP	2		1	13.9	0.220 U	16.7	0.295	1.32	9.27	0.109	1.35	1.54	192
RH COMP	3		1	15.5	0.220 U	12.9	0.286	1.48	9.58	0.206	1.52	1.24	131
RH COMP	4		1	14.9	0.220 U	16.9	0.232	1.06	9.39	0.0580	0.603	1.63	433
RH COMP	5		1	14.2	0.220 U	14.3	0.232	1.19	11.6	0.147	1.64	1.39	153
BR-A COMP	1		1	14.3	0.281	14.6	0.222	1.02	8.85	0.0496	1.24	1.52	146
BR-A COMP	2		1	14.9	0.220 U	13.9	0.204	0.98	8.67	0.106	1.07	1.08	118
BR-A COMP	3		1	14.5	0.220 U	12.6	0.271	1.61	9.63	0.0970	1.48	1.42	96.0
BR-A COMP	4		1	15.7	0.220 U	13.4	0.219	1.11	8.74	0.121	1.11	1.01	123
BR-A COMP	5	1	1	15.7	0.224	15.2	0.259	1.02	8.33	0.0460	0.943	1.55	89
BR-A COMP	5	2	1	15.7	0.220 U	15.4	0.339	1.01	8.54	0.0500	0.928	1.82	226
BR-A COMP	5	3	1	15.7	0.220 U	14.8	0.219	0.924	7.80	0.0491	0.885	1.59	124
BR-B COMP	1		1	14.3	0.220 U	11.5	0.281	1.25	9.88	0.147	1.15	1.13	59.3
BR-B COMP	2		1	13.6	0.220 U	14.2	0.273	1.11	9.21	0.122	1.54	1.55	246
BR-B COMP	3		1	14.2	0.220 U	15.0	0.263	1.40	10.5	0.103	1.60	1.51	177
BR-B COMP	4		1	14.6	0.220 U	13.4	0.278	1.20	9.11	0.130	1.29	1.12	70.1
BR-B COMP	5		1	15.7	0.250	12.6	0.199	1.26	11.1	0.0534	1.24	1.19	149
MDRS[b]	1		1	14.4	0.220 U	15.5	0.205	1.42	10.8	0.128	0.704	1.11	111
MDRS	2		1	13.5	0.220 U	16.7	0.271	1.33	9.57	0.231	0.723	1.05	167
MDRS	3		1	15.3	0.242	13.3	0.385	1.09	8.72	0.105	1.06	0.918	79.8
MDRS	4		1	14.1	0.220 U	20.5	0.210	1.11	9.40	0.127	0.684	1.28	137
MDRS	5		1	16.2	0.220 U	21.0	0.270	1.06	9.36	0.0886	0.530	0.985	53.7
Nereis Bkgd. Tissue	1	1	1	15.6	0.220 U	17.0	0.275	0.903	10.6	0.0924	0.534	0.719	83.2
Nereis Bkgd. Tissue	1	2	1	15.6	0.220 U	17.0	0.272	1.06	10.4	0.0930	0.497	0.825	75.2
Nereis Bkgd. Tissue	1	3	1	15.6	0.220 U	16.9	0.317	1.12	10.4	0.0915	0.545	0.925	62.9

(a) U Undetected at or above given concentration.
(b) MDRS Mud Dump Reference Site.

Table G.3. Quality Control Summary for Metals in Tissue of *N. virens*

Sediment Treatment	Replicat	Analytical Batch	Concentration (µg/g dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Blank	1	1	0.220 U[a]	0.83 U	0.081 U	0.08 U	NA [b]	0.0011 U	0.25 U	0.08 U	NA
Blank	2	1	0.220 U	0.83 U	0.081 U	0.08 U	1.20 U	NA	0.25 U	0.08 U	1.37 U
Matrix Spike Results											
Nereis Bkgd. Tiss.	Mean[c]	1	0.220 U	17.0	0.288	1.03	10.5	0.0923	0.525	0.823	73.8
Nereis Bkgd. Tiss.(MS)			0.95	42.8	1.19	2.07	35.6	1.02	26.8	23.9	75.6
Concentration Spiked			1.00	25.0	1.00	1.00	25.0	1.00	25.0	25.0	25.0
Concentration Recovered			0.95	25.8	0.902	1.04	25.1	0.933	26.3	23.1	US [d]
Percent Recovery			95	103	90	104	100	93	105	92	NA
Standard Reference Material											
1566a	1	1	1.60	14.5	4.04	1.23	69.7	0.0512	2.31	0.305	854
1566a	2	1	1.58	13.9	3.91	1.22	70.6	0.0521	1.82	0.250	860
1566a	3	1	1.59	14.1	3.83	1.35	70.5	0.0536	1.69	0.370	828
Mean			1.59	14.2	3.93	1.27	70.3	0.0523	1.94	0.308	847
Certified Value			1.68	14.0	4.15	1.43	66.3	0.0642	2.25	0.371	830
Range			±0.15	±1.2	±0.38	±0.46	±4.3	±0.0067	±0.44	±0.014	±57
Percent Difference	1		5	4	3	14	5	20	3	18	3
	2		6	1	6	15	6	19	19	33 [e]	4
	3		5	1	8	6	6	17	25 [e]	0	0

Table G.3. (contd)

Sediment Treatment	Replicat	Analytical Batch	Concentration (µg/g dry wt) Ag ICP/MS	As ICP/MS	Cd ICP/MS	Cr ICP/MS	Cu ICP/MS	Hg CVAA	Ni ICP/MS	Pb ICP/MS	Zn ICP/MS
Analytical Replicates											
BR-A[f]	1	1	0.224	15.2	0.259	1.02	8.3	0.046	0.94	1.55	89
BR-A	2	1	0.220 U	15.4	0.339	1.01	8.5	0.050	0.93	1.82	226
BR-A	3	1	0.220 U	14.8	0.219	0.924	7.8	0.049	0.89	1.59	124
RSD (%)			1	2	22 [g]	5	5	4	3	9	49 [g]
Nereis Bkgd. Tissue	1	1	0.220 U	17.0	0.275	0.903	10.6	0.0924	0.534	0.719	83.2
Nereis Bkgd. Tissue	2	1	0.220 U	17.0	0.272	1.06	10.4	0.0930	0.497	0.825	75.2
Nereis Bkgd. Tissue	3	1	0.220 U	16.9	0.317	1.12	10.4	0.0915	0.545	0.925	62.9
RSD (%)			0	0	9	11	1	1	5	13	14

(a) U Undetected at or above given concentration.
(b) NA Not applicable.
(c) Mean of analytical replicates.
(d) US Under spiked.
(e) Outside SRM quality control criteria (≤20%).
(f) Sample randomly selected for use as a quality control sample in analytical batch
(g) Outside quality control criteria (≤20%) for replicate analysis.

Table G.4. Pesticides and Polychlorinated Biphenyls (PCBs), Wet Weight, in Tissue of *N. virens*, Red Hook and Bay Ridge Channels

	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	2	2	3
Analytical Replicate		1	2	3	
Percent Dry Wt. (%)	14.7	13.9	13.9	13.9	15.5
Batch	1	1	1	1	1
Heptachlor[a]	0.25 U[b]	0.28 U	1.06	0.26 U	0.19 U
Aldrin	2.79	3.07	2.83	3.19	2.16
Heptachlor Epoxide	0.18 U	0.20 U	0.22 U	0.18 U	0.13 U
2,4'-DDE	0.35 U	0.40 U	0.42 U	0.36 U	0.26 U
Endosulfan I	0.24 U	0.28 U	0.29 U	0.25 U	0.18 U
α-Chlordane	0.90	1.01	0.97	1.00	0.72
Trans Nonachlor	0.19 U	0.70	0.24 U	0.79	0.39
4,4'-DDE	3.53	3.72	3.81	3.87	2.88
Dieldrin	1.52	1.88	1.78	1.91	1.29
2,4'-DDD	1.29	1.60	1.53	1.87	1.10
2,4'-DDT	0.24 U	0.28 U	0.29 U	0.25 U	0.18 U
4,4'-DDD	3.01	3.58	3.33	3.58	2.77
Endosulfan II	0.24 U	0.28 U	0.29 U	0.25 U	0.18 U
4,4'-DDT	2.76	3.20	3.05	3.10	2.15
Endosulfan Sulfate	0.34 U	0.39 U	0.41 U	0.35 U	0.25 U
PCB 8	0.47 U	0.54 U	0.57 U	0.49 U	0.35 U
PCB 18	11.5	11.9	11.4	15.2	11.6
PCB 28	7.51	8.76	7.89	9.08	6.46
PCB 52	10.0	11.6	11.0	12.1	8.39
PCB 49	4.46	5.04	4.66	5.25	3.60
PCB 44	5.45	6.53	9.61	6.55	5.65
PCB 66	7.27	7.15	6.70	7.58	5.70
PCB 101	5.49	5.37	5.07	5.73	4.06
PCB 87	0.48	0.60	0.44	0.70	0.52
PCB 118	3.41	3.69	3.45	4.07	2.76
PCB 184	0.25 U	0.28 U	0.30 U	0.25 U	0.18 U
PCB 153	5.86	6.02	5.67	6.69	4.13
PCB 105	1.36	1.40	1.33	1.68	1.13
PCB 138	3.65	4.30	4.00	4.64	2.91
PCB 187	1.97	2.09	2.20	2.43	1.48
PCB 183	0.69	0.71	0.66	0.93	0.58
PCB 128	0.14 U	0.37	0.17 U	0.58	0.35
PCB 180	1.97	2.11	2.04	2.37	1.57
PCB 170	0.75	0.80	0.83	1.00	0.60
PCB 195	0.17 U	0.20 U	0.21 U	0.21	0.14
PCB 206	0.57	0.66	0.58	0.74	0.48
PCB 209	0.34	0.31	0.32	0.35	0.20 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	75	65	48	63	82
PCB 198 (SIS)	61	56	39	53	74

Table G.4. (contd)

Sediment Treatment	RH COMP	RH COMP	BR-A COMP	BR-A COMP	BR-A COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.9	14.2	14.3	14.9	14.5
Batch	2	2	1	1	1
	Concentration (µg/kg wet wt)				
Heptachlor	0.19 U	0.19 U	0.19 U	0.18 U	0.19 U
Aldrin	2.28	2.10	1.63	1.82	1.93
Heptachlor Epoxide	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
2,4'-DDE	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
Endosulfan I	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
α-Chlordane	0.68	0.58	0.64	0.87	0.81
Trans Nonachlor	0.43	0.15 U	0.38	0.43	0.50
4,4'-DDE	3.20	2.67	1.72	2.34	2.28
Dieldrin	1.31	1.20	0.80	1.03	0.86
2,4'-DDD	1.09	1.16	0.87	1.13	0.25 U
2,4'-DDT	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
4,4'-DDD	3.09	2.72	1.95	2.27	2.16
Endosulfan II	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
4,4'-DDT	2.30	2.54	1.80	2.00	2.43
Endosulfan Sulfate	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB 8	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
PCB 18	9.05	11.5	3.96	7.97	4.51
PCB 28	7.53	5.22	3.64	5.10	4.33
PCB 52	9.46	8.15	4.74	6.36	6.10
PCB 49	4.44	3.36	2.44	3.32	3.22
PCB 44	6.36	9.52	3.12	4.20	3.74
PCB 66	6.57	5.56	4.18	5.12	5.37
PCB 101	4.73	4.25	3.01	3.53	4.32
PCB 87	0.67	0.42	0.25 U	0.29	0.25 U
PCB 118	3.22	3.05	1.85	1.96	2.79
PCB 184	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
PCB 153	4.64	5.18	3.66	4.46	5.84
PCB 105	1.14	1.18	0.88	0.97	1.30
PCB 138	3.20	3.46	2.44	2.83	3.82
PCB 187	1.55	1.73	1.24	1.62	2.13
PCB 183	0.62	0.59	0.38	0.54	0.75
PCB 128	0.36	0.11 U	0.26	0.36	0.42
PCB 180	1.75	1.84	1.38	1.71	2.23
PCB 170	0.64	0.71	0.56	0.70	0.94
PCB 195	0.14	0.13 U	0.13 U	0.13 U	0.15
PCB 206	0.51	0.50	0.21 U	0.34	0.34
PCB 209	0.32	0.20 U	0.20 U	0.20 U	0.20 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	76	37	77	87	55
PCB 198 (SIS)	67	30	67	75	45

Table G.4. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	15.7	15.7	14.3	13.6	14.2
Batch	1	1	1	1	1
Heptachlor	0.18 U	0.19 U	0.19 U	0.18 U	0.19 U
Aldrin	1.96	1.77	4.22	3.13	3.25
Heptachlor Epoxide	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
2,4'-DDE	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
Endosulfan I	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
α-Chlordane	1.04	0.82	1.36	1.73	1.18
Trans Nonachlor	1.03	0.57	1.06	0.91	1.05
4,4'-DDE	2.65	1.99	7.68	10.8	7.96
Dieldrin	1.25	0.85	2.83	3.36	2.33
2,4'-DDD	1.41	1.09	2.85	2.53	2.20
2,4'-DDT	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
4,4'-DDD	2.86	2.09	9.38	9.10	7.20
Endosulfan II	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
4,4'-DDT	2.84	2.17	5.32	3.41	4.03
Endosulfan Sulfate	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB 8	0.34 U	0.35 U	0.35 U	0.34 U	0.35 U
PCB 18	14.5	5.16	10.2	12.5	9.40
PCB 28	4.62	4.02	9.77	11.3	8.49
PCB 52	6.45	5.75	15.8	14.0	13.3
PCB 49	3.27 U	2.90	6.69	6.83	5.80
PCB 44	3.77	4.26	6.36	9.08	6.09
PCB 66	5.89	4.94	13.10	11.6	10.3
PCB 101	4.68	3.72	10.9	8.54	8.44
PCB 87	0.31	0.25 U	0.99	1.43	0.99
PCB 118	2.78	2.16	7.05	5.96	5.43
PCB 184	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
PCB 153	6.16	4.60	11.6	7.84	8.42
PCB 105	1.56	1.07	3.82	2.54	2.66
PCB 138	4.38	3.03	8.98	5.83	6.11
PCB 187	2.24	1.58	4.32	2.89	3.16
PCB 183	0.90	0.53	2.16	1.36	1.52
PCB 128	0.58	0.29	1.41	0.89	0.90
PCB 180	2.28	1.67	5.46	3.31	3.74
PCB 170	0.98	0.66	2.25	1.28	1.52
PCB 195	0.12 U	0.13 U	0.13 U	0.12 U	0.27
PCB 206	0.51	0.34	1.24	0.97	1.17
PCB 209	0.19 U	0.20 U	0.57	0.61	0.72
Surrogate Recoveries (%)					
PCB 103 (SIS)	80	81	97	85	76
PCB 198 (SIS)	71	69	63	73	66

Table G.4. (contd)

Sediment Treatment	Concentration (µg/kg wet wt)				
	BR-B COMP	BR-B COMP	MDRS[c]	MDRS	MDRS
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.6	15.7	14.4	13.5	15.3
Batch	1	1	1	1	1
Heptachlor	0.18 U	0.21 U	0.21 U	0.19 U	0.19 U
Aldrin	2.63	3.01	0.14 U	0.13 U	0.13 U
Heptachlor Epoxide	0.13 U	0.15 U	0.15 U	0.13 U	1.50
2,4'-DDE	0.26 U	0.30 U	0.29 U	0.26 U	0.26 U
Endosulfan I	0.18 U	0.21 U	0.20 U	0.18 U	0.58
α-Chlordane	1.13	1.16	0.31	0.16	0.10 U
Trans Nonachlor	0.69	0.74	0.16 U	0.15 U	0.54
4,4'-DDE	6.91	7.73	0.21 U	0.19 U	0.68
Dieldrin	2.23	2.13	0.76	0.62	0.72
2,4'-DDD	2.08	2.39	0.28 U	0.25 U	0.77
2,4'-DDT	0.18 U	0.21 U	0.20 U	0.18 U	0.18 U
4,4'-DDD	7.27	6.64	0.96	0.84	0.85
Endosulfan II	0.18 U	0.21 U	0.20 U	0.18 U	0.18 U
4,4'-DDT	3.33	4.43	1.64	1.38	1.54
Endosulfan Sulfate	0.25 U	0.29 U	0.28 U	0.25 U	0.25 U
PCB 8	0.34 U	0.41 U	0.39 U	0.35 U	0.35 U
PCB 18	9.35	12.0	0.11 U	0.10 U	0.10 U
PCB 28	8.87	8.42	0.12 U	0.11 U	0.11 U
PCB 52	11.4	13.5	0.36 U	0.32 U	0.32 U
PCB 49	5.21	5.95	0.21 U	0.18 U	0.18 U
PCB 44	6.35	7.52	0.08 U	0.07 U	0.07 U
PCB 66	9.41	11.9	0.17 U	0.15 U	0.15 U
PCB 101	7.12	9.43	0.77	0.32	0.78
PCB 87	1.04	1.23	0.28 U	0.25 U	0.25 U
PCB 118	4.88	6.69	0.39	0.19 U	0.36
PCB 184	0.18 U	0.21 U	0.21 U	0.18 U	0.18 U
PCB 153	7.38	11.0	3.08	1.96	2.47
PCB 105	2.10	3.35	0.19 U	0.17 U	0.89
PCB 138	5.28	7.99	1.89	1.07	1.37
PCB 187	2.54	3.64	1.12	0.62	0.83
PCB 183	1.18	1.78	0.30	0.21	0.25
PCB 128	0.75	1.18	0.12 U	0.12	0.16
PCB 180	3.00	4.54	0.86	0.63	0.66
PCB 170	1.23	1.88	0.34	0.25	0.24
PCB 195	0.20	0.30	0.14 U	0.13 U	0.13 U
PCB 206	0.66	1.03	0.25 U	0.21 U	0.21 U
PCB 209	0.33	0.60	0.22 U	0.20 U	0.20 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	78	67	87	70	72
PCB 198 (SIS)	67	57	70	57	59

Table G.4. (contd)

	Concentration (µg/kg wet wt)		
Sediment Treatment	MDRS	MDRS	*Nereis* Bkgd. Tissue
Replicate	4	5	1
Analytical Replicate			
Percent Dry Wt. (%)	14.1	16.2	15.6
Batch	1	2	1
Heptachlor	0.18 U	0.19 U	0.18 U
Aldrin	0.12 U	0.13 U	0.12 U
Heptachlor Epoxide	0.13 U	0.13 U	0.13 U
2,4'-DDE	0.26 U	0.26 U	0.26 U
Endosulfan I	0.18 U	0.18 U	0.18 U
α-Chlordane	0.09 U	0.10 U	0.18
Trans Nonachlor	0.14 U	0.15 U	0.30
4,4'-DDE	0.60	0.19 U	0.18 U
Dieldrin	0.81	0.64	0.75
2,4'-DDD	0.25 U	0.25 U	0.25 U
2,4'-DDT	0.18 U	0.18 U	0.18 U
4,4'-DDD	0.75	0.26 U	0.70
Endosulfan II	0.18 U	0.18 U	0.18 U
4,4'-DDT	1.51	1.41	1.37
Endosulfan Sulfate	0.25 U	0.25 U	0.25 U
PCB 8	0.34 U	0.35 U	0.34 U
PCB 18	0.10 U	0.10 U	0.10 U
PCB 28	0.11 U	0.11 U	0.11 U
PCB 52	0.32 U	0.32 U	0.32 U
PCB 49	0.18 U	0.18 U	0.18 U
PCB 44	0.07 U	0.07 U	0.07 U
PCB 66	0.15 U	0.15 U	0.15 U
PCB 101	0.13 U	0.13 U	0.41
PCB 87	0.25 U	0.25 U	0.25 U
PCB 118	0.22	0.19 U	0.20
PCB 184	0.18 U	0.18 U	0.18 U
PCB 153	2.77	2.24	2.04
PCB 105	0.16 U	0.17 U	0.16 U
PCB 138	1.49	1.18	1.14
PCB 187	0.94	0.74	0.66
PCB 183	0.28	0.22	0.22
PCB 128	0.16	0.11 U	0.14
PCB 180	0.87	0.70	0.62
PCB 170	0.35	0.25	0.22
PCB 195	0.12 U	0.13 U	0.12 U
PCB 206	0.21	0.21 U	0.21 U
PCB 209	0.19 U	0.20 U	0.19 U
Surrogate Recoveries (%)			
PCB 103 (SIS)	67	77	90
PCB 198 (SIS)	64	68	76

(a) Target detection limits are 0.4 µg/kg for all analytes.
(b) U Undetected at or above given concentration.
(c) MDRS Mud Dump Reference Site.

Table G.5. Pesticides and Polychlorinated Biphenyls (PCBs), Dry Weight, in Tissue of *N. virens*, Red Hook and Bay Ridge Channels

	Concentration (µg/kg dry wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	2	2	3
Analytical Replicate		1	2	3	
Percent Dry Wt. (%)	14.7	13.9	13.9	13.9	15.5
Batch	1	1	1	1	1
Heptachlor	1.7 U[(a)]	2.0 U	7.60	1.9 U	1.2 U
Aldrin	19.0	22.0	20.3	22.9	14.0
Heptachlor Epoxide	1.2 U	1.4 U	1.6 U	1.3 U	0.84 U
2,4'-DDE	2.4 U	2.9 U	3.0 U	2.6 U	1.7 U
Endosulfan I	1.6 U	2.0 U	2.1 U	1.8 U	1.2 U
α-Chlordane	6.1	7.25	7.0	7.17	4.7
Trans Nonachlor	1.3 U	5.0	1.7 U	5.7	2.5
4,4'-DDE	24.0	26.7	27.3	27.8	18.6
Dieldrin	10.4	13.5	12.8	13.7	8.34
2,4'-DDD	8.79	11.5	11.0	13.4	7.12
2,4'-DDT	1.6 U	2.0 U	2.1 U	1.8 U	1.2 U
4,4'-DDD	20.5	25.7	23.9	25.7	17.9
Endosulfan II	1.6 U	2.0 U	2.1 U	1.8 U	1.2 U
4,4'-DDT	18.8	23.0	21.9	22.2	13.9
Endosulfan Sulfate	2.3 U	2.8 U	2.9 U	2.5 U	1.6 U
PCB 8	3.2 U	3.9 U	4.1 U	3.5 U	2.3 U
PCB 18	78.3	85.2	82.0	109	75.0
PCB 28	51.2	62.8	56.6	65.1	41.8
PCB 52	68.3	83.1	78.7	86.9	54.3
PCB 49	30.4	36.2	33.4	37.7	23.3
PCB 44	37.1	46.8	68.9	47.0	36.5
PCB 66	49.5	51.3	48.1	54.4	36.9
PCB 101	37.4	38.5	36.4	41.1	26.3
PCB 87	3.3	4.3	3.2	5.0	3.4
PCB 118	23.2	26.5	24.7	29.2	17.9
PCB 184	1.7 U	2.0 U	2.2 U	1.8 U	1.2 U
PCB 153	39.9	43.2	40.7	48.0	26.7
PCB 105	9.26	10.0	9.54	12.1	7.31
PCB 138	24.9	30.8	28.7	33.3	18.8
PCB 187	13.4	15.0	15.8	17.4	9.57
PCB 183	4.7	5.1	4.7	6.7	3.8
PCB 128	0.95 U	2.7	1.22 U	4.2	2.3
PCB 180	13.4	15.1	14.6	17.0	10.2
PCB 170	5.1	5.7	6.0	7.17	3.9
PCB 195	1.2 U	1.4 U	1.5 U	1.5	0.91
PCB 206	3.9	4.7	4.2	5.3	3.1
PCB 209	2.3	2.2	2.3	2.5	1.3 U

Table G.5. (contd)

Sediment Treatment	RH COMP	RH COMP	BR-A COMP	BR-A COMP	BR-A COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.9	14.2	14.3	14.9	14.5
Batch	2	2	1	1	1
	Concentration (µg/kg dry wt)				
Heptachlor	1.3 U	1.3 U	1.3 U	1.2 U	1.3 U
Aldrin	15.3	14.8	11.4	12.3	13.3
Heptachlor Epoxide	0.87 U	0.92 U	0.91 U	0.88 U	0.90 U
2,4'-DDE	1.7 U	1.8 U	1.8 U	1.8 U	1.8 U
Endosulfan I	1.2 U	1.3 U	1.3 U	1.2 U	1.2 U
α-Chlordane	4.6	4.1	4.5	5.9	5.6
Trans Nonachlor	2.9	1.1 U	2.7	2.9	3.5
4,4'-DDE	21.4	18.9	12.0	15.8	15.8
Dieldrin	8.77	8.47	5.6	6.94	5.9
2,4'-DDD	7.30	8.19	6.1	7.61	1.7 U
2,4'-DDT	1.2 U	1.3 U	1.3 U	1.2 U	1.2 U
4,4'-DDD	20.7	19.2	13.6	15.3	14.9
Endosulfan II	1.2 U	1.3 U	1.3 U	1.2 U	1.2 U
4,4'-DDT	15.4	17.9	12.6	13.5	16.8
Endosulfan Sulfate	1.7 U	1.8 U	1.7 U	1.7 U	1.7 U
PCB 8	2.3 U	2.5 U	2.4 U	2.4 U	2.4 U
PCB 18	60.6	80.9	27.7	53.7	31.2
PCB 28	50.4	36.9	25.5	34.3	29.9
PCB 52	63.4	57.6	33.1	42.8	42.2
PCB 49	29.7	23.7	17.1	22.4	22.3
PCB 44	42.6	67.2	21.8	28.3	25.8
PCB 66	44.0	39.3	29.2	34.5	37.1
PCB 101	31.7	30.0	21.0	23.8	29.9
PCB 87	4.5	3.0	1.7 U	2.0	1.7 U
PCB 118	21.6	21.5	12.9	13.2	19.3
PCB 184	1.2 U	1.3 U	1.3 U	1.2 U	1.2 U
PCB 153	31.1	36.6	25.6	30.0	40.4
PCB 105	7.64	8.33	6.2	6.5	8.98
PCB 138	21.4	24.4	17.1	19.1	26.4
PCB 187	10.4	12.2	8.67	10.9	14.7
PCB 183	4.2	4.2	2.7	3.6	5.2
PCB 128	2.4	0.78 U	1.8	2.4	2.9
PCB 180	11.7	13.0	9.65	11.5	15.4
PCB 170	4.3	5.0	3.9	4.7	6.5
PCB 195	0.94	0.92 U	0.91 U	0.88 U	1.0
PCB 206	3.4	3.5	1.5 U	2.3	2.3
PCB 209	2.1	1.4 U	1.4 U	1.3 U	1.4 U

Table G.5. (contd)

Sediment Treatment	Concentration (µg/kg dry wt)				
	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	15.7	15.7	14.3	13.6	14.2
Batch	1	1	1	1	1
Heptachlor	1.1 U	1.2 U	1.3 U	1.3 U	1.3 U
Aldrin	12.5	11.3	29.5	22.9	23.0
Heptachlor Epoxide	0.83 U	0.83 U	0.91 U	0.95 U	0.92 U
2,4'-DDE	1.7 U	1.7 U	1.8 U	1.9 U	1.8 U
Endosulfan I	1.1 U	1.1 U	1.3 U	1.3 U	1.3 U
α-Chlordane	6.61	5.2	9.50	12.7	8.34
Trans Nonachlor	6.55	3.6	7.41	6.7	7.42
4,4'-DDE	16.8	12.7	53.7	79.3	56.3
Dieldrin	7.95	5.4	19.8	24.6	16.5
2,4'-DDD	8.96	6.93	19.9	18.5	15.5
2,4'-DDT	1.1 U	1.1 U	1.3 U	1.3 U	1.3 U
4,4'-DDD	18.2	13.3	65.5	66.7	50.9
Endosulfan II	1.1 U	1.1 U	1.3 U	1.3 U	1.3 U
4,4'-DDT	18.1	13.8	37.2	25.0	28.5
Endosulfan Sulfate	1.6 U	1.6 U	1.7 U	1.8 U	1.8 U
PCB 8	2.2 U	2.2 U	2.4 U	2.5 U	2.5 U
PCB 18	92.1	32.8	71.1	91.6	66.4
PCB 28	29.4	25.6	68.3	82.5	60.0
PCB 52	41.0	36.6	111	103	93.7
PCB 49	20.8 U	18.4	46.8	50.1	41.0
PCB 44	24.0	27.1	44.4	66.6	43.0
PCB 66	37.4	31.4	91.5	85.0	72.5
PCB 101	29.8	23.7	76.5	62.6	59.6
PCB 87	2.0	1.6 U	6.9	10.5	7.0
PCB 118	17.7	13.7	49.3	43.7	38.4
PCB 184	1.1 U	1.1 U	1.3 U	1.3 U	1.3 U
PCB 153	39.2	29.3	81.2	57.5	59.5
PCB 105	9.92	6.81	26.7	18.6	18.8
PCB 138	27.8	19.3	62.8	42.7	43.2
PCB 187	14.2	10.1	30.2	21.2	22.3
PCB 183	5.7	3.4	15.1	9.97	10.7
PCB 128	3.7	1.8	9.85	6.5	6.4
PCB 180	14.5	10.6	38.2	24.3	26.4
PCB 170	6.2	4.2	15.7	9.38	10.7
PCB 195	0.76 U	0.83 U	0.91 U	0.88 U	1.9
PCB 206	3.2	2.2	8.67	7.1	8.27
PCB 209	1.2 U	1.3 U	4.0	4.5	5.1

Table G.5. (contd)

Sediment Treatment	BR-B COMP	BR-B COMP	MDRS[b]	MDRS	MDRS
	Concentration (µg/kg dry wt)				
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.6	15.7	14.4	13.5	15.3
Batch	1	1	1	1	1
Heptachlor	1.2 U	1.3 U	1.5 U	1.4 U	1.2 U
Aldrin	18.0	19.2	0.97 U	0.96 U	0.85 U
Heptachlor Epoxide	0.89 U	0.96 U	1.0 U	0.96 U	9.82
2,4'-DDE	1.8 U	1.9 U	2.0 U	1.9 U	1.7 U
Endosulfan I	1.2 U	1.3 U	1.4 U	1.3 U	3.8
α-Chlordane	7.73	7.41	2.1	1.2	0.65 U
Trans Nonachlor	4.7	4.7	1.1 U	1.1 U	3.5
4,4'-DDE	47.3	49.4	1.5 U	1.4 U	4.5
Dieldrin	15.3	13.6	5.3	4.6	4.7
2,4'-DDD	14.2	15.3	1.9 U	1.9 U	5.0
2,4'-DDT	1.2 U	1.3 U	1.4 U	1.3 U	1.2 U
4,4'-DDD	49.8	42.4	6.7	6.2	5.6
Endosulfan II	1.2 U	1.3 U	1.4 U	1.3 U	1.2 U
4,4'-DDT	22.8	28.3	11.4	10.2	10.1
Endosulfan Sulfate	1.7 U	1.9 U	1.9 U	1.9 U	1.6 U
PCB 8	2.3 U	2.6 U	2.7 U	2.6 U	2.3 U
PCB 18	64.0	76.4	0.76 U	0.74 U	0.65 U
PCB 28	60.7	53.8	0.83 U	0.81 U	0.72 U
PCB 52	78.1	86.0	2.5 U	2.4 U	2.1 U
PCB 49	35.7	38.0	1.5 U	1.3 U	1.2 U
PCB 44	43.5	48.0	0.55 U	0.52 U	0.46 U
PCB 66	64.4	76.1	1.2 U	1.1 U	0.98 U
PCB 101	48.7	60.2	5.3	2.4	5.1
PCB 87	7.12	7.85	1.9 U	1.9 U	1.6 U
PCB 118	33.4	42.7	2.7	1.4 U	2.4
PCB 184	1.2 U	1.3 U	1.5 U	1.3 U	1.2 U
PCB 153	50.5	70.3	21.3	14.5	16.2
PCB 105	14.4	21.4	1.3 U	1.3 U	5.8
PCB 138	36.1	51.0	13.1	7.92	8.97
PCB 187	17.4	23.2	7.76	4.6	5.4
PCB 183	8.08	11.4	2.1	1.6	1.6
PCB 128	5.1	7.54	0.83 U	0.89	1.0
PCB 180	20.5	29.0	6.0	4.7	4.3
PCB 170	8.42	12.0	2.4	1.9	1.6
PCB 195	1.4	1.9	0.97 U	0.96 U	0.85 U
PCB 206	4.5	6.58	1.7 U	1.6 U	1.4 U
PCB 209	2.3	3.8	1.5 U	1.5 U	1.3 U

Table G.5. (contd)

Sediment Treatment	Concentration (µg/kg dry wt)		
	MDRS	MDRS	*Nereis* Bkgd. Tissue
Replicate	4	5	1
Analytical Replicate			
Percent Dry Wt. (%)	14.1	16.2	15.6
Batch	1	2	1
Heptachlor	1.3 U	1.2 U	1.2 U
Aldrin	0.85 U	0.80 U	0.77 U
Heptachlor Epoxide	0.92 U	0.80 U	0.83 U
2,4'-DDE	1.8 U	1.6 U	1.7 U
Endosulfan I	1.3 U	1.1 U	1.2 U
α-Chlordane	0.64 U	0.62 U	1.2
Trans Nonachlor	0.99 U	0.93 U	1.9
4,4'-DDE	4.2	1.2 U	1.2 U
Dieldrin	5.7	3.9	4.8
2,4'-DDD	1.8 U	1.5 U	1.6 U
2,4'-DDT	1.3 U	1.1 U	1.2 U
4,4'-DDD	5.3	1.6 U	4.5
Endosulfan II	1.3 U	1.1 U	1.2 U
4,4'-DDT	10.7	8.70	8.78
Endosulfan Sulfate	1.8 U	1.5 U	1.6 U
PCB 8	2.4 U	2.2 U	2.2 U
PCB 18	0.71 U	0.62 U	0.64 U
PCB 28	0.78 U	0.68 U	0.71 U
PCB 52	2.3 U	2.0 U	2.1 U
PCB 49	1.3 U	1.1 U	1.2 U
PCB 44	0.50 U	0.43 U	0.45 U
PCB 66	1.1 U	0.93 U	0.96 U
PCB 101	0.92 U	0.80 U	2.6
PCB 87	1.8 U	1.5 U	1.6 U
PCB 118	1.6	1.2 U	1.3
PCB 184	1.3 U	1.1 U	1.2 U
PCB 153	19.6	13.8	13.1
PCB 105	1.1 U	1.0 U	1.0 U
PCB 138	10.5	7.28	7.31
PCB 187	6.6	4.6	4.2
PCB 183	2.0	1.4	1.4
PCB 128	1.1	0.68 U	0.90
PCB 180	6.2	4.3	4.0
PCB 170	2.5	1.5	1.4
PCB 195	0.85 U	0.80 U	0.77 U
PCB 206	1.5	1.3 U	1.3 U
PCB 209	1.3 U	1.2 U	1.2 U

(a) U Undetected at or above given concentration.
(b) MDRS Mud Dump Reference Site.

Table G.6. Quality Control Summary for Pesticide and Polychlorinated Byphenyl (PCB) Analysis in Tissue of *N. virens* (Wet Weight)

Matrix Spike Results

Sediment Treatment	Method Blank	Concentration (µg/kg wet wt) RH COMP[a]	RH COMP (MS)			
Replicate		1	1	Concentration		Percent
Analytical Replicate				Spiked	Recovered	Recovery
Batch		1	1	1		
Heptachlor	0.19 U	0.25 U[b]	3.22	3.30	3.22	98
Aldrin	0.13 U	2.79	4.66	3.30	1.87	57
Heptachlor Epoxide	0.13 U	0.18 U	2.73	3.30	2.73	83
2,4'-DDE	0.26 U	0.35 U	NA [c]	NS[d]	NA	NA
Endosulfan I	0.18 U	0.24 U	2.56	3.30	2.56	78
α-Chlordane	0.10 U	0.90	3.27	3.30	2.37	72
Trans Nonachlor	0.15 U	0.19 U	NA	NS	NA	NA
4,4'-DDE	0.19 U	3.53	5.49	3.30	1.96	59
Dieldrin	0.52 U	1.52	4.01	3.30	2.49	75
2,4'-DDD	0.25 U	1.29	NA	NS	NA	NA
2,4'-DDT	0.18 U	0.24 U	NA	NS	NA	NA
4,4'-DDD	0.26 U	3.01	5.01	3.30	2.00	61
Endosulfan II	0.18 U	0.24 U	3.63	3.30	3.63	110
4,4'-DDT	0.15 U	2.76	4.80	3.30	2.04	62
Endosulfan Sulfate	0.25 U	0.34 U	4.50	3.30	4.50	136 [e]
PCB 8	0.35 U	0.47 U	NA	NS	NA	NA
PCB 18	0.10 U	11.5	NA	NS	NA	NA
PCB 28	0.11 U	7.51	11.4	4.21	3.85	91
PCB 52	0.32 U	10.0	16.7	8.78	6.68	76
PCB 49	0.18 U	4.46	NA	NS	NA	NA
PCB 44	0.07 U	5.45	NA	NS	NA	NA
PCB 66	0.15 U	0.20 U	NA	NS	NA	NA
PCB 101	0.13 U	5.49	10.7	5.96	5.24	88
PCB 87	0.25 U	0.48	NA	NS	NA	NA
PCB 118	0.19 U	3.41	NA	NS	NA	NA
PCB 184	0.18 U	0.25 U	NA	NS	NA	NA
PCB 153	0.44 U	5.86	8.32	3.48	2.46	71
PCB 105	0.17 U	1.36	NA	NS	NA	NA
PCB 138	0.27 U	3.65	5.62	2.69	1.97	73
PCB 187	0.21 U	1.97	NA	NS	NA	NA
PCB 183	0.18 U	0.69	NA	NS	NA	NA
PCB 128	0.11 U	0.14 U	NA	NS	NA	NA
PCB 180	0.38 U	1.97	NA	NS	NA	NA
PCB 170	0.18 U	0.75	NA	NS	NA	NA
PCB 195	0.13 U	0.17 U	NA	NS	NA	NA
PCB 206	0.21 U	0.57	NA	NS	NA	NA
PCB 209	0.20 U	0.34	NA	NS	NA	NA
Surrogate Recoveries (%)						
PCB 103 (SIS)	87	75	77	NA	NA	NA
PCB 198 (SIS)	76	61	63	NA	NA	NA

Table G.6. (contd)

Analytical Replicates

Sediment Treatment	Concentration (µg/kg wet wt) RH COMP	RH COMP	RH COMP	
Replicate	2	2	2	RSD
Analytical Replicate	1	2	3	(%)
Batch	1	1	1	
Heptachlor	0.28 U	1.06	0.26 U	NA
Aldrin	3.07	2.83	3.19	6
Heptachlor Epoxide	0.20 U	0.22 U	0.18 U	NA
2,4'-DDE	0.40 U	0.42 U	0.36 U	NA
Endosulfan I	0.28 U	0.29 U	0.25 U	NA
α-Chlordane	1.01	0.97	1.00	2
Trans Nonachlor	0.70	0.24 U	0.79	NA
4,4'-DDE	3.72	3.81	3.87	2
Dieldrin	1.88	1.78	1.91	4
2,4'-DDD	1.60	1.53	1.87	NA
2,4'-DDT	0.28 U	0.29 U	0.25 U	NA
4,4'-DDD	3.58	3.33	3.58	4
Endosulfan II	0.28 U	0.29 U	0.25 U	NA
4,4'-DDT	3.20	3.05	3.10	2
Endosulfan Sulfate	0.39 U	0.41 U	0.35 U	NA
PCB 8	0.54 U	0.57 U	0.49 U	NA
PCB 18	11.9	11.4	15.2	16
PCB 28	8.76	7.89	9.08	7
PCB 52	11.6	11.0	12.1	5
PCB 49	5.04	4.66	5.25	6
PCB 44	6.53	9.61	6.55	23
PCB 66	7.15	6.70	7.58	6
PCB 101	5.37	5.07	5.73	6
PCB 87	0.60	0.44	0.70	23
PCB 118	3.69	3.45	4.07	8
PCB 184	0.28 U	0.30 U	0.25 U	NA
PCB 153	6.02	5.67	6.69	8
PCB 105	1.40	0.27 U	1.68	NA
PCB 138	4.30	4.00	4.64	7
PCB 187	2.09	2.20	2.43	8
PCB 183	0.71	0.66	0.93	19
PCB 128	0.37	0.17 U	0.58	NA
PCB 180	2.11	2.04	2.37	8
PCB 170	0.80	0.83	1.00	12
PCB 195	0.20 U	0.21 U	0.21	NA
PCB 206	0.66	0.58	0.74	12
PCB 209	0.31	0.32	0.35	6
Surrogate Recoveries (%)				
PCB 103 (SIS)	65	48	63	NA
PCB 198 (SIS)	56	39	53	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NA Not applicable.
(d) NS Not spiked.
(e) Outside quality control criteria (50-120%) for spike recovery.

Table G.7. Polynuclear Aromatic Hydrocarbons (PAHs) in Tissue of *N. virens* (Wet Weight), Red Hook and Bay Ridge Channels

	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	2	2	3
Analytical Replicate		1	2	3	
Percent Dry Wt. (%)	14.7	13.9	13.9	13.9	15.5
Batch	1	1	1	1	1
1,4-Dichlorobenzene[a]	2.61 U[b]	2.87 U	3.02 U	2.57 U	1.86 U
Naphthalene	16.9	11.3	25.4	26.2	3.74 [c]
Acenaphthylene	12.7	8.63	10.8 [c]	10.5	5.00
Acenaphthene	118	95.7	120	120	48.1
Fluorene	43.3	32.9	40.9	41.2	13.7
Dibenzothiophene	17.0	13.0	12.0	13.8	8.17
Phenanthrene	181	124	119	131	89.0
Anthracene	69.2	42.3	41.3	44.8	27.8
Fluoranthene	420	307	284	326	285
Pyrene	388	267	252	281	272
Benzo[a]anthracene	119	60.2	53.1	63.1	50.9
Chrysene	256	181	171	193	160
Benzo[b]fluoranthene	50.4	33.5	30.6	34.2	30.1
Benzo[k]fluoranthene	28.7	14.0	14.6 [c]	15.0	13.0
Benzo[e]pyrene	87.7	52.5	49.7	54.7	48.8
Benzo[a]pyrene	84.5	40.8	39.1	42.8	38.9
Perylene	6.93	5.07	4.97	5.34	4.45
Indeno[123-cd]pyrene	11.2	7.23	7.52	6.78	6.02
Dibenzo[a,h]anthracene	7.12	3.86	3.68 [c]	3.93	3.33
Benzo[g,h,i]perylene	20.7	14.5	12.8	13.0	11.7
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	8 [d]	17 [d]	6 [d]	5 [d]	50
d8 Naphthalene	15 [d]	27 [d]	9 [d]	12 [d]	60
d10 Acenaphthene	41	48	24 [d]	38	72
d12 Chrysene	75	64	44	62	85
d14 Dibenzo(a,h)anthracene	63	85	52	67	66

Table G.7. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	RH COMP	RH COMP	BR-A COMP	BR-A COM	BR-A COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.9	14.2	14.3	14.9	14.5
Batch	1	1	1	1	1
1,4-Dichlorobenzene	1.86 U	1.86 U	1.86 U	1.83 U	1.86 U
Naphthalene	6.75	6.94	4.16 (c)	3.30	2.87 (c)
Acenaphthylene	6.12	6.53 (c)	1.11 (c)	1.10 (c)	1.61 (c)
Acenaphthene	66.5	57.8	2.73	3.34	2.53
Fluorene	20.2	14.6	1.24 U	1.48 (c)	1.24 U
Dibenzothiophene	9.92	8.68	0.50 U	0.84 (c)	0.50 U
Phenanthrene	103	65.2	2.56 U	2.97	2.56 U
Anthracene	37.6	26.3	2.24 U	2.19 U	2.24 U
Fluoranthene	277	169	9.65	21.3	9.80
Pyrene	271	152	15.6	33.8	17.4
Benzo[a]anthracene	53.2	39.1	1.43	3.20	1.35
Chrysene	174	145	6.62	12.2	6.72
Benzo[b]fluoranthene	46.6	20.9	3.02	6.52	3.79
Benzo[k]fluoranthene	1.67 U	13.8	1.79 (c)	1.64 U	1.67 U
Benzo[e]pyrene	56.9	37.7	2.44 (c)	4.18 (c)	2.54 (c)
Benzo[a]pyrene	44.5	38.9	1.97	3.28	1.85
Perylene	5.09	3.06 (c)	1.40 U	1.38 U	1.40 U
Indeno[123-cd]pyrene	6.90	5.02	1.95 (c)	2.10 (c)	1.95 (c)
Dibenzo[a,h]anthracene	3.83	3.74	1.26 U	1.24 U	1.26 U
Benzo[g,h,i]perylene	14.2	9.40	2.41 (c)	2.53 (c)	2.44 (c)
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	24 (d)	18 (d)	13 (d)	52	25 (d)
d8 Naphthalene	38	22 (d)	23 (d)	67	34
d10 Acenaphthene	63	29 (d)	47	75	62
d12 Chrysene	77	35	84	84	50
d14 Dibenzo(a,h)anthracene	74	26 (d)	70	60	45

Table G.7. (contd)

	Concentration (µg/kg wet wt)				
Sediment Treatment	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	15.7	15.7	14.3	13.6	14.2
Batch	1	1	1	1	1
1,4-Dichlorobenzene	1.83 U	1.86 U	1.86 U	1.86 U	1.86 U
Naphthalene	3.52	3.96 (c)	67.7	142	22.5
Acenaphthylene	1.27 (c)	1.17 (c)	13.1	16.5	6.32
Acenaphthene	4.22	2.88	200	386	101
Fluorene	1.86	1.39 (c)	22.9	97.2	16.7
Dibenzothiophene	0.80 (c)	0.50 U	7.29	25.0	5.85
Phenanthrene	3.80	2.56 U	28.7	165	34.4
Anthracene	2.29 (c)	2.24 U	9.32	54.8	10.1
Fluoranthene	21.3	10.9	58.3	219	62.6
Pyrene	33.8	16.8	55.8	224	58.8
Benzo[a]anthracene	4.81	1.80	10.6	30.5	8.43
Chrysene	13.8	7.76	40.3	88.1	40.7
Benzo[b]fluoranthene	7.75	4.53	7.30	22.8	6.52 (c)
Benzo[k]fluoranthene	1.64 U	1.67 U	4.51	1.67 U	3.92 (c)
Benzo[e]pyrene	4.96 (c)	3.07 (c)	12.0	22.3	10.2 (c)
Benzo[a]pyrene	4.03	2.42	10.0	18.4	8.59
Perylene	1.38 U	1.40 U	1.40 U	2.86	1.40 U
Indeno[123-cd]pyrene	2.27 (c)	2.10 (c)	2.44	3.29	2.42 (c)
Dibenzo[a,h]anthracene	1.52 (c)	1.26 U	1.86 (c)	2.15	1.74 (c)
Benzo[g,h,i]perylene	2.75 (c)	2.67 (c)	3.89	5.74	4.21
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	49	25 (d)	3 (d)	3 (d)	19 (d)
d8 Naphthalene	61	37	9 (d)	10 (d)	31
d10 Acenaphthene	70	61	37	44	60
d12 Chrysene	79	79	74	88	77
d14 Dibenzo(a,h)anthracene	53	77	49	63	77

Table G.7. (contd)

Sediment Treatment	Concentration (µg/kg wet wt) BR-B COMP	BR-B COMP	MDRS[e]	MDRS	MDRS
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.6	15.7	14.4	13.5	15.3
Batch	1	1	1	1	1
1,4-Dichlorobenzene	1.86 U	2.16 U	2.24 U	1.86 U	1.86 U
Naphthalene	65.3	9.16	3.15 [c]	3.17 [c]	3.21 [c]
Acenaphthylene	10.6	5.08	0.87 U	0.73 U	0.73 U
Acenaphthene	249	59.1	1.94	1.57 [c]	1.84
Fluorene	55.6	7.92	1.48 U	1.24 U	1.73 [c]
Dibenzothiophene	16.5	5.49	0.60 U	0.50 U	2.91
Phenanthrene	108	24.5	3.07 U	2.56 U	14.0
Anthracene	35.0	8.07	2.69 U	2.24 U	3.17
Fluoranthene	131	71.9	6.44 U	5.36 U	5.36 U
Pyrene	138	79.2	5.48 U	4.57 U	8.58
Benzo[a]anthracene	22.3	12.4	1.83 [c]	1.31 [c]	1.95
Chrysene	62.6	54.7	2.72 U	2.27 U	4.92
Benzo[b]fluoranthene	19.0	10.7 [c]	2.41 [c]	1.64 U	3.29 [c]
Benzo[k]fluoranthene	1.67 U	6.49	2.00 U	1.67 U	1.67 U
Benzo[e]pyrene	18.3	19.8	1.86 U	1.55 U	2.68 [c]
Benzo[a]pyrene	15.2	16.0	1.79 U	1.56	1.49 U
Perylene	2.59	2.12	1.68 U	1.40 U	1.40 U
Indeno[123-cd]pyrene	3.38	4.25	2.11 U	1.76 U	1.87 [c]
Dibenzo[a,h]anthracene	2.11 [c]	2.70	1.51 U	1.26 U	1.26 U
Benzo[g,h,i]perylene	5.70	7.70	1.68 U	1.40 U	3.52
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	8 [d]	17 [d]	53	31	29 [d]
d8 Naphthalene	16 [d]	29 [d]	64	41	42
d10 Acenaphthene	44	52	70	52	63
d12 Chrysene	78	65	80	65	69
d14 Dibenzo(a,h)anthracene	66	63	70	61	64

Table G.7. (contd)

Sediment Treatment	Concentration (µg/kg wet wt) MDRS	MDRS	Nereis Bkgrd. Tissue
Replicate	4	5	1
Analytical Replicate			
Percent Dry Wt. (%)	14.1	16.2	15.6
Batch	1	1	1
1,4-Dichlorobenzene	1.83 U	1.86 U	1.86 U
Naphthalene	4.60 (c)	3.79	8.43 (c)
Acenaphthylene	0.71 U	0.73 U	0.73 U
Acenaphthene	1.28 U	1.70	2.17
Fluorene	1.46 (c)	1.24 U	1.24 U
Dibenzothiophene	0.49 U	0.50 U	0.50 U
Phenanthrene	2.51 U	2.56 U	2.56 U
Anthracene	2.19 U	2.24 U	2.24 U
Fluoranthene	5.26 U	5.36 U	5.36 U
Pyrene	4.48 U	4.57 U	4.57 U
Benzo[a]anthracene	1.07 U	1.09 U	1.12 (c)
Chrysene	2.22 U	2.27 U	2.27 U
Benzo[b]fluoranthene	1.61 U	1.96 (c)	1.64 U
Benzo[k]fluoranthene	1.64 U	1.67 U	1.67 U
Benzo[e]pyrene	1.52 U	1.55 U	1.55 U
Benzo[a]pyrene	1.46 U	1.49 U	1.49 U
Perylene	1.38 U	1.40 U	1.40 U
Indeno[123-cd]pyrene	1.73 U	1.76 U	1.76 U
Dibenzo[a,h]anthracene	1.24 U	1.26 U	1.26 U
Benzo[g,h,i]perylene	1.37 U	1.40 U	1.40 U
Surrogate Recoveries (%)			
d4 1,4-Dichlorobenzene	19 (d)	31	4 (d)
d8 Naphthalene	31	42	12 (d)
d10 Acenaphthene	49	57	40
d12 Chrysene	58	69	89
d14 Dibenzo(a,h)anthracene	48	57	83

(a) Target detection limits are 4.0 µg/kg for all analytes.
(b) U Undetected at or above given concentration.
(c) Ion ratio out or confirmation ion not detected.
(d) Outside quality control criteria (30-150%) for surrogate recovery.
(e) MDRS Mud Dump Reference Site

Table G.8. Polynuclear Aromatic Hydrocarbons (PAHs) in Tissue of *N.virens* (Dry Weight), Red Hook and Bay Ridge Channels

	Concentration (µg/kg dry wt)				
Sediment Treatment	RH COMP	RH COMP	RH COMP	RH COMP	RH COMP
Replicate	1	2	2	2	3
Analytical Replicate		1	2	3	
Percent Dry Wt. (%)	14.7	13.9	13.9	13.9	15.5
Batch	1	1	1	1	1
1,4-Dichlorobenzene	17.8 U[a]	20.6 U	21.7 U	18.4 U	12.0 U
Naphthalene	115	81.0	182	188	24.2 [b]
Acenaphthylene	86.6	61.9	77.3 [b]	75.4	32.3
Acenaphthene	803	687	861	862	311
Fluorene	295	236	293	296	88.8
Dibenzothiophene	116	93.1	85.8	99.1	52.8
Phenanthrene	1230	886	851	943	575
Anthracene	471	303	296	321	179
Fluoranthene	2860	2200	2040	2340	1840
Pyrene	2640	1910	1810	2010	1760
Benzo[a]anthracene	810	432	381	453	329
Chrysene	1750	1300	1220	1380	1030
Benzo[b]fluoranthene	343	240	219	245	195
Benzo[k]fluoranthene	195	101	105 [b]	108	84.3
Benzo[e]pyrene	598	377	357	392	315
Benzo[a]pyrene	575	292	281	307	251
Perylene	47.2	36.4	35.7	38.3	28.8
Indeno[123-cd]pyrene	76.3	51.9	53.9	48.6	38.9
Dibenzo[a,h]anthracene	48.5	27.7	26.4 [b]	28.2	21.5
Benzo[g,h,i]perylene	70.4	104	92.1	93.5	75.6

Table G.8. (contd)

Sediment Treatment	RH COMP	RH COMP	BR-A COMP	BR-A COMP	BR-A COMP
	Concentration (µg/kg dry wt)				
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.9	14.2	14.3	14.9	14.5
Batch	1	1	1	1	1
1,4-Dichlorobenzene	12.5 U	13.1 U	13.0 U	12.3 U	12.9 U
Naphthalene	45.2	49.0	29.1 (b)	22.2	19.8 (b)
Acenaphthylene	41.0	46.1 (b)	7.76 (b)	7.41 (b)	11.1 (b)
Acenaphthene	445	408	19.1	22.5	17.5
Fluorene	135	103	8.67 U	9.97 (b)	8.57 U
Dibenzothiophene	66.4	61.3	3.5 U	5.7 (b)	3.5 U
Phenanthrene	690	460	17.9 U	20.0	17.7 U
Anthracene	252	186	15.7 U	14.7 U	15.5 U
Fluoranthene	1860	1200	67.5	144	67.7
Pyrene	1820	1080	109	228	120
Benzo[a]anthracene	356	276	10.0	21.5	9.33
Chrysene	1160	1020	46.3	82.4	46.4
Benzo[b]fluoranthene	312	148	21.1	43.9	26.2
Benzo[k]fluoranthene	11.2 U	97.1	12.5 (b)	11.0 U	11.5 U
Benzo[e]pyrene	381	266	17.1 (b)	28.1 (b)	17.6 (b)
Benzo[a]pyrene	298	274	13.8	22.1	12.8
Perylene	34.1	21.6 (b)	9.79 U	9.29 U	9.68 U
Indeno[123-cd]pyrene	46.2	35.5	13.6 (b)	14.1 (b)	13.5 (b)
Dibenzo[a,h]anthracene	25.7	26.4	8.81 U	8.35 U	8.71 U
Benzo[g,h,i]perylene	95.4	66.4	16.9 (b)	17.0 (b)	16.9 (b)

Table G.8. (contd)

Sediment Treatment	Concentration (µg/kg dry wt)				
	BR-A COMP	BR-A COMP	BR-B COMP	BR-B COMP	BR-B COMP
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	15.7	15.7	14.3	13.6	14.2
Batch	1	1	1	1	1
1,4-Dichlorobenzene	11.6 U	11.8 U	13.0 U	13.6 U	13.1 U
Naphthalene	22.4	25.2 (b)	473	1040	159
Acenaphthylene	8.07 (b)	7.44 (b)	91.7	121	44.7
Acenaphthene	26.8	18.3	1400	2830	716
Fluorene	11.8	8.84 (b)	160	713	118
Dibenzothiophene	5.1 (b)	3.2 U	50.9	184	41.3
Phenanthrene	24.2	16.3 U	201	1210	243
Anthracene	14.6 (b)	14.2 U	65.1	402	71.7
Fluoranthene	135	69.2	407	1610	443
Pyrene	215	107	390	1640	415
Benzo[a]anthracene	30.6	11.5	74.1	223	59.6
Chrysene	87.7	49.4	282	646	288
Benzo[b]fluoranthene	49.3	28.8	51.0	167	46.1 (b)
Benzo[k]fluoranthene	10.4 U	10.6 U	31.5	12.2 U	27.7 (b)
Benzo[e]pyrene	31.5 (b)	19.5 (b)	83.6	164	72.2 (b)
Benzo[a]pyrene	25.6	15.4	70.0	135	60.7
Perylene	8.77 U	8.91 U	9.78 U	21.0	9.89 U
Indeno[123-cd]pyrene	14.4 (b)	13.4 (b)	17.1	24.1	17.1 (b)
Dibenzo[a,h]anthracene	9.66 (b)	8.02 U	13.0 (b)	15.8	12.3 (b)
Benzo[g,h,i]perylene	17.5 (b)	17.0 (b)	27.2	42.1	29.8

Table G.8. (contd)

Sediment Treatment	Concentration (µg/kg dry wt)				
	BR-B COMP	BR-B COMP	MDRS[c]	MDRS	MDRS
Replicate	4	5	1	2	3
Analytical Replicate					
Percent Dry Wt. (%)	14.6	15.7	14.4	13.5	15.3
Batch	1	1	1	1	1
1,4-Dichlorobenzene	12.7 U	13.8 U	15.5 U	13.8 U	12.2 U
Naphthalene	447	58.5	21.8 [b]	23.5 [b]	21.0 [b]
Acenaphthylene	72.2	32.4	6.0 U	5.4 U	4.8 U
Acenaphthene	1710	378	13.4	11.6 [b]	12.0
Fluorene	381	50.6	10.3 U	9.18 U	11.3 [b]
Dibenzothiophene	113	35.1	4.2 U	3.7 U	19.1
Phenanthrene	741	156	21.3 U	18.9 U	91.6
Anthracene	240	51.5	18.6 U	16.6 U	20.8
Fluoranthene	897	459	44.6 U	39.7 U	35.1 U
Pyrene	947	506	38.0 U	33.8 U	56.2
Benzo[a]anthracene	152	78.9	12.7 [b]	9.70 [b]	12.8
Chrysene	429	349	18.8 U	16.8 U	32.2
Benzo[b]fluoranthene	130	68.1 [b]	16.7 [b]	12.1 U	21.5 [b]
Benzo[k]fluoranthene	11.4 U	41.4	13.9 U	12.4 U	10.9 U
Benzo[e]pyrene	125	127	12.9 U	11.5 U	17.6 [b]
Benzo[a]pyrene	104	102	12.4 U	11.5	9.76 U
Perylene	17.7	13.5	11.6 U	10.4 U	9.17 U
Indeno[123-cd]pyrene	23.1	27.1	14.6 U	13.0 U	12.2 [b]
Dibenzo[a,h]anthracene	14.4 [b]	17.2	10.5 U	9.33 U	8.25 U
Benzo[g,h,i]perylene	39.0	49.2	11.6 U	10.4 U	23.1

Table G.8. (contd)

Sediment Treatment	Concentration (µg/kg dry wt) MDRS	MDRS	*Nereis* Bkgrd. Tissue
Replicate	4	5	1
Analytical Replicate			
Percent Dry Wt. (%)	14.1	16.2	15.6
Batch	1	1	1
1,4-Dichlorobenzene	12.9 U	11.5 U	11.9 U
Naphthalene	32.5 (b)	23.4	54.0 (b)
Acenaphthylene	5.0 U	4.5 U	4.7 U
Acenaphthene	9.05 U	10.5	13.9
Fluorene	10.3 (b)	7.65 U	7.95 U
Dibenzothiophene	3.5 U	3.1 U	3.2 U
Phenanthrene	17.8 U	15.8 U	16.4 U
Anthracene	15.5 U	13.8 U	14.4 U
Fluoranthene	37.2 U	33.1 U	34.4 U
Pyrene	31.7 U	28.2 U	29.3 U
Benzo[a]anthracene	7.57 U	6.72 U	7.18 (b)
Chrysene	15.7 U	14.0 U	14.6 U
Benzo[b]fluoranthene	11.4 U	12.1 (b)	10.5 U
Benzo[k]fluoranthene	11.6 U	10.3 U	10.7 U
Benzo[e]pyrene	10.7 U	9.56 U	9.94 U
Benzo[a]pyrene	10.3 U	9.19 U	9.55 U
Perylene	9.76 U	8.64 U	8.97 U
Indeno[123-cd]pyrene	12.2 U	10.9 U	11.3 U
Dibenzo[a,h]anthracene	8.77 U	7.77 U	8.08 U
Benzo[g,h,i]perylene	9.69 U	8.64 U	8.97 U

(a) U Undetected at or above given concentration.
(b) Ion ratio out or confirmation ion not detected.
(c) MDRS Mud Dump Reference Site.

Table G.9. Quality Control Data for Polynuclear Aromatic Hydrocarbon (PAH) Analysis of *N. virens* Tissue (Wet Weight)

Matrix Spike Results

Sediment Treatment	Concentration (µg/kg wet wt)					
	Blank	RH COMP[a]	RH COMP (MS)	Concentration		Percent
Replicate		1	1	Spiked	Recovered	Recovery
Analytical Replicate						
Batch	1	1	1	1		
1,4-Dichlorobenzene	1.98 U	2.61 U[b]	2.61 U	NS [c]	NA[d]	NA
Naphthalene	2.07 [e]	16.9	38.9	35.0	22.0	63
Acenaphthylene	0.77 U	12.7	40.0	35.0	27.3	78
Acenaphthene	1.38 U	118	98.6	35.0	US[f]	NC [g]
Fluorene	1.97	43.3	62.3	35.0	19.0	54
Dibenzothiophene	0.53 U	17.0	13.4	NS	NA	NA
Phenanthrene	2.71 U	181	177	35.0	US	NC
Anthracene	2.37 U	69.2	89.5	35.0	20.3	58
Fluoranthene	5.69 U	420	370	35.0	US	NC
Pyrene	4.84 U	388	341	35.0	US	NC
Benzo[a]anthracene	1.16 U	119	135	35.0	16.0	46 [h]
Chrysene	2.40 U	256	242	35.0	US	NC
Benzo[b]fluoranthene	1.74 U	50.4	77.5	35.0	27.1	77
Benzo[k]fluoranthene	1.77 U	28.7	57.9	35.0	29.2	83
Benzo[e]pyrene	1.64 U	87.7	67.5	NS	NA	NA
Benzo[a]pyrene	1.58 U	84.5	102	35.0	17.5	50 [h]
Perylene	1.49 U	6.93	5.98	NS	NA	NA
Indeno[123-cd]pyrene	1.87 U	11.2	39.1	35.0	27.9	80
Dibenzo[a,h]anthracene	1.34 U	7.12	33.6	35.0	26.5	76
Benzo[g,h,i]perylene	1.49 U	20.7	42.8	35.0	22.1	63
Surrogate Recoveries (%)						
d4 1,4-Dichlorobenzene	63	8 [i]	44	NA	NA	NA
d8 Naphthalene	67	15 [i]	54	NA	NA	NA
d10 Acenaphthene	74	41	65	NA	NA	NA
d12 Chrysene	82	75	74	NA	NA	NA
d14 Dibenzo(a,h)anthracene	76	63	47	NA	NA	NA

Table G.9. (contd)

Analytical Replicates

Sediment Treatment	Concentration (µg/kg wet wt)			RSD
	RH COMP	RH COMP	RH COMP	
Replicate	2	2	2	(%)
Analytical Replicate	1	2	3	
Batch	1	1	1	
1,4-Dichlorobenzene	2.87 U	3.02 U	2.57 U	NA
Naphthalene	11.3	25.4	26.2	40 (i)
Acenaphthylene	8.63	10.8 (e)	10.5	12
Acenaphthene	95.7	120	120	13
Fluorene	32.9	40.9	41.2	12
Dibenzothiophene	13.0	12.0	13.8	7
Phenanthrene	124	119	131	5
Anthracene	42.3	41.3	44.8	4
Fluoranthene	307	284	326	7
Pyrene	267	252	281	5
Benzo[a]anthracene	60.2	53.1	63.1	9
Chrysene	181	171	193	6
Benzo[b]fluoranthene	33.5	30.6	34.2	6
Benzo[k]fluoranthene	14.0	14.6 (e)	15.0	3
Benzo[e]pyrene	52.5	49.7	54.7	5
Benzo[a]pyrene	40.8	39.1	42.8	5
Perylene	5.07	4.97	5.34	4
Indeno[123-cd]pyrene	7.23	7.52	6.78	5
Dibenzo[a,h]anthracene	3.86	3.68 (e)	3.93	3
Benzo[g,h,i]perylene	14.5	12.8	13.0	7
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	17 (i)	6 (i)	5 (i)	NA
d8 Naphthalene	27 (i)	9 (i)	12 (i)	NA
d10 Acenaphthene	48	24 (i)	38	NA
d12 Chrysene	64	44	62	NA
d14 Dibenzo(a,h)anthracene	85	52	67	NA

(a) Sample randomly selected for use as a quality control sample in analytical batch.
(b) U Undetected at or above given concentration.
(c) NS Not spiked.
(d) NA Not applicable.
(e) Ion ratio out or confirmation ion not detected.
(f) US Under spiked.
(g) NC Not calculated.
(h) Outside quality control criteria (50-120%) for spike recovery.
(i) Outside quality control criteria (30-150%) for surrogate recovery.
(j) Outside quality control criteria (≤30%) for replicate analysis.

Table G.10. Lipids in Tissue of *N. virens*

Sample ID	% Dry Weight	% Lipid (wet wt)	% Lipid (dry wt)
Nereis Bkgd. Tissue	14.00	1.72	12.29
Nereis Bkgd. Tissue	14.00	1.72	12.29
Nereis Bkgd. Tissue	14.00	1.94	13.86