US Army Corps of Engineers
Baltimore District

December 21, 2000

Notice of Availability

DRAFT EVALUATION OF DREDGED MATERIAL: UPPER CHESAPEAKE BAY APPROACH CHANNELS TO THE PORT OF BATIMORE, MARYLAND

ALL INTERESTED PARTIES: The U.S. Army Corps of Engineers, Baltimore District, conducted a complex series of tests to assess sediment quality in federal navigation channels in the upper Chesapeake Bay. This study did not include channels in the Patapsco River or Baltimore's Inner Harbor. The testing program followed the guidance in the *Inland Testing Manual* published by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers in 1998. The purpose of the testing was twofold: 1) to determine the quality of the sediments proposed for dredging; and 2) to evaluate the potential effects to Bay resources that could occur from moving the sediment and placing it at another location in the Bay, or placing it at a designated ocean placement site. The study included chemical tests and biological tests that assessed potential effects to larval fish, shrimp, worms, clams, amphipods (marine pillbugs), and larval mussels put in the channel sediments and in water mixed with sediments.

The chemical tests found low concentrations of chemicals in the sediments. These low concentrations were expected because many of these chemicals are found in soils and sediments in the upper Chesapeake Bay area. The overall quality of the sediments in the channels is similar to that found in past studies of areas outside of the navigation channels in the upper Chesapeake Bay. The studies also found that low concentrations of some chemicals were released from sediments into the water when sediments and water were mixed together. This finding was also expected.

Two sets of laboratory tests were performed to evaluate the potential effects of sediment and sediment and water mixtures to aquatic animals. In the first set of tests, bottom-dwelling worms and amphipods were placed in sediments to see if harmful effects occurred. Results of the tests showed that bottom-dwelling worms and amphipods lived in all of the channel sediments in these laboratory tests with no harmful effects. This indicates that aquatic animals could live in sediments dredged from channels in the upper Bay and placed in other areas of the Bay. In the second set of tests, larval fish, shrimp, and larval mussels were placed in water that had been mixed with sediment to see if harmful effects occurred. Larval animals were used because they are the most sensitive life stage and most likely to show any potential for harm. Results of the tests showed that larval fish, shrimp, and larval mussels could live in most of the water and sediment mixtures without harmful effects. However, some of the water and sediment mixtures did have harmful effects on some of one type of larval fish and some of the larval mussels. Therefore, more studies were conducted to compare conditions used in the laboratory tests to what would happen in the Bay during placement of dredged material.

These additional studies showed that aquatic animals in the Bay are not expected to show harmful effects if these sediments were to be dredged and placed in the Bay. In most cases, the water into which the sediment would be placed would meet all water quality standards, and there would be no potential for harmful effects within minutes of placement. However, because the tests indicated that water quality standards might have been exceeded on a limited basis, a mixing zone, or an allowed distance or length of time to achieve standards, would have been required. Since the State of Maryland is striving to phase out the use of mixing zones as one of its Chesapeake Bay Agreement commitments and because of the preliminary finding of potential adverse effects on two of the species tested in the laboratory, the State removed Site 104 from consideration as an open water placement site. For ocean placement, all water quality standards would be met during the four-hour period allowed in the ocean regulations.

Further tests of the sediments were conducted to see if any chemicals found in the sediments could build up inside animals that live in sediments. Aquatic worms and clams were placed in the sediments in the laboratory for four weeks, and then their tissues were tested for build-up of chemicals. Nine of 151 chemicals showed a chance of accumulating to potentially harmful levels over time in the tissue of bottom-dwelling animals. These nine remaining chemicals will be further evaluated to see if the sediments could cause harm to the environment.

In summary, this study shows that the dredged material from the channels is similar in quality to sediments outside the shipping channels in other areas of the upper Chesapeake Bay. The Corps of Engineers concludes that no placement alternatives would be eliminated from consideration based on tests conducted to date. However, the Corps will perform additional studies on nine chemicals to further evaluate the potential of these chemicals to accumulate in aquatic animals. The Corps will use the results of this study to work with the State to find other placement options for sediments dredged from the channels.

This Notice of Availability is being sent to organizations and individuals known to have an interest in the results of the sediment testing. Please bring this notice to the attention of any other individuals with an interest in this matter. Comments on the draft report should be submitted in writing to the following address by February 15, 2001.

District Engineer
ATTN: CENAB-PL-P
U.S. Army Corps of Engineers
Baltimore District
P.O. Box 1715
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Copies of the draft report are available for review at the following locations:

- Annapolis Public Library, 1410 West Street, Annapolis, MD
- Baltimore County Public Library, North Point Branch, 1716 Merrit Boulevard, Baltimore, MD
- Enoch Pratt Free Library, 400 Cathedral St., Baltimore, Maryland
- Kent County Library 408 High Street, Chestertown, Maryland
- Queen Anne's County Public Library, 121 South Commerce St., Centreville, Maryland
- Talbot County Public Library, 100 W. Dover St., Easton, Maryland

Individuals may obtain a copy of the draft report through the Baltimore District's web site at: http://www.nab.usace.army.mil/projects/Maryland/sediment.htm, by writing to the address above, by telephoning Mr. Mark Mendelsohn at (410) 962-9499 or toll free at 1 (800) 295-1610, or by e-mailing Mr. Mendelsohn at mark.mendelsohn@usace.army.mil.

Christina E. Correale

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From: Nat Brown
To: Cece Donovan
Date: 12/12/00 4:56PM
Subject: Review of the Sediment Study Overview

Hello Cece:

Please accept the following review comments for your consideration. I apologize for the tardiness in which these comments are being sent.

- Page 1, Study Purpose, 2nd sentence: suggest adding..... "must travel to call **on** the Port of Baltimore".
- Page 1, Study Purpose, last sentence: Recommend changing to the following: " In order to dredge in an environmentally sound way, **the composition of the sediments and the behavior of the material are studied** when it is dredged and then moved.
- Page 3, 1st para. : It is 20 years.
- Page 3 observation: There is no mention about SAVs and how that supports marine life. Some marine/aquatic life thrives in SAVs.

It is nice to have this report written in layman's terms. However, it seems more appealing to have the word "animal(s)" substituted with either " marine life or aquatic life". It seems that the image of animals that most people may have refers mostly to land animals; not underwater animals.

Thank you.

Nat Brown
Harbor Development

CC: Frank Hamons

12/11/00

SEDIMENT STUDY OVERVIEW

Study Purpose

The purpose of this overview is to provide an understanding of testing done on sediments in the Chesapeake Bay. These sediments accumulate in channels that commercial ships must travel to call ON the Port of Baltimore. To ensure safe passage of these ships, the sediments must be moved – a process that involves dredging the material and depositing it in approved sites. In order to dredge in an environmentally sound way, ~~we study~~ the composition of the sediments and the behavior of the material ARE STUDIED when it is dredged and then moved.

Study Benefit

In Maryland, as elsewhere, international commerce drives prosperity – and ports drive jobs. More than 126,000 jobs in the state are in some way related to the movement of cargo at the Port of Baltimore. This represents nearly 6% of all individuals employed within Maryland. Businesses providing direct services at the Port received $1.4 billion in revenue during 1998. Maintaining the shipping channels within the Chesapeake Bay is essential to the continued success of the Port – and Maryland.

The *Inland Testing Manual*

In 1998, the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA) finalized new sediment testing guidelines called the *Inland Testing Manual* (ITM). The ITM is a companion to the *Ocean Testing Manual* (OTM, also referred to as the *"Green Book"*) which is used to evaluate dredged sediments that are planned for ocean placement. The ITM testing process is used in inland waters, such as rivers or estuaries. In particular, the ITM process helps to determine the quality of sediments that are considered for open water placement. The guidance documents were developed to provide guidelines for a uniform basis for testing and evaluating dredging projects and to comply with the Clean Water Act (CWA) and the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972.

This report provides information from testing Upper Chesapeake Bay shipping channel sediments and background sediments using the ITM guidelines. While the channel sediments have been tested numerous times in the past, this is the first time the complete testing process outlined in the recently developed ITM has been fully applied to Chesapeake Bay sediments.

The majority of sediments dredged annually in the U.S. is placed in open water sites. Open water placement is generally cost-effective, and return of the sediments to conditions similar to their original state in the channels can minimize environmental effects. Even in relatively clean ecosystems like the Chesapeake Bay, however, questions arise on the quality of the sediment and potential impacts to aquatic life and human health. The ITM provides guidelines for addressing such questions in a tiered approach.

The ITM testing process is not a regulatory requirement. It recommends a standard process that that may be used to characterize sediment quality and evaluate the potential for ecological and human health effects if the sediments are placed in open water. The ultimate goal of the data generated by the ITM process is to help regulators, project sponsors, and other public interest groups determine whether open water placement can be managed with acceptable environmental and human health effects.

These studies were originally undertaken to evaluate sediments proposed for open water placement at Site 104. Open water placement of dredged material at Site 104 is no longer under consideration. The data collected in these studies may be used to provide a greater understanding of the sediment quality in the Upper Chesapeake Bay shipping channels to the Port of Baltimore. In addition, the information will help managers and regulators to determine where to place dredged material in the future.

Where Sediments Come From

Erosion is natural. Flowing water breaks down and moves rock and soil from land structures. Weather events, like heavy rainfall, hurricanes and nor'easters accelerate erosion. Other factors speed the process, too: removing forests and grass, building homes, paving roads, constructing shopping centers and commercial and industrial structures, and some farming practices.

Wherever these activities occur throughout the drainage basin of the Chesapeake, eroded sediments are suspended in the water and begin their path to the Bay. Much of the suspended material begins to settle out of the water when a river enters an estuary and slows down. Large amounts of sediment accumulate where large amounts of flowing water (such as from the Susquehanna or Potomac Rivers) meet tidal waters. The flow of rivers, water movement, and erosion from the shoreline continually wash sediments into the Chesapeake Bay.

Current estimates of the annual inputs of sediment into the Bay vary, depending on the amount of storm events, rainfall, and the rates of land disturbance. However, on average, approximately 2.2 million cubic yards of sediment are deposited in the Bay annually. In addition, sediment already in the Bay is in constant motion, moving from the shallow areas to the deep areas including the shipping channels, and moving with the tides.

All ports face this problem. However, the channels from the open ocean to the Port of Baltimore are far longer than those of any other U.S. seaport. The port lies 150 nautical miles from the ocean via the Virginia and Maryland channels and 113 nautical miles via the Delaware Bay, Chesapeake & Delaware (C&D) Canal, and the northern Bay approach channels. Although portions of these channels are naturally deep, a total of approximately 126 miles of channel must be dredged periodically to remove sediments and to provide adequate depth and width to accommodate the draft and length of ever-larger new vessels. The need to keep these channels clear for the safe passage of large modern ships presents a perpetual challenge both because of the need to dredge periodically and the need to store or place dredged material in an environmentally responsible manner.

Throughout the past 20? years, Maryland's dredging program has evolved to keep pace with annual channel maintenance needs and the identified needs for channel improvements. Today, over 4 million cubic yards (mcy) of material are dredged annually for channel maintenance in the upper Chesapeake Bay. Additional volumes are identified periodically for improvements to channels, anchorages, and berthing areas.

The Port is currently served by Congressionally authorized channels that are: 50 feet deep leading from the Atlantic Ocean to Ft. McHenry, 35-feet deep from the Delaware River to the Patapsco River, and depths ranging from 22 to 50 feet in various branch channels and anchorages in the Port. These depths give the Port of Baltimore a distinct advantage for attracting international trade over other ports of similar size. However, to maintain the viability of the Port, the approach channels must be maintained at prescribed depths. To improve their efficiency of service, all of the shipping lines serving the Port are converting to much larger ships. Thus, channels require more regular dredging to maintain adequate depths.

Dredging and Chesapeake Bay Initiatives

In recent years, the health of some Bay resources has prompted special attention from the State of Maryland and neighboring states and jurisdictions, the federal government, scientists, public interest groups, and citizens. Millions of dollars have been invested to ensure the future health and condition of Bay resources. Given the level of interest and effort being undertaken to protect the Bay and its resources, extensive testing was warranted to evaluate sediment quality for a proposed new open water placement option. The information generated will also be useful in understanding sediment quality in the Chesapeake Bay channels and other areas.

ITM – Tiered Testing Conducted for This Study

The placement of dredged sediments in open water can potentially impact the community of animals that live in the water and bottom mud (sediment). Therefore the USACE and USEPA developed guidelines for testing sediments to identify and evaluate the following types of potential impacts:

- Effects to animals in the water during the process of placing the dredged material.
- Effects to animals that live in the sediments and will re-colonize the sediment after placement activities have ceased.
- Bioaccumulation of chemicals in animals inhabiting the placement site that could affect other animals that feed on them.
- Effects to humans that eat fish and shellfish harvested from the placement site.

NO MENTION OF SAV'S. THAT SUPPORTS MARINE LIFE.

To gather information on the above potential impacts, a series of studies was conducted of the sediments in the federal navigation channels to define their chemical, physical, and biological characteristics.

Location of Tested Sediments

Twelve channels segments proposed for dredging to maintain their existing authorized depths were sampled in 1999. The maintenance dredging samples were taken from the Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, Tolchester Channel, Swan Point Channel, and southern approach channel to the Chesapeake & Delaware Canal. In addition, samples were collected from a proposed channel improvement area, where straightening an existing S-Turn in the Tolchester Channel is planned to improve navigation safety. In addition, two proposed placement areas (Site 104 and the Norfolk Ocean Disposal Site) and an upper Chesapeake Bay reference area (Outside Site 104) were sampled.

Evaluation Procedures Used

Testing guidelines in the *ITM* were used to evaluate dredged material to be placed in the Upper Chesapeake Bay. Testing guidelines in the *OTM* were used to evaluate the possible use of the Norfolk, Virginia Ocean Placement Site in the Atlantic Ocean outside of the mouth of the Chesapeake Bay.

Both the *ITM* and the *OTM* describe a stepwise or tiered approach for evaluating the water column and Bay bottom impacts associated with open water placement of dredged material. Data are collected and reviewed in each step of the evaluation process, and conservative (worst-case) assumptions are used to evaluate to data. Depending on the results of each step, either the next step in the process may be undertaken to collect more information, a factual determination to proceed with open water placement may be made, or open water placement may be eliminated as a dredged material placement alternative. This stepwise approach is known as a "tiered" testing approach, and is used to predict and evaluate the physical, chemical, and biological characteristics of the sediment when it is placed in an open water location.

Tier I Results – Review of Available Data

Four levels or tiers form the overall "tiered testing approach". The first Tier requires the least detailed testing. Each successive Tier includes more rigorous testing.

Under Tier I, available data and information that are representative of the areas proposed for dredging were reviewed and evaluated. The objective of the review was to identify chemical constituents of potential concern that may have been identified in previous studies and to determine if additional testing in subsequent tiers was recommended. The data review included sediment quality information from previous channel studies conducted by the USACE, Baltimore District, in 1998. The results of this investigation indicated that additional testing under Tier II would provide additional useful information.

Tier II Results – Chemical Testing of Sediment and Water

Under Tier II, samples of sediments and water were collected from the channels, proposed placement sites, and reference areas. These samples were then analyzed for a long list of chemical constituents. This list was agreed upon after consultation among the USACE, State of Maryland, and the USEPA Region III. The list contained 203 chemical constituents and 6 physical parameters, not all of which may be of equal concern, but the list was made as inclusive as possible.

Potential water column impacts were evaluated by creating and testing elutriate samples to simulate placing sediment in open water. Elutriate samples are created by mixing water and sediment in a fairly concentrated solution. Concentrations of chemical constituents in the elutriate solutions were compared to federal Water Quality Criteria (WQC) and to state Water Quality Standards (WQS). WQC and WQS are established for protection of animals in the environment and to humans who may eat them.

Sediment chemistry data were used to perform a statistical calculation, termed a Theoretical Bioaccumulation Potential (TBP). This mathematical calculation is used to predict the potential for chemical constituents to accumulate in animal tissue.

The ITM guidance recommends Tier III testing to further evaluate the potential concern if a calculated TBP exceeds a reference site value, or if dissolved chemical constituents in an elutriate sample exceed WQC or WQS. Both of the data evaluation procedures used were implemented using extremely conservative – or very cautious choices in how to perform the evaluations. An effort was made to do every evaluation in a "worst case scenario". This was done to understand and quantify even small levels of concern and to be protective of human health and the environment.

The sediment chemistry studies at this point indicated that the channel sediments were very similar in quality to ambient non-channel sediments in the upper Chesapeake Bay, based on comparisons to past studies of sediment quality (Eskin et al. 1996). However, because there were some WQC and WQS that were exceeded in full-strength elutriate samples, and because some values for TBP were greater in channel sediments than in reference sediments, the results of the Tier II evaluation suggested that Tier III biological testing was recommended. The decision was made to continue to test the sediments in Tier III in order to gather more information.

Tier III Results – Bioassays

Under Tier III, the sediments and elutriates were again tested using a series of laboratory biological tests, which are referred to as bioassays. These tests were performed to gather information on the potential risk and level of risk associated with placement of these sediments in open water to the health or survival of aquatic animals either in the Bay or in the ocean.

One of the bioassay tests involved placing several hundred individuals of two different mud-dwelling animals into the sediment for ten days in the laboratory, and seeing how they survive. Following ITM guidance, an aquatic worm and an amphipod (similar to an aquatic pillbug), were chosen to represent the general types of animals found in the Bay or ocean. The results of this test would give an indication as to whether the sediment would have a potential effect on bottom-living animals after placement. The results of these tests indicated that bottom-dwelling animals would not have any difficulty living in the sediment after placement occurred. This means that the sediments that were tested would not hurt bottom-dwelling animals if placed in open water in the Bay or the ocean.

In addition to testing the sediments themselves, other tests were conducted on the elutriate samples (the water after being mixed with the sediments). These tests were conducted to evaluate potential effects to animals in the water column during open water placement of dredged material. Four species of animals were used in these tests: two fish, one shrimp, and one mussel. As suggested by the test procedures, all animals are tested while they were in larval, or developmental life stages. This is when the animals are most sensitive, so conservatively, this is the life stage that will be most likely to show an affect. These animals were placed in elutriate solutions and were observed over either a 48-hour or 96-hour period in the laboratory tests. It is acknowledged that animals in the Bay would not be exposed to the same full-strength elutriate concentrations for the entire length of time as the laboratory tests, but the tests are conservatively designed to gather information on effects, more so than to mimic real-life conditions that would occur during dredged material placement. In these tests, none of the full-strength elutriates adversely affected two of the animals – a fish and a shrimp. Several of the elutriates adversely affected the other fish species and larval mussels.

The normal procedure with theses result is to calculate the length of time necessary under real-life conditions that would allow the water quality to achieve water quality standards, and when it would no longer have the potential to effect animals in the Bay. For open water placement in the Bay, all of the tests would have met this endpoint with minimal lengths of time and distance from the discharge point. A State Water Quality Certification (WQC) was needed for open water placement in the Chesapeake Bay. The State of Maryland would not consider issuance of a WQC with a mixing zone, or an allowed length of time to achieve standards, in a new open water placement area at the time that these studies were conducted. So based on the partial results available in June 2000, Site 104 was removed from consideration as an open water placement site.

For ocean water placement, the OTM specifies that time allowed to achieve this standard is 4 hours after placement. Modeling for the elutriate mixtures showed that minutes, rather than hours, would be needed to achieve standards and to eliminate the potential for effects to water column animals. Based on the results of the water column and sediment bioassays, all channels would have been acceptable for ocean placement.

Tier III – Bioaccumulation Studies

A third set of laboratory tests involved placing a large number of clams and worms (also chosen to represent the general types of animals found on the Bay or ocean bottom) into the sediment for 28 days. These animals not only live in the mud but also eat it to get nutrients. Because they have great exposure to the sediments in which they live, their potential for showing affects is greater. This is why they were selected for these tests. At the end of the 28-day time period, the animals were analyzed for various chemical constituents, to determine if the animals had accumulated these chemical constituents in their bodies. Overall, 151 chemical constituents and 2 physical properties were tested in the animal tissues. The list of chemical constituents was again developed in coordination with state and federal agencies to be as inclusive as possible.

These tests are referred to as bioaccumulation tests and they are used to evaluate ecological and human health concerns related to bioaccumulation of chemical constituents from the sediments. Some chemical constituents that bioaccumulate, can magnify (become more concentrated) if they accumulate in animals low on the food chain. If these animals accumulate chemical constituents and are then eaten by larger (higher order) animals, effects may be seen in the higher order animals, even though these effects are not seen in the lower food chain animals.

The results of the bioaccumulation tests indicated that the sediments were expected to be acceptable for open water placement. There were 53 chemical constituents of the 151 tested that had higher concentrations in animals tested in channel sediments compared to reference sediments. However, review of the characteristics of each chemical indicated that the majority of the chemicals were present at insignificant concentrations. In some cases, the chemical constituents that appeared to bioaccumulate were never detected in the sediments. In other cases, conservative handling of non-detect levels in laboratory analyses may have resulted in the appearance of bioaccumulation, when none may actually have occurred. Overall, only 7 of the 151 tested chemicals warranted further investigation. Additional evaluation of these 7 chemical constituents will be conducted in order to further ensure that none of the materials proposed for open water placement would cause harm to the environment.

Summary of Other Information

In addition to conducting this series of tiered tests, the concentrations of chemicals found in the channel sediments were compared to information collected by other research programs in the Upper Chesapeake Bay. The results of these comparisons indicated that, while there were wide variations in reported concentrations, there were no substantial differences found between the channel sediments to be dredged and sediments in areas outside the channels. While sediments in Baltimore Harbor are known to have higher concentrations of many of the chemicals tested, these sediments were excluded from this study because they must be placed in a confined site (such as Hart-Miller Island).

The State of Maryland has been evaluating and monitoring dredged material placement sites for many years. Established placement sites and facilities have been monitored with the following results:

- No impacts to aquatic animals from contaminants have been detected adjacent to the Hart-Miller Island Confined Containment Facility in 17 years of monitoring. It should be noted that the HMI facility has been receiving contaminated sediments from Baltimore Harbor and these have not affected benthic animals, or had negative effects on water or sediment quality. These studies have included evaluation of benthic tissue samples.

- Hart-Miller Island has become a haven for many bird species. Over 276 species have been found utilizing the site.

- Open-water placement at Pooles Island has been ongoing for decades in the upper Bay. It has been monitored and shown to only have temporary effects on benthic populations, only due to burial at the time of placement. Benthic animal populations generally recover within 18 months of placement activities.

- There is one Region of Concern in the vicinity of the Port of Baltimore. This is an area that has been identified by the USEPA and the Chesapeake Bay Program as containing high levels of chemical contaminants. This region of concern is in the Baltimore Harbor in the Patapsco River. The navigation channels in the main Chesapeake Bay are not part of this Region Of Concern.

- Some older open water placement sites, such as Man-O-War Shoals, have demonstrated enhanced fisheries value after placement and are heavily fished by both recreational and commercial fishermen.

- The dredged material studied under the ITM has been approved for placement at the Poplar Island Environmental Restoration Project. The findings of this study indicate that this material is still considered acceptable for beneficial use, and ongoing monitoring will continue to enable continued high levels of environmental safety.

Conclusions

An extensive series of tiered test procedures was fully implemented for the first time to evaluate sediment quality in federal navigation channels in the Chesapeake Bay. The test results found detectable levels of some chemical constituents in the sediments. This was expected, as many of these chemical constituents are ubiquitous (found everywhere) in nature, and have been found in the past in soils and sediments in the area. The quality of the sediments in the channels was similar to that found in previous studies of non-channel areas of the Chesapeake Bay.

Laboratory bioassay tests of sediments found that bottom animals could live in the sediments after placement in the Chesapeake Bay. Bioassay tests of elutriates (sediment-water mixtures) showed no effects to some larval aquatic animals, but showed some adverse effects to some other larval aquatic animals that were tested.

These test results were further evaluated to compare the exposure time and chemical concentrations of the aquatic animals tested in the laboratory to the exposure time and chemical concentrations that would be expected to occur in the Bay during open water placement. Results indicated that minimal effects would actually occur to animals in the water column in the Bay during placement. In most cases, the elutriate would achieve WQC and WQS and no effect would be expected within minutes of discharge. For ocean placement, all of the dredged material would meet the standards during the 4-hour placement period specifies in the ocean regulations. The State of Maryland decided not to issue a Water Quality Certification for the proposed open water placement site, known as Site 104, in the Chesapeake Bay based on preliminary information from the aquatic bioassays.

Lastly, further testing of the sediments was performed to determine the potential for contaminants in the sediments to accumulate in bottom organisms. Only 7 of 151 chemical constituents in animal tissues warranted further investigation. The remaining seven will be further evaluated, in order to further ensure that none of the materials would cause environmental harm. Indications are that the dredged material in the federal navigation channels is of similar quality to ambient sediment quality in the Chesapeake Bay (Eskin et al. 1996), and placement alternatives would not be limited based on the results of the ITM testing process.

SEDIMENT STUDY OVERVIEW

Sediment Study Background

A sediment study has been conducted to characterize the quality of sediments in navigation channels in the Chesapeake Bay. Determining the quality of the sediments is important to answer questions about how the sediments can acceptably be used after they are dredged from navigation channels. Each year, a quantity of sediments must be dredged to maintain the channels at safe depths for ships. In the Chesapeake Bay, a variety of options have been considered for the sediments after they are dredged. Sediment management options can include island creation, containment within a confined area, beneficial uses such as habitat restoration or shoreline erosion control, open water placement and many other options.

In 1998, the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency finalized a new set of guidelines. These guidelines are referred to as the Inland Testing Manual (ITM). The ITM procedures were developed as a companion to the Ocean Testing Manual (OTM), which has been in use for several years as a way of evaluating dredged sediments planned for ocean placement. The ITM was developed for use in inland waters, such as rivers or estuaries. In particular, the ITM was developed to determine the quality of sediments that are considered for open water placement. This report provides the information from testing of Chesapeake Bay channel and background sediments using the ITM guidelines. This is the first time the ITM has been used for Chesapeake Bay sediments.

While open water placement is a popular method for dredged sediment management, it raises many questions in the minds of the public. It is the placement method used to handle the bulk of the dredged material generated annually in the U.S. It is generally cost-effective, and return of the sediments to conditions similar to their original state can minimize environmental affects, but questions about the quality of the sediment and potential impacts to aquatic life and human health persist, even in relatively clean ecosystems like the Chesapeake Bay. The ITM was developed as a tiered testing protocol to attempt to provide guidelines for addressing many of these questions. From a regulatory perspective, the ITM is a guideline – not a regulatory mechanism – set up to allow a characterization of sediment quality and an evaluation of the affects if the sediments are placed in open water. The OTM, on the other hand, is a regulatory procedure. The ultimate goal of the data generated by the ITM is to help regulators and project sponsors determine whether open water placement can be managed with acceptable environmental affects.

Port History

The Port of Baltimore is an historic port, with a 300-year history. It remains a vital part of the overall economy of the region. Recent evaluations of the contribution of the Port to the regional economy have indicated that the Port contributes significantly to the local tax base and economy in several important ways. The Port creates both direct and indirect revenues and jobs and supplies Maryland and Midwest industries with imported goods and exporting services.

In 1998, more than 126,000 jobs were in some way related to Port activities. This represents nearly 6% of all individuals employed within Maryland. In terms of revenues, the businesses providing direct services at the Port received $1.4 billion in revenue during 1998. Maryland's continued economic success is made possible by the Port and the shipping channels within the Chesapeake Bay, that allow access to the Port. In order to ensure that shipping continues and access to the Port is maintained, the Port of Baltimore channels must be periodically dredged.

Sedimentation in the Chesapeake Bay

It is the ultimate fate of every estuary to fill in over time. An estuary is formed by the confluence of riverine and ocean waters. The influence of the watershed, wind and tidal flows create an area that fills with sediment over geologic time. In the Chesapeake Bay, natural processes of erosion and the breakdown and of rock and soil by flowing water are accelerated by the impacts of more and more people living in the watershed. These impacts include removal of forests and grasslands, the creation of impervious surfaces from the construction of roads, homes, shopping centers and commercial and industrial structures, and by some farming practices. Meteorological events, like heavy rainfall, hurricanes and nor'Easters also accelerate erosion.

Eroded sediments are put in motion (suspended in the water) on their way to the Bay wherever these activities occur throughout the drainage basin of the Chesapeake. Much of the suspended material begins to settle out of the water when a river enters an estuary and slows down. Where large amounts of flowing water (such as from the Susquehanna or Potomac Rivers) meet tidal waters, the deposition of sediments is substantial. The Chesapeake receives these inputs, or sediments, continually from the flow of rivers and shoreline erosion as a result of activity throughout the drainage basin. Current estimates of the annual inputs of sediment into the Bay vary, depending on the amount of rainfall and the rates of economic land disturbance. However, on average, approximately 2.2 million cubic yards of sediment are deposited in the Bay annually. In addition to deposits of new sediment every year, sediment already in the Bay is in constant motion, moving from the shoals to the deep areas, and moving with the tides.

Shoaling in the channels is attributable to a combination of riverine deposits, shoreline erosion, and resuspension of sediments from shallower portions of the Bay. All ports face this challenge of managing shoaled sediments in navigation channels. However, because the channels from the open ocean to the Port of Baltimore are far longer than those of any other U.S. seaport, the problem is a greater challenge here. The port lies 150 nautical miles from the ocean via the Virginia and Maryland channels and 113 nautical miles via the Delaware Bay, Chesapeake & Delaware (C&D) Canal and the northern Bay approach channels. Although portions of these channels are naturally deep, approximately 50 nautical miles on each approach must be dredged periodically to remove sediments and to provide adequate depth and turning radius to accommodate the draft and length of ever-larger new vessels. The need to keep these channels clear for the safe passage of large modern ships presents a perpetual challenge-both to dredge periodically and to store or place dredged material in an environmentally acceptable manner.

Throughout the past 200 years, Maryland's dredging program has evolved to keep pace with annual channel maintenance needs and the identified needs for channel improvements. Today, over 4 million cubic yards (mcy) of dredged material are moved annually for channel maintenance. Additional volumes are identified periodically for improvements to channels, anchorages and piers.

The Port is currently served by Congressionally authorized channels that are: 50 feet deep leading from the Atlantic Ocean to Ft. McHenry, 35-feet deep from the Delaware River to the Patapsco River, and depths ranging from 22 to 50 feet in various branch channels and anchorages in the Port. These depths give the Port of Baltimore a distinct advantage for attracting international trade. To improve their efficiency of service, all of the shipping lines serving the Port are converting to much larger ships.

Dredging and Chesapeake Bay Initiatives

In recent years, the status and condition of some Bay resources have prompted special attention from the State of Maryland and neighboring states and jurisdictions, the federal government, scientists, public interest groups and citizens. Millions of dollars have been invested to ensure the future health and condition of Bay resources. Given the level of interest and effort being undertaken to protect the Bay and its resources, use of the new ITM was warranted to evaluate sediment quality for a proposed new open water placement option. The information generated will also be useful in understanding sediment quality in the Chesapeake Bay channels and other areas.

ITM – Tiered Testing Conducted for This Study

The placement of dredged sediments in open water can potentially impact the community of animals that live in the water and bottom mud. Therefore the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) have developed guidelines for testing sediments to identify and evaluate the following types of potential impacts:

- Toxicity to animals in the water during the process of placing the dredged material
- Toxicity to animals that live in the sediments and will re-colonize the sediment after placement activities have ceased.
- Bioaccumulation of chemicals in animals inhabiting the placement site that could result in toxicity to other animals that feed on them.
- Impacts to humans that eat fish and shellfish harvested from the placement site.

To gather information on the above potential impacts, a series of studies was conducted of the sediments in the federal navigation channels to define their chemical and physical characteristics.

Location of Sediments

Thirteen channels segments proposed for dredging to maintain their existing authorized depths were sampled in 1999. The maintenance dredging samples were taken from the Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, Tolchester Channel, Swan Point Channel, and southern approach channel to the Chesapeake & Delaware Canal. In addition, samples were collected from a proposed channel improvement area, where straightening an existing S-Turn in the Tolchester Channel has been requested to improve navigation safety. In addition, two proposed placement areas (Site 104 and the Norfolk Ocean Disposal Site) and an upper Chesapeake Bay reference area (Outside Site 104) were sampled.

Two Evaluation Procedures Used

There are two USEPA/USACE guidance documents that describe the recommended testing and evaluation procedures for sediments to be dredged and placed in open water sites. The *Inland Testing Manual* (the *ITM*) describes testing and evaluation procedures for dredged material proposed for placement in either fresh, estuarine, or saline (near coastal) waters. This guidance is used for dredged material to be placed in the Upper Chesapeake Bay. The *Ocean Testing Manual* (*OTM*, also referred to as the *"Green Book"*) describes the testing and evaluation procedures for dredged material proposed for placement in ocean sites. In this report, the latter document was used to evaluate the possible use of the Norfolk, Virginia Ocean Placement Site in the Atlantic outside of the mouth of the Chesapeake Bay. These guidance documents were developed to provide guidelines for a uniform basis for testing and evaluating dredging projects and to comply with the Clean Water Act (CWA) and the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972.

Both the *ITM* and the *OTM* describe a stepwise approach for evaluating the impacts associated with open water placement of dredged material placement. Depending on the results of each step in the evaluation, the next step could be undertaken, or open water placement could be eliminated as a dredged material placement alternative. The material could be eliminated from consideration if there is "reason to believe" that significant unacceptable adverse effects will occur to either the water column or the benthic environment. This approach is known as a "tiered" testing approach, and is used to evaluate the chemical or physical component of the sediment when it is placed in an open water location.

Tier I Results – Review of Available Data

There are four levels or tiers, which form the overall "tiered approach". The first Tier requires the least detailed testing. Each successive Tier includes more rigorous testing.

Under Tier I, available data and information that are representative of the areas proposed for dredging were reviewed and evaluated. The objective of the review is to identify Contaminants Of Potential Concern (COPCs) and to determine if additional testing in subsequent tiers is necessary. The results of this investigation indicated that additional testing under Tier II would be recommended.

Tier II Results – Chemical and Water Testing

Under Tier II, samples of sediments and water were collected from the channels, proposed placements, and reference areas. These samples were then analyzed for a long list of chemical constituents. This list was agreed upon after consultation among the USACE, State of Maryland, and the USEPA, Region III. The list contained 200 constituents, not all of which may be of equal concern, but since this was the first time this procedure was used, the list was made as inclusive as possible.

Potential water column impacts were evaluated by first mixing water and sediment in a fairly concentrated solution (elutriate), then comparing concentrations of contaminants in that solution to federal Water Quality Criteria (WQC) and to state Water Quality Standards (WQS).

Sediment chemistry data were used to perform a statistical calculation, termed a Theoretical Bioaccumulation Potential (TBP). This mathematical calculation is used to predict the potential for contaminants to accumulate in animal tissue.

The guidelines in the ITM are that if a calculated TBP exceeds a reference site value, or if dissolved contaminants exceed WQS, then Tier III testing is recommended. Both of the procedures used were implemented using extremely conservative – or very cautious choices in how to perform the evaluations. Every effort was made to do every evaluation in a "worst case scenario". This was done to understand and quantify even small levels of risk.

Since there were some water quality standards that were exceeded in elutriate, and some values for TBP that were greater in channel sediments than in reference sediments, the results of this evaluation indicated that Tier III biological testing was recommended. There was also indication at this stage that the channel sediments were very similar in quality to ambient non-channel sediments in the Chesapeake Bay, based on past studies of sediment quality (Eskin et al). The decision was made to continue to Tier III in order to gather more information.

Tier III Results – Bioassays

Under Tier III, the sediments and elutriates are again tested using a series of biological tests, which are referred to as bioassays. These tests are performed to gather information on the potential risk and level of risk associated with placement of these sediments in open water to the health or survival of aquatic animals either in the Bay or in the ocean.

One of the bioassay tests involves placing several hundred individuals of two different mud-dwelling animals bottom into the sediment for ten days, and seeing how they survive. A kind of worm and an amphipod (similar to an aquatic pillbug), were chosen to represent the general types of animals found in the Bay or ocean. This test would give an indication as to whether the sediment would have a potential toxic effect on animals after placement. The results of these tests indicated that none of the sediments was toxic to the test animals. This means that the sediments that were tested would not hurt bottom-dwelling animals if placed in open water in the Bay or the ocean.

In addition to testing the sediments themselves, other tests were conducted of the water after being mixed with the sediments. These were conducted to evaluate potential impacts to animals in the water column during dredged material placement. Four species were used in these tests, two fish, one shrimp, and one mussel. As suggested by the test procedures, all animals are tested while they are in larval, or developmental stages. This is when they are most sensitive, so this is the life stage that will be most likely to show an affect. These animals were placed in elutriate solutions and were observed over either a 48-hour or 96-hour period in the laboratory tests. It is acknowledged that animals in the Bay would not be exposed to the same concentrations for the same length of time as the tests, but the tests are conservatively designed to gather information on effects, not to mimic real-life conditions that would occur during dredged material placement. In these tests, none of the sediment/water mixtures were toxic to two of the animals – a fish and a shrimp, some of the sediments were toxic to two other animals – a different fish and larval mussels.

The normal procedure with this result is to calculate the length of time necessary under real-life conditions that would allow the water quality to achieve water quality standards, and when it would no longer have the potential to be toxic. All of the tests would have met this endpoint with minimal lengths of time and distance from the discharge point. For ocean water placement, the allowed time to achieve this standard is 4 hours after placement. Modeling for these sediment/water mixtures showed minutes, rather than hours, would be needed to achieve standards and to eliminate the potential for toxicity. All channels would have been acceptable for ocean placement. Given that the ITM is a guideline, a State Water Quality Certification (WQC) was needed for inland open water placement in the Chesapeake Bay. The State of Maryland would not consider issuance of a WQC with a mixing zone, or an allowed length of time to achieve standards, in a new open water placement area at this time. So based on the partial results available in mid-2000, Site 104 was removed from consideration as an open water placement site. The State and Corps of Engineers are looking for other placement sites at this time.

Tier III – Bioaccumulation Studies

A third set of tests involved placing a large number of clams and worms (also chosen to represent the general types of animals found on the Bay or ocean bottom) into the sediment for 28 days. These animals not only live in the mud but also eat it to get nutrients. Because they have great exposure to the sediments in which they live, their potential for showing affects is greater. This is why they are selected to perform tests on. At the end of the 28-day time period, the animals are analyzed for various contaminants, to determine if the animals have accumulated these contaminants in their bodies. The list of contaminants was again developed in coordination with state and federal agencies to be as inclusive as possible.

These tests are referred to as bioaccumulation tests and they are used to evaluate ecological concerns related bioaccumulation of contaminants from the sediments. Bioaccumulation can magnify potentially toxic compounds if it accumulates in animals low on the food chain. If these animals accumulate toxins and are then eaten by higher order animals, toxic effects can be seen in the higher order animals, even these affects are not seen in the lower food chain animals.

The results of the bioaccumulation tests indicated that the sediments are expected to be acceptable for open water placement. There were seven compounds out of 152 that were detected in higher concentrations in animals tested in channel sediments compared to reference sediments. In some cases, the compounds that appeared to bioaccumulate were never detected in the sediments. In other cases, conservative handling of non-detect levels in laboratory analyses may have resulted in the appearance of bioaccumulation, when none may actually have occurred. Additional evaluation of these 7 chemical constituents will be conducted in order to further ensure that none of the materials proposed for open water placement would cause environmental harm.

Summary of Other Information

In addition to conducting this series of tests, the concentrations of chemicals found in the channel sediments were compared to information collected by other research programs in the Upper Chesapeake Bay. The results of these comparisons indicated that, while there were wide variations in reported concentrations, there were no substantial differences found between the channel sediments to be dredged and sediments in areas outside the channels. While sediments in Baltimore Harbor are known to have higher concentrations of many of the chemicals tested, these sediments were excluded from this study because they must be placed in a confined site (such as Hart-Miller Island).

The State of Maryland has been evaluating and monitoring dredged material placement sites for many years. Established placement sites and facilities have been monitored with the following results:

- No impacts to aquatic animals from contaminants has been detected adjacent to the Hart-Miller Island Confined Containment Facility in 17 years of monitoring. It should be noted that the HMI facility has been receiving contaminated sediments from Baltimore Harbor and these have not affected benthic animals, or had negative effects on water or sediment quality. This has included evaluation of benthic tissue samples.
- Hart-Miller Island has become a haven for many bird species. Over 276 species have been found utilizing the site.
- Open-water placement at Pooles Island has been ongoing for decades in the upper Bay. It has been monitored and shown to only have temporary effects on benthic populations, due to burial at the time of placement. Benthic animal populations generally recover within 18 months of placement activities.
- There is one Region of Concern in the vicinity of the Port of Baltimore. This is an area that has been identified by EPA and the Chesapeake Bay Program as containing high levels of contaminants. This is in the Baltimore Harbor, in the Patapsco River. This does not include the navigation channels in the main Chesapeake Bay.
- Some older open water placement sites, such as Man-O-War Shoals, have demonstrated enhanced fisheries value after placement and are heavily fished by both recreational and commercial fishermen.
- The material studied under the ITM has been approved for placement at the Poplar Island Environmental Restoration Project. The findings of this study indicate that this material can still be considered acceptable for beneficial use, and ongoing monitoring will continue to enable continued high levels of environmental safety.

Conclusions

An extensive series of test procedures was implemented for the first time to give guidance on sediment quality in federal navigation channels in the Chesapeake Bay. The test results found detectable levels of some contaminants in the sediments. This was expected, as many of these contaminants are ubiquitous in nature, and have been found in the past in soils and sediments in the area. The quality of the sediments in the channels was similar to that found in previous studies of non-channel areas of the Chesapeake Bay.

Bioassay tests of sediments found no toxicity to bottom-dwelling animals that would be expected to live in the sediments in the Chesapeake Bay. Bioassay tests of sediment-water mixtures found some toxicity in some channel sediments to some of the larval aquatic animals that were tested. (Some channel sediments and some animals showed no toxicity.)

These test results were further evaluated to assess the exposure of aquatic animals to potentially toxic conditions, and this was found to be minimal when compared to expected field conditions. In most cases, the dredged sediment-water mixture would achieve water quality standards and no toxicity would be expected within minutes of discharge. All of the material would have met the standards for ocean disposal. The State of Maryland decided not to issue a Water Quality Certification for the proposed open water placement site based on preliminary information from the aquatic bioassays.

Further testing was performed to determine the potential for contaminants in the sediments to bioaccumulate. All except 7 of 152 compounds had no potential for bioaccumulation. The remaining seven will be further evaluated, in order to further ensure that none of the materials would cause environmental harm. Indications are that the dredged material in the federal navigation channels is of similar quality to ambient sediment quality in the Chesapeake Bay, and placement alternatives would not be limited, given the guidelines in the ITM.

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28 November 2000

Mr. Jeffrey A. McKee
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Baltimore, MD 21201

Reference: **Contract No.Contract No. DACA31-94-D-0025, Delivery Order No.: 0141, Final Draft Report - Evaluation of Dredged Material: Upper Chesapeake Bay Approach Channels to the Port of Baltimore**

Dear Mr. McKee:

EA Engineering, Science and Technology, Inc., is pleased to submit 13 copies of the referenced report for internal review. The copies are to be distributed as follows:

- USACE Baltimore staff 4
- Maryland Department of the Environment 3
- Maryland Port Administration 2
- UASCE Philadelphia District 2
- Maryland Environmental Service 1
- USEPA Region III (Bill Muir) 1

As discussed at our last meeting, we will need to have all comments back to us no later than 8 December 2000 in order to meet the 15 December deadline for making the changes and copying and distributing the Final Document. If the comments for any section are completed before the 8^{th}, please forward them as soon as possible in order to allow us to expedite incorporation into the final document.

Thank you for the opportunity to participate in this endeavor and have this very important and challenging role in developing this document. As always, please call either of us if you have any questions or concerns regarding the enclosed.

Sincerely,
EA ENGINERING, SCIENCE, AND TECHNOLOGY, INC.

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Project Manager/Coordinator

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This *Final Draft Report on Evaluation of Dredged Material: Upper Chesapeake Bay Approach Channels to the Port of Baltimore, Maryland* documents existing sediment quality in the Upper Chesapeake Bay approach channels to the Port of Baltimore. The objective of this study was to evaluate dredged material proposed for open-water placement in the Chesapeake Bay. Thirteen channel reaches that are proposed for either maintenance or new work dredging in the upper Chesapeake Bay are evaluated in this report. In addition, two proposed placement areas (Site 104 and the Norfolk Ocean Disposal Site (NODS)) and an upper Chesapeake Bay reference area were evaluated. The dredged material evaluations followed the tiered testing approach as recommended by U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (USEPA/USACE) guidance in the *Inland Testing Manual* (ITM) (USEPA/USACE 1998) as related to section 404(b)(1) guidelines. The Governor of Maryland withdrew Site 104 from consideration prior to completion of this evaluation. Therefore, Site 104 is no longer under consideration as a placement area. The data and evaluations presented in this document are intended to facilitate dredged material management decisions and to support the identification of feasible and environmentally acceptable placement alternatives.

The investigation was designed to obtain, analyze, and evaluate the physical, chemical and biological characteristics of sediment and water samples that would be representative of the areas proposed for maintenance dredging and one area proposed for new work dredging. The study was designed to characterize and evaluate each channel separately to facilitate management of each dredged material from each individual channel. The study area was located in the upper Chesapeake Bay, Maryland, as shown in Figure EX-1. Sampling stations were located in the Chesapeake Bay approach channels to the Port of Baltimore that were proposed for maintenance dredging (28 stations), in approach channels recently dredged (17 stations), and in one new work area (2 stations). In addition, sampling was conducted inside Site 104, outside Site 104, and at an Atlantic Ocean reference area for the NODS.

The Upper Chesapeake Bay Approach Channels proposed for dredging in FY00 and FY01 include: Craighill Entrance, Craighill Angle, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, Swan Point Channel, Tolchester Channel, and the southern Chesapeake and Delaware Canal (C&D) approaches. Channels that have been recently dredged include: Craighill Channel, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, and areas of the southern C&D Canal Approach Channels. The proposed straightening of the Tolchester Channel S-Turn is a new work dredging project.

The USACE and the USEPA are responsible for regulating placement of dredged material in navigable waters of the United States. Open water placement of dredged material in waters of the U.S. is governed by the USEPA's Guidelines for Specification of Disposal Sites for Dredged or Fill Material implemented in response to Section 404(b)(1) of the Clean Water Act (CWA). Evaluation of dredged material proposed for ocean placement is mandated by Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972. The USACE is responsible for issuing 404 permits that authorize discharges of dredged material into waters of the U.S. and for issuing permits for the transportation of dredged material for the purpose of ocean placement in accordance with Section 103 of MPRSA. Discharges in waters of the U.S. must comply with 40 CFR 230 Guidelines and 33 CFR 320-330 (public interest review) prior to being issued a 404 permit. Dredged material proposed for ocean placement must comply with 40 CFR 220-228 and 33 CFR 320-330 for approval.

The USACE and USEPA have jointly issued technical guidance for compliance with these regulations and statutory requirements. The dredged material evaluation presented in this report followed the tiered testing approach and guidance described in the following documents:

- USEPA/USACE, 1998 (EPA-823-B-98-004). *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.–Testing Manual (Inland Testing Manual).*
- USEPA/USACE, 1991 (EPA-503/8-91/001). *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual (The Green Book).*
- USEPA/USACE, 1995 (EPA-823-B-95-001). *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations.*

In addition, regional recommendations were provided by USEPA Region III-Philadelphia during the collection, testing, and evaluation process.

Both the *ITM* and the *Ocean Testing Manual* describe a tiered testing approach for evaluating the potential for unacceptable adverse impacts associated with dredged material placement. Either open water or ocean placement may be eliminated as a dredged material placement alternative if there is "reason to believe" that significant unacceptable adverse effects will occur to either the water column or the benthic environment. The "tiered" testing approach used to evaluate potential contaminant-related impacts associated with placement of dredged material is depicted in Figure EX-2. This report describes the studies undertaken and presents the findings of Tiers I, II, and III.

EX.1 TIER I -EVALUATION OF EXISTING INFORMATION

A Tier I evaluation requires the review of available data that are representative of the areas proposed for dredging and/or placement. The objective of the review is to identify Contaminants Of Potential Concern (COPCs) and to determine if additional testing in subsequent tiers is necessary. Two recent studies by USACE–Baltimore District have documented sediment and elutriate chemistry in the Upper Chesapeake Bay approach channels to the Port of Baltimore (EA 1998a and EA 2000c). In addition, a study conducted in 1997 (EA1998a) documented sediment quality/chemistry inside Site 104 and in the vicinity immediately outside Site 104. Data from these studies were reviewed in the Tier I evaluation.

Evaluation of the 1997 and 1998 sediment data set indicated that 61 of 189 tested organic and inorganic constituents (32%) were detected at least once in the channel sediments. At least one tested constituent in each channel reach exceeded environmental benchmark values (Threshold

Effect Levels (TEL) and Probable Effect Levels (PEL). TELs represent the chemical concentrations below which adverse biological effects rarely occur. PELs represent chemical concentrations above which adverse biological effects are likely to occur. Chemical concentrations that fall between the TEL and PEL represent the concentrations at which biological effects occasionally occur. Of the 189 organic and inorganic constituents tested in the sediments, a total of 15 constituents (8% of the total tested) exceeded TELs in the channel sediments (7 metals, 3 PAHs, 2 pesticides, total PCBs, and 2 SVOCs). Only 2 constituents, nickel and zinc, exceeded the PEL value in the channel sediments. Although toxicity cannot be predicted from TEL and PEL comparisons, none of the sediments could be considered non-toxic without additional information.

Evaluation of the 1998 elutriate data indicated that, of the 152 organic and inorganic constituents tested, only 6 constituents in the 100% elutriates exceeded USEPA water quality criteria (WQC). Silver exceeded acute WQC; ammonia-nitrogen, mercury, and nickel exceeded chronic WQC; and arsenic, manganese, mercury, and nickel exceeded human health criteria for the consumption of aquatic organisms.

EX.2 TIER II – SEDIMENT AND ELUTRIATE CHEMISTRY

Since review of the existing sediment data showed that none of the sediments could be considered non-toxic without additional information, Tier II level studies were undertaken. The Tier II evaluation involved sediment and water chemistry. Additional sediment and water sampling was conducted in the upper Chesapeake Bay approach channels to the Port of Baltimore. Potential water column impacts were evaluated by comparing concentrations of contaminants in elutriates to federal Water Quality Criteria (WQC) or state Water Quality Standards (WQS). Bulk sediment chemistry data were screened against Sediment Quality Guidelines (SQGs) and detected chemical concentrations were used to calculate Theoretical Bioaccumulation Potential (TBP), the potential for contaminants to accumulate in organism tissue.

Field Program

The project Field Sampling Plan (FSP) (Appendix A) describes the field sampling and data-gathering methods for the upper Chesapeake Bay approach channels and Site 104 study. The FSP was prepared following guidance provided by the USACE Engineer Manual (EM) 200-1-3 *Requirements for the Preparation of Sampling and Analysis Plans* (1994).

The field effort for the dredged material evaluation consisted of three separate rounds of sampling and subsequent chemical and biological testing. Sediments were collected for physical and chemical testing, and water was collected for elutriate testing. A total of 56 stations were sampled in 13 channel reaches in the upper Chesapeake Bay and inside Site 104 in September 1999. Grab samples were collected at 26 locations in five channel reaches and inside Site 104 using a stainless steel Van Veen grab sampler, and sediment cores were collected at 30 locations in eight reaches with targeted sample core lengths ranging from 2.5 to 10 ft, using a vibracoring system. Sediments from each station were submitted for chemical analyses, and a sediment composite from each sampling reach was prepared and submitted for biological testing.

In response to recommendations from USEPA Region III–Philadelphia for additional chemical and biological testing, a second round of sampling was conducted during the period of 8-15 December 1999. Sampling locations included those locations sampled in September 1999 in addition to an Outside Site 104 reference area.

For both rounds of sampling, site water from each sampling reach was collected and submitted for the preparation of elutriates that were targeted for chemical and biological testing. In addition, receiving water samples, targeted for chemical analysis, were collected from Inside Site 104 during both rounds of sampling, and from Outside Site 104 during the second round of sampling.

In order to evaluate the feasibility of ocean placement, a third round of sampling consisted of the collection of sediment and site water from the NODS reference area on February 1, 2000 in conjunction with the Woodrow Wilson Bridge sediment sampling and testing program (EA 2000b).

Analytical Methods

The analytical program for this project is described in detail in the Analytical Quality Assurance Project Plan (QAPP) (EA and STL 2000) (Appendix B). Sediments, receiving water, and elutriates were tested for the following chemical constituents:

- volatile organic compounds (VOCs),
- semivolatile organic compounds (SVOCs),
- chlorinated and organophosphorus pesticides,
- polychlorinated biphenyl (PCB) aroclors and congeners,
- polynuclear aromatic hydrocarbons (PAHs),
- metals,
- butyltins,
- dioxin and furan congeners, and
- cyanide.

In addition, sediments, receiving water, and elutriates were tested for nutrient and general chemistry parameters: ammonia-nitrogen, organic nitrogen, nitrate, nitrite, total phosphorus, total sulfide, Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD).

Bulk Sediment Chemistry Results

The bulk sediment chemistry data were compared to TEL and PEL to assess the potential for toxicity to benthic organisms. Inside Site 104 and Outside Site 104 had the highest number of TEL exceedances for mean concentrations, 21 and 22 respectively. Of the 13 channels, Tolchester Straightening had the highest number of TEL exceedances (20), followed by the Brewerton Channel Eastern Extension (15), C&D Approach (surficial) (15), Cutoff Angle (15), and Tolchester Channel North (15). Seven constituents in the channel sediments exceeded PEL values: nickel, zinc, acenaphthene, acenaphthylene, fluorene, naphthalene, and 2-methylnaphathalene. Inside Site 104 and Tolchester Straightening had the highest number of PEL exceedances (5 and 6 exceedances, respectively). Although the number of TEL or PEL exceedances within a given channel reach can not predict toxicity, none of the tested sediments may be ruled out as non-toxic without additional evaluation (O'Connor et al. 1998). Therefore, Tier III toxicity testing was undertaken.

Theoretical Bioaccumulation Potential (TBP) was calculated to identify whether further evaluation in bioaccumulation testing was necessary. Comparison of TBP in channel sediments to TBP in reference sediments indicated that several pesticides, PCB congeners, PAHs, and dioxin/furan congeners had the potential to bioaccumulate to higher concentrations in aquatic organisms exposed to channel sediments than in organisms exposed to one or more of the placement site/reference sediments. Results of the TBP comparisons indicated that further evaluation in Tier III (bioaccumulation testing) was necessary to determine the actual bioaccumulation of chemical constituents in tissues of aquatic organisms.

Elutriate Chemistry Results and STFATE Modeling

The dispersion of dissolved constituents into the ambient water following the release of dredged material from a barge was modeled to evaluate compliance of the channel elutriates with applicable water quality criteria. The elutriate simulates the undiluted pore water that is released from the dredged material during placement. The modeling of the elutriate fraction of the dredged material was performed for both placement at Site 104 and for placement at the Norfolk Ocean Disposal Site (NODS).

The dispersion of the elutriate was modeled using STFATE, which is a standard USACE hydrodynamic model used for computing the fate of material placed from either a split-hull barge or a hopper dredge (Johnson and Fong 1995). Basic output from the model consists of information on the amount of material in suspension and the footprint of the deposited material on the seafloor. The STFATE modeling provides dilution factors as a function of distance and time following the placement event. Results of the modeling indicated that, for the NODS, the 100% elutriate would be expected to be diluted to 50-fold and 500-fold at distances of 1,296 and 3,707 ft, respectively, from the discharge location. At Site 104 the 100% elutriate would be expected to be diluted to 50-fold and 500-fold at distances of 2,443 and 6,588 ft (ebb tide), respectively, from the discharge location. At the ocean site, dilution factors occurring 1-hour and 4-hours following the placement are 43 and 1,000, respectively, slightly higher than the dilution factors that would be expected after placement at Site 104.
Only 12 of 192 chemicals tested in the undiluted channel elutriates exceeded aquatic life or human health criteria based on numerical comparisons. These chemicals were: ammonia-nitrogen, arsenic, beryllium, copper, manganese, silver, cyanide, sulfide, heptachlor, heptachlor epoxide, total PCBs, and tributyltin.

Elutriates from the following reaches would be expected to comply with ambient acute, chronic, and human health criteria in less than one hour of release:

- C&D Approach Channels (cores)
- Craighill Channel
- Craighill Angle East
- Craighill Entrance
- Craighill Upper Range
- Swan Point Channel
- Tolchester Channel–North
- Tolchester Straightening

None of the elutriates prepared from the three placement/reference areas complies with all USEPA criteria. In fact, each of the three placement site/reference areas have undiluted elutriate concentrations that exceed USEPA criteria for at least two analytes.

Out of more than 150 tested analytes, only three constituents (manganese, sulfide, and heptachlor) would require more than 1 hour to achieve compliance with applicable ambient criteria. Two of these (manganese and sulfide) are naturally occurring chemicals which are present in all waterbodies, and the third (heptachlor) has not been commercially available since 1978.

Acute criteria were rarely exceeded in the elutriate data set. In every instance except one, compliance with acute criteria would be attained within 3 minutes of release (less than 100 ft). The largest exceedance was for heptachlor at Craighill Angle West, where compliance with criteria would occur within 11 minutes at a distance of approximately 371 ft. USEPA's acute ambient water quality criteria are based upon a 1-hour average exposure concentration.

Based on the results of the STFATE modeling at the NODS, all constituents detected in the channel elutriates for which WQC exist would be expected to comply with applicable ambient WQC within the 4-hour mixing period allowed by USEPA/USACE (1991) inside the placement site boundaries.

Overall, the ambient water quality criteria for the protection of aquatic life and human health criteria are exceeded for a small number of chemicals in full strength (undiluted) elutriate samples. However, given (1) the releases at the site will not be on a continuous basis at a given location; (2) the exposure assumptions that are the basis of USEPA's ambient water quality criteria for the protection of aquatic life and human health are not met; and (3) that all of the elutriate analytes will be in compliance with ambient water quality criteria for the protection of aquatic life and human health within several hours of release from a split hull barge (conservative), unacceptable adverse effects to the water column would not be expected from proper management of the discharges at either Site 104 or NODS. Further, alternate release scenarios (e.g., hydraulic placement under specific tidal conditions) could further reduce water column exposure from elutriate conditions.

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EX.3 TIER III – TOXICITY TESTING

The potential effects of exposure to the elutriates and exposure to whole-sediment on aquatic biota were evaluated using toxicity tests. The water column toxicity testing program consisted of acute water column (elutriate) bioassays with *Mysidopsis bahia* (opossum shrimp), *Cyprinodon variegatus* (sheepshead minnow), *Mytilus* sp. (blue mussel), and *Menidia beryllina* (inland silverside). Whole-sediment toxicity tests were conducted with *Neanthes arenaceodentata* (estuarine polychaete) and *Leptocheirus plumulosus* (estuarine amphipod).

In the water column tests, survival was the endpoint for the opposum shrimp, sheepshead minnow, and inland silverside tests. The endpoint of the larval blue mussel test was normal hinge development. As a worst case assessment, all water column tests were conducted with larval or juvenile test organisms which are considered the most sensitive life stage. The age ranges as specified by the USEPA/USACE (1998) testing guidelines were: opposum shrimp (1-5 days old), sheepshead minnow (1-14 days old), inland silverside (9-14 days old), and blue mussels (< 4 hours old). Results of the water column tests were as follows:

- None of the tested 100% elutriates was acutely toxic to larval sheepshead minnows during 96-hour tests. The No Observable Acute Effect Concentration (NOAEC) was 100% elutriate for all 13 of the tested channel elutriates.

- The LC50 values were >100% elutriate for all of the 96-hour, opposum shrimp tests; however, mean survival in 5 of the 13 elutriates was statistically lower than the mean laboratory control survival. The NOAEC were 100% elutriate for 10 of the 13 channels and 50% elutriate for the remaining 3 channels.

- In the larval blue mussel tests, the 48-hour EC50 (median effect concentration) for the channel sediments ranged from 21.2 to >100% elutriate. Eleven of the 13 reaches had EC50 values for 100% elutriate that were statistically lower than the laboratory controls, indicating that 11 of the undiluted (100%) elutriates affected normal hinge development in the larval (<4 hrs old) organisms. The NOEC ranged from <10% elutriate (one channel only) to 100% elutriate.

- Results of the 96-hour, inland silverside bioassays indicated that 11 of the 13 channel elutriates elicited some level of acute toxicity to juvenile (9-14 day old) inland silversides when exposed to undiluted (100%) elutriate. The NOAEC ranged from <10% elutriate (one channel only) to 100% elutriate.

Based on the results of the STFATE modeling, an elutriate concentration of 10% (dilution to 10% of full-strength) would be expected at the placement site within less than 30 minutes after placement occurs. The No Observable Acute Effect Concentrations (NOAEC) indicated that no effect would be expected for the majority of test organisms/channels at a concentration of 10% over either a 96-hour (opposum shrimp, sheepshead minnow, and inland silverside) or a 48-hour (blue mussel) exposure period. During open water placement, the duration of organism exposure to elutriate constituents in the water column would be expected to be short (acute), not a long-term continuous chronic exposure. Therefore, assuming that material would not be placed successively or consecutively at the same location within a proposed placement site, no unacceptable adverse acute impact to water column organisms would be expected for a single placement event.

Based on the results of the water column toxicity testing, a maximum mixing factor of 472-fold would be required for all reaches to comply with the 0.01 LC50/EC50 requirement at the edge of the allowable mixing zone for ocean placement. This value is based on the lowest EC50 of 21.2% (C&D approach–core elutriate for blue mussel) in combination with a very conservative acute to chronic conversion factor of 0.01. Modeling of conditions at the ocean placement site indicated that 1,000-fold mixing would occur within the placement site boundary during the allowable 4-hour ocean placement mixing period. Therefore, none of the channel elutriates would be expected to be acutely toxic to aquatic organisms during ocean placement.

Results of the whole-sediment bioassays indicated that none of the none of the approach channel sediments was acutely toxic to either the estuarine polychaete (*Neanthes arenaceodentata)* or estuarine amphipod (*Leptocheirus plumulosus).* Therefore, the dredged material was not predicted to be acutely toxic to benthic organisms after placement occurs.

EX.4 TIER III – BIOACCUMULATION TESTING

Sediments from the approach channels and reference areas were evaluated in 28-day laboratory bioaccumulation studies with *Nereis virens* (sand worm) and *Macoma nasuta* (blunt-nose clam). The studies measured survival of the test organisms and the potential for bioaccumulation of contaminants in organism tissue as a result of exposure to the channel, placement site, and reference area sediments.

The purpose of the bioaccumulation testing was to predict the potential for uptake of chemical contaminants in the dredged material by aquatic organisms. The evaluation process for this study was developed based on guidance in the *ITM* (USEPA/USACE 1998), guidance in the *Ocean Testing Manual* (USEPA/USACE 1991), and input from USEPA Region III–Philadelphia (William Muir, USEPA–Region III, personal communications, 2000).

Survival rates in the bioaccumulation testing with *Nereis virens* and *Macoma nasuta* indicated that all of the sediments were of sufficient quality to support test organisms throughout the 28-day test period. These results, in combination with the results for the whole-sediment toxicity testing indicate that the sediments are of sufficient quality to support benthic communities after placement.

Organism tissues from the bioaccumulation studies were submitted for analytical testing for the following constituents: SVOCs, chlorinated pesticides, metals, PAHs, PCB aroclors and congeners, dioxin and furan congeners, lipids, and percent moisture.

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The measured tissue-residues were evaluated in two phases. The first phase involved statistically comparing all tissue concentrations to USFDA Action Levels and USEPA Tolerance/Guidance Levels. The second phase involved statistical comparisons of chemical concentrations in channel test tissues to chemical concentrations in tissues exposed to placement site/reference sediments and comparisons to other ecological benchmarks.

Mercury, total PCBs, aldrin+dieldrin, chlordane, DDD+DDE+DDT, mirex, and total heptachlor steady-state tissue-residue concentrations were statistically compared to USFDA Action Levels. Results indicated that steady-state tissue-residues for all of the constituents were significantly lower than USFDA Action Levels. Concentrations of arsenic, cadmium, chromium, lead, and nickel were statistically compared to USEPA Tolerance/Guidance Levels. Results indicated that the steady-state tissue-residue for all of the constituents were statistically lower than the USEPA Tolerance/Guidance Levels criteria. This finding indicates that the material may be acceptable for open water or ocean placement pending further analyses. The additional analyses are:

- Comparison of channel tissue-residues to placement site/reference tissue-residues and
- Comparison of channel tissue-residues that statistically exceed placement site/reference tissue-residues to other ecological benchmarks.

Statistical comparisons of channel tissue-residues to reference tissue-residues indicated that, for all channels combined, 32 constituents in worm tissue and 44 constituents in clam tissue exceeded tissue-residues for at least one of the placement/reference sites. These constituents were retained as Contaminants Of Potential Concern (COPCs) to evaluate further.

Comparison of Channel Tissue-Residues to Other Benchmarks

Following guidance provided by USEPA Region III-Philadelphia, COPCs were compared to other available fish tissue criteria and residue-effects data to determine the ecological significance and relevance of the detected concentrations. It should be noted that these values are generally derived based on conservative assumptions appropriate to use in the early screeening phases of the risk assessment process.

Upper Confidence Limits of the Mean (UCLM) 95% steady-state concentrations of dioxin (TEQ), arsenic, mercury, selenium, DDT, chlordane, dieldrin, endosulfan I and II, gamma-BHC, and total heptachlor were compared to USEPA Fish Tissue Screening Values (USEPA 1995). Results revealed that the 95% UCLM steady-state concentrations for dioxin (TEQ) and arsenic in clams exceeded the criteria for several channels, and the 95% UCLM steady-state concentration for dioxin and total heptachlor in worm tissue exceeded the criteria for several channels.

Comparisons to residue-effects data identified only one constituent, benzo(a)pyrene in clam tissue, with a 95%UCLM that exceeded relevant residue-effect data.

Calculation of Critical Body Residue (CBR) for PAHs and PAHs + pesticides indicated that the total body burdens for organic constitutents in all channel tissues were substantially below the concentrations that would be expected to cause either acute or chronic effects to aquatic organisms.

Comparisons to USEPA Region III Risk Based Concentrations (RBCs) for fish tissue indicated that the 95% UCLM for 19 constituents in clam tissue and 14 constituents in worm tissue exceeded the RBC in at least one channel reach. UCLMs were compared to the whole RBC value for carcinogenic constituents and one-tenth of the RBC value for non-carcinogenic constituents.

Integrated Evaluation for Channel/Placement Options

Two placement options and one reference site were evaluated for each of the thirteen channel reaches. When evaluating tissue-residue data, it is important to remember that bioaccumulation is a phenomenon, and does not necessarily produce an adverse effect to organism viability or ecological resources. The effects of bioaccumulation are dependent upon exposure (concentration and duration). In the COPC evaluation process, fish tissue criteria were conservatively applied to tissue-residues for benthic invertebrates. In some cases, there were significant differences between channel and placement site/reference tissue concentrations; however, the detected concentration varied little from that which was reported in the baseline pre-test tissue. In addition, in some cases, the tissue-residues of the COPCs were either below the recommended target detection limits in *QA/QC Guidance for Dredged Material Evaluations* (USEPA/USACE 1995) or were detected in only one of five tested tissue replicates.

The results of the statistical comparisons to placement site/reference tissues and the results of the integrated evaluation for each channel are summarized as follows:

- Seven of the 13 channel reaches contained at least one COPC for placement Inside Site 104. Brewerton Channel Eastern Extension, Craighill Channel, Craighill Angle East, Craighill Entrance, Craighill Upper Range, and Swan Point Channel contained no COPCs that would be relevant to placement Inside Site 104.

- Ten of the 13 channel reaches contained at least one COPC for placement outside Site 104. Dioxin is one of the COPCs relevant to placement Outside Site 104 for each of those ten channels. Craighill Upper Range, Tolchester Channel - North, and Tolchester Channel - South had no COPCs that would be relevant to placement Outside Site 104.

- Each of 13 channel reaches contained at least one COPC that would be relevant to ocean placement.

- Although a total of 53 COPCs were identified as a result of the statistical comparisons against the placement site/reference tissue-residues, the integrated evaluation revealed only seven COPCs that warrant further consideration (dioxin, alpha-BHC, beta-BHC, chlorbenside, benz[a]anthracene, benzo(a)pyrene, and benzo[b]fluoranthene).

- Although not detected in many of the sediments, the pesticides alpha-BHC, beta-BHC, and chlorbenside were detected in the channel tissues at concentrations that statistically exceeded one or more placement site/reference tissue-residues.

- Dioxin tended to be a COPC only when the TEQ was calculated using ND=1/2 DL and ND=DL. Dioxin was a COPC in both worm and clam tissue.

- PAHs (particularly benz[a]anthracene, benzo(a)pyrene, and benzo[b]fluoranthene) were detected in the channel clam tissues at concentrations that statistically exceeded one or more placement site/reference tissue-residues; however, the mean detected concentrations were less than the recommended TDL (USEPA/USACE 1995). CBR for Total PAHs was not exceeded, however, in any of the channel tissues.

- Chlorbenside was retained as a COPC for worm tissue because there are no fish-tissue criteria to screen the tissue-residues.

The remaining seven COPCs were retained based on comparisons to conservative screening values which indicated that a potential for risk could not be ruled out. Further evaluation of these COPCs with respect to realistic exposure scenarios at each proposed placement site is necessary to determine whether the potential for ecological or human health risk is significant. This procedure for further evaluation is consistent with the Tier IV procedures of the ITM and *Ocean Testing Manual.*

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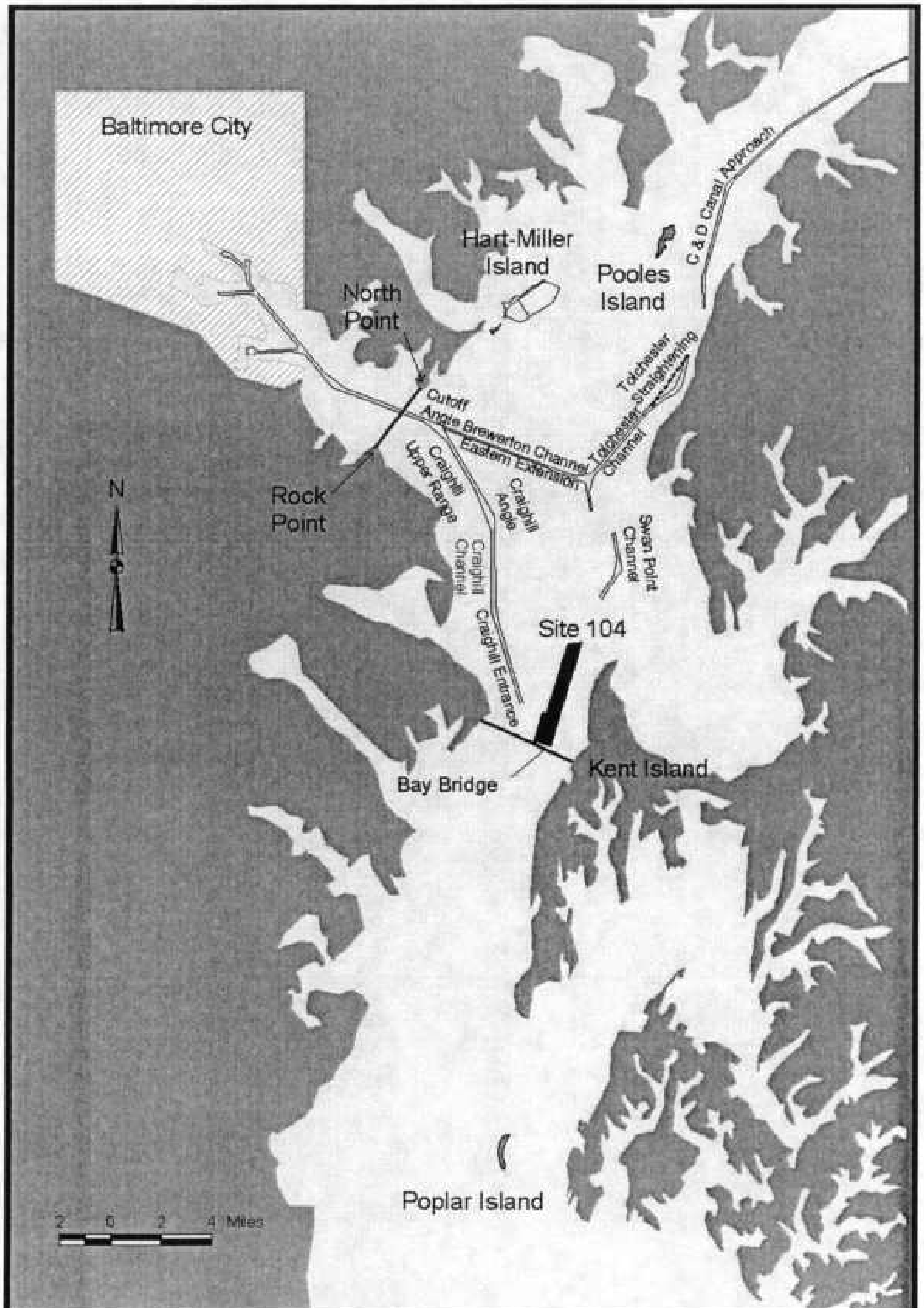

Figure EX-1. Location Map: Upper Chesapeake Bay Approach Channels to the Port of Baltimore and Site 104.

Elements of the *Inland Testing Manual* Tiered Testing Approach		Tier	Studies Conducted for Evaluation of Dredged Material from the Upper Chesapeake Bay Approach Channels to the Port of Baltimore
Evaluate Existing Information; (Possible Limited Testing for Exclusions)		Tier I (Generally Represents Existing Information)	• Comparison of 1997 and 1998 Bulk Sediment Chemistry Data to TEL/PEL • Comparison of 1998 Elutriate Chemistry Data to WQC
Water Column	**Benthos**		
Measure and Model Dissolved Contaminants; Compare To WQS	Calculate Theoretical Bioaccumulation Potential; Compare to Reference	Tier II (Solely Concerned with Chemistry)	• Collection and Chemical Analysis of Channel Sediments and Elutriates (1999) • Comparison of Bulk Sediment Chemistry Data to TEL/PEL • Calculation of Theoretical Bioaccumulation Potential (TBP) • Comparison of Elutriate Chemistry Data to WQC • STFATE Modeling to Determine Time and Distance Required for Compliance with WQC
Measure Toxicity; Model Suspended Phase; Determine Toxicity After Mixing	Measure Toxicity; Measure Bioaccumulation; Compare to FDA Limits and to Reference	Tier III (Generic Bioassay [Toxicity and Bioaccumulation] Tests)	• Water Column Toxicity Tests to Evaluate Survival of Opposum Shrimp, Sheephead Minnows and Inland Silverside • Water Column Toxicity Tests to Evaluate Hinge Development in Larval Blue Mussels • Whole Sediment Toxicity Tests to Evaluate Survival of Estuarine Amphipod and Polychaete • Bioaccumulation Testing of *Nereis virens* and *Macoma nasuta* • Statistical Comparisons of Channel Tissue-Residues to FDA Action Levels • Statistical Comparisons of Channel Tissue-Residues to Placement Site/Reference Tissue-Residues • Integrated Evaluation of Bioaccumulation Results
Conduct Case-Specific Toxicity Tests	Conduct Case-Specific Toxicity; Bioaccumulation; Other Tests	Tier IV (Specific Bioassay [Toxicity and Bioaccumulation] and Other Tests)	

Figure EX-2. *Inland Testing Manual* Tiered Approach for Evaluating Potential Impacts Related to Dredged Material Placement (USEPA/USACE 1998) and Synopsis of Studies Conducted for Evaluation of Dredged Material from the Upper Chesapeake Bay Approach Channels to the Port of Baltimore.

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LIST OF ABBREVIATIONS, ACRONYMS, AND UNITS

AAS	Atomic Adsorption Spectrophotometry
AET	Apparent Effects Threshold
ANOVA	Analysis of Variance
ASA	American Society of Agronomy
ASI	Aqua Survey, Inc.
ASTM	American Society for Testing and Materials
AVS	Acid Volatile Sulfides
BE	Brewerton Channel Eastern Extension
BOD	Biological Oxygen Demand
BSAF	Biota Sediment Accumulation Factor
BZ	Ballschmiter and Zell
°C	Degrees Celsius
C&D	Chesapeake and Delaware Canal (Approach Canal)
CAB	Cellulose Acetate Butylrate
CBR	Critical Body Residue
CENAB	Corps of Engineers North Atlantic – Baltimore
CENAP	Corps of Engineers North Atlantic – Philadelphia
CdCl	Cadmium Chloride
CF	Concentration Factor
CFR	Code of Federal Regulations
cm/sec	centimeter per second
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CBP	Chesapeake Bay Program
COE	Corps of Engineers
COMAR	Code of Maryland
COPC	Contaminant of Potential Concern
CORMIX	(USACE Corps of Engineers model)
CR	Craighill Channel
CRA-E	Craighill Angle-East
CRA-W	Craighill Angle-West
CRE	Craighill Entrance
CRU	Craighill Upper Range
$CuSO_4\ 5H_2O$	Copper Sulfate
CUT	Cutoff Angle
CVAAs	Cold Vapor Atomic Absorption Spectrophotometry
CWA	Clean Water Act
cy	cubic yard

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HPLC	High Pressure Liquid Chromatography
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
ICP	Inductively Coupled Plasma
IDL	Instrument Detection Limit
ITM	Inland Testing Manual
IUPAC	International Union of Pure and Applied Chemistry
KCl	Potassium Chloride
l	liter
LC50	Median Lethal Concentration
LCS	Laboratory Control Sample
LMW	Low Molecular Weight
LOED	Lowest Observed Effect Dose
LPC	Limiting Permissible Concentration
LSD	Least Significant Difference
m	meter
MB	Method Blank
mg/kg	milligram per kilogram (ppm)
mg/l	milligram per liter (ppm)
MDE	Maryland Department of the Environment
MDL	Method Detection Limits
ml	milliliter
MLW	Mean Low Water
MLLW	Mean Lower Low Water
MPA	Maryland Port Administration
MPRSA	Marine Protection Research and Sanctuaries Act of 1972
MS	Matrix Spike
MSA	Method of Standard Addition
MSD	Matrix Spike Duplicate
MSE	Mean Square Error
M&N	Moffatt & Nichol Engineers
NA	Not Analyzed
NAD	North American Datum
NAS	Northwest Aquatic Sciences
ND	Non-Detect
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOAEC	No Observed Acute Effect Concentration

NODS	Norfolk Ocean Disposal Site
NOEC	No Observed Effect Concentration
NOED	No Observed Effect Dose
NPD	Nitrogen/Phosphorous Detector
NPDES	National Pollutant Discharge Elimination System
ng/kg	nanogram per kilogram (pptr)
ng/l	nanograms per liter (pptr)
PAH	Polynuclear Aromatic Hydrocarbons
PAL	Paradigm Analytical Laboratories
PCB	Polychlorinated Biphenyl
PEL	Probable Effect Level
ppb	parts per billion (ug/kg or ug/L)
ppm	parts per million (mg/kg or mg/L)
ppt	parts per thousand (salinity units) (g/kg or g/L)
pptr	parts per trillion (ng/kg or ng/L)
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RBC	Risk-Based Concentration/Criteria
RfD	Oral Reference Dose
RIM	Regional Implementation Manual
RL	Reporting Limit
SDG	Sample Delivery Group
SDS	Sodium Dodecyl Sulfate
SF	Oral Slope Factor
SE	Standard Error
SEM	Simultaneously Extracted Metals
SOP	Standard Operating Procedure
SQG	Sediment Quality Guidelines
SQL	Sample Quantitation Limit
SRM	Standard Reference Material
SSHP	Site Safety and Health Plan
STFATE	Short Term Fate of Dredged Material
STL	Severn Trent Laboratories
SV	Screening Value
SVOA	Semivolatile Organic Analysis
SVOC	Semivolatile Organic Compound
SWP	Swan Point Channel

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DGPS	Differential Global Positioning System
DI	De-ionized (Water)
DL	Detection Limit
DO	Dissolved Oxygen
DQO	Data Quality Objective
DVR	Data Validation Report
EA	EA Engineering, Science, and Technology, Inc.
EC50	Effective Sub-lethal Concentration
ECD	Electron Capture Detector
EDM	Estimated Detection Limit
EDS	Environmental Data Services, Inc.
EDT	Eastern Daylight Time
EIS	Environmental Impact Statement
EM	Engineer Manual
EMAP	Environmental Monitoring and Assessment Program
EMPC	Estimated Maximum Possible Concentration
ERED	Environmental Residue-Effects Database
ERL	Effect Range Low
ERM	Effect Range Median
EST	Eastern Standard Time
FD	Field Duplicate
FDA	Food and Drug Administration
ft	foot
ft/sec	feet per second
FSP	Field Sampling Plan
FPD	Flame Photometric Detector
FY	Fiscal Year
GC/MS	Gas Chromatography / Mass Spectrometry
GFAAS	Graphite Furnace Atomic Absorption Spectrophotometry
GPC	Gel Permeation Chromatography
gm/cc	gram per cubic centimeter
g/kg	gram per kilogram (ppt)
g/l	gram per liter (ppt)
hr	hour
H_2S	Hydrogen Sulfide
HCl	Hydrochloric Acid
HH	Human Health
HMW	High Molecular Weight
HNO_3	Nitric Acid

TBP	Theoretical Bioaccumulation Potential
TBT	Tributyltin
TDL	Target Detection Limit
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalency Quotient
TEL	Threshold Effect Level
TIC	Tentatively Identified Compounds
TKN	Total Kjeldahl Nitrogen
TLC-N	Tolchester Channel-North
TLC-S	Tolchester Channel-South
TLS	Tolchester Straightening
TOC	Total Organic Carbon
TP	Total Phosphorus
UCLM	Upper Confidence Limit of the Mean
µg/kg	microgram per kilogram (ppb)
µg/l	microgram per liter (ppb)
µmol/g	micromoles per gram
UMCES	University of Maryland, Center for Environmental Sciences
UR	Uptake Ratio
USACE	U.S. Army Corps of Engineers
USACE-WES	U.S. Army Corps of Engineers – Waterways Experiment Station
USEPA	U.S. Environmental Protection Agency
VC	Vibracoring (location or core sample)
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WQC	Water Quality Criteria
WQS	Water Quality Standards
YSI	Yellow Springs Instruments

CHAPTER 1 -
EVALUATION GUIDELINES

1. EVALUATION OF SEDIMENTS PROPOSED FOR OPEN WATER AND OCEAN PLACEMENT

The objective of this study was to evaluate dredged material proposed for open-water placement in the Chesapeake Bay. Thirteen channel reaches that are proposed for either maintenance or new work dredging in the upper Chesapeake Bay are evaluated in this report using the tiered testing approach as recommended by U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (USEPA/USACE) guidance (1998). In addition, two proposed placement areas (Site 104 and the Norfolk Ocean Disposal Site (NODS)) and an upper Chesapeake Bay reference area were evaluated. This dredged material evaluation follows guidelines in *the Inland Testing Manual* (ITM) (USEPA/USACE 1998) as related to section 404(b)(1) guidelines. The Governor of Maryland withdrew Site 104 from consideration prior to completion of this evaluation. Therefore, Site 104 is longer under consideration as a placement area.

The information presented provides weight-of-evidence to assist decision-makers with a factual determination regarding the potential for short-term or long-term impacts associated with the placement of dredged material in open water. The data and evaluations presented in this document are intended to support dredged material management decisions and to support the identification of feasible and environmentally acceptable placement alternatives.

1.1 REGULATORY OVERVIEW

The USACE and the USEPA are responsible for regulating placement of dredged material in navigable waters of the United States. Open water placement of dredged material in waters of the U.S. is governed by the USEPA's Guidelines for Specification of Disposal Sites for Dredged or Fill Material implemented in response to Section 404(b)(1) of the Clean Water Act (CWA). The Section 404(b)(1) Guidelines are published in the Code of Federal Regulations (CFR) in 40 CFR Part 230. The technical evaluation of potential contaminant-related impacts that may be associated with open water placement of dredged material is conducted in accordance with 40 CFR 230.60 and 230.61. Evaluation of dredged material proposed for ocean placement is mandated by Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972. The technical evaluation of potential contaminant-related impacts that may be associated with ocean placement of dredged material is conducted in accordance with 40 CFR 220-228 and the *Ocean Testing Manual* (USEPA/USACE 1991).

The USACE is responsible for issuing 404 permits that authorize discharges of dredged material into waters of the U.S. and for issuing permits for the transportation of dredged material for the purpose of ocean placement in accordance with Section 103 of MPRSA. Discharges in waters of the U.S. must comply with 40 CFR 230 Guidelines and 33 CFR 320-330 (public interest review) prior to being issued a 404 permit. Dredged material proposed for ocean placement must comply with 40 CFR 220-228 and 33 CFR 320-330 prior to being issued an ocean permit.

The USEPA is responsible for assisting USACE with the development of environmental guidelines for evaluating permit applications. In addition, the USEPA is responsible for reviewing and commenting on permit applications, regulating the placement of materials that may adversely impact the aquatic environment, determining authority, and defining exemptions. The USACE and USEPA share the authority to enforce the regulations (USEPA/USACE 1998).

1.2 GUIDANCE FOR TESTING AND EVALUATIONS

The USEPA and USACE have jointly published guidance documents that describe the recommended testing and evaluation procedures for dredged materials proposed for placement in waters of the U.S. and in ocean waters. The *Inland Testing Manual* (USEPA/USACE 1998) describes testing and evaluation procedures for dredged material proposed for placement in either fresh, estuarine, or saline (near coastal) waters of the United States, in accordance with 40 CFR 230.60 and 230.61. The *Ocean Testing Manual* (USEPA/USACE 1991) (also known as "*The Green Book*") describes the testing and evaluation procedures for dredged material proposed for ocean placement, in accordance with 40 CFR 220-228.

The ITM serves as the national framework and primary guidance document for evaluating impacts related to open water placement of dredged material in inland waterways. It was created as the counterpart to the *Ocean Testing Manual*, and the testing and evaluation procedures in the ITM were patterned after the guidance in the *Ocean Testing Manual.* The ITM serves as the basis for developing and implementing dredged material evaluations for navigation projects and was created with the intent to provide uniformity between dredged material evaluations under the CWA and MPRSA. The testing framework permits regional flexibility with regard to implementation and application to accommodate project-specific, site-specific, or situation-specific issues.

Both the ITM and the *Ocean Testing Manual* describe a tiered testing approach for evaluating the potential for unacceptable adverse impacts associated with dredged material placement. Either open water or ocean placement may be eliminated as a dredged material placement alternative if there is "reason to believe" that unacceptable adverse effects will occur to either the water column or the benthic environment. Therefore, evaluation of both potential water column and potential benthic effects associated with dredged material placement are required.

Although the ITM and the *Ocean Testing Manual* serve as the primary guidance manuals for the evaluation of dredged material, various USEPA regions and states have developed Regional Implementation Manuals (RIMs) that describe region-specific testing requirements, testing methodologies, and recommended test species. Currently, neither USEPA Region III nor the State of Maryland has published guidance regarding region-specific requirements for dredged material evaluations. The USEPA Region III office in Philadelphia and the Maryland Department of the Environment (MDE) provide consultation on requirements on a project-specific basis.

Overall, the testing and evaluation procedures and criteria in the ITM and *the Ocean Testing Manual* are nearly equivalent. The ITM provides the most recent federal guidance for evaluating dredged material and is referenced as the primary information source for the remaining sections of both this chapter and this report.

1.3 TIERED TESTING

The "tiered" testing approach to evaluate contaminant-related impacts associated with placement of dredged material is depicted in Figure 1-1 and a tiered testing flow diagram is provided in Figure 1-2. The recommended process for evaluating potential water column and benthic impacts is detailed in Figures 1-3 and 1-4, respectively.

The initial tier (Tier I) uses readily available existing information to evaluate the impact of placement. If this information is inadequate to support a decision, testing proceeds through subsequent tiers of more extensive and specific testing until sufficient information is generated to support a decision. It is necessary to proceed through the tiers only until information on each topic becomes sufficient to make the required factual determination.

1.3.1 Tier I

Tier I consists of an evaluation of existing information to determine (1) if there is evidence or "reason to believe" that adverse effects could potentially occur, and (2) to identify potential contaminants of concern. If there is sufficient information to determine that the sediments are not contaminated and are similar to sediments in the proposed placement site, then the material may be excluded from additional testing, or only limited additional testing may be required.

1.3.2 Tier II

Tier II involves sediment and water chemistry. Sediments are collected for physical and chemical testing, and water is collected for elutriate testing. Bulk sediment chemistry data are used to calculate Theoretical Bioaccumulation Potential (TBP), the potential for contaminants to accumulate in organism tissue. Potential water column impacts are evaluated by comparing concentrations of contaminants in elutriates to national or state Water Quality Standards (WQS). If TBP exceeds a reference site value, or if dissolved contaminants exceed WQS, then Tier III testing is recommended.

1.3.3 Tier III

Tier III involves toxicity and bioaccumulation studies. Water column bioassays, whole sediment bioassays, and bioaccumulation studies are conducted to determine acute toxicity and to determine the bioavailability of contaminants. Water column tests evaluate the effects of dissolved and suspended particulates on organisms, after allowance for mixing that would occur within the water column. Whole sediment bioassays evaluate the effect of the sediment exposure to benthic organisms. Bioaccumulation tests evaluate the uptake of contaminants from the dredged material into the tissue of benthic organisms. The results of Tier III are usually sufficient to determine if the dredged material will cause adverse impacts.

1.3.4 Tier IV

Tier IV is implemented in situations where earlier tiers do not provide sufficient information to determine the potential effects of the dredged material. Tier IV uses case-specific toxicity and bioaccumulation studies designed to answer case-specific questions. These studies may include risk assessment, calculation of steady-state bioaccumulation, field assessments of resident biological communities, or food web modeling.

1.4 TESTING REQUIREMENTS

Testing of sediments proposed for dredging are dictated by a number of factors, including the history of the dredging location, proximity to point sources of contamination, present use of the dredging location, and the proposed placement location. Types of testing pertinent to open water and ocean placement include physical and chemical analysis of bulk sediment, elutriate testing, and bioassay and bioaccumulation studies. Table 1-1 summarizes the analyses or constituents analyzed in each type of test as recommended by the ITM and conducted for this for study . Target detection limits, preservation techniques, and holding time requirements for target analytes are provided in *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (USEPA/USACE 1995). Target analytes and benchmark species may be modified based on consultation with regulatory agencies to accommodate regional or project-specific requirements.

1.4.1 Reference Sediment

Reference sediment tests serve as the point of comparison (reference benchmark) to which benthic test results are compared. Until recently, sediment from the proposed placement site has served as the standard point of comparison for the test results. A proposed revision to Section 404 guidelines (40 CFR Part 230) was published in January 1995 (Federal Register, Vol. 60, No. 2, pg. 419-422). This proposed rule suggests the comparison of dredged material to "reference sediment" that is located outside the proposed placement site, as opposed to sediments from inside the placement site (USEPA/USACE 1998). The proposed rule defines "reference sediment" as follows: "...sediment that reflects the conditions at the disposal site had no dredged material disposal ever occurred there. Reference sediment serves a point of comparison to identify potential environmental effects of a discharge of dredged material. Reference sediment shall be collected taking into account the following considerations: (1) to obtain physical characteristics, including grain size, as similar as practicable as the dredged material proposed for discharge, (2) to avoid areas in the immediate vicinity of, including depositional zones of, spills, outfalls, or other significant sources of contaminants, and (3) to be as close as practicable to the same hydrologic influences as, the disposal site, but removed from areas which are subject to sediment migration of previous dredged material discharges. If existing information that provides easy-to-interpret indication of the presence of bioavailable contaminants in the reference sediment and in the sediment form the disposal site waterbody is not available, sediment testing (e.g., toxicity testing) is necessary to ensure that the reference sediment accurately reflects the conditions of the sediment from the disposal site waterbody." Dredged material comparisons to non-impacted reference sediments are expected to yield more valid results regarding the potential for individual and cumulative impacts. More than one location may serve as a reference comparison, and depending upon the objectives of the project, it may be important to compare test results to both the actual conditions within the placement site and to a non-impacted outside reference area.

Importantly, "reference" sediment should not be confused with "control" sediment, or with "standard reference material" (SRM). "Control" sediment is a natural sediment that is used in the ecotoxicology laboratory to assess the health of the testing organisms and the acceptability of test conditions. SRM is sediment with a certified concentration of a constituent and is used by the analytical laboratory to monitor analytical accuracy.

1.4.2 Physical Analyses

Physical testing represents the minimal testing that would be required prior to any dredging project. Physical sediment characteristics include grain size and moisture content determinations. Since sediment contaminants tend to sorb to organic particles, sediments with a high percentage of sand are likely to contain fewer and lower concentrations of contaminants than sediments with higher percentages of silt and clay particles. Sediments primarily comprised of sand or gravel may qualify for testing exclusions (USEPA/USACE 1998). Specific gravity and Atterberg Limits may also be determined for evaluating compaction and settling of particles at open water placement sites.

1.4.3 Bulk Sediment Chemistry

Chemical analysis of bulk sediments is required to characterize the sediment and identify Contaminants Of Potential Concern (COPCs). Contaminants in sediment include: bulk organics (hydrocarbons that include oil and grease), halogenated hydrocarbons (persistent organics that degrade slowly), polynuclear aromatic hydrocarbons (PAHs) (organics that include petroleum products and petroleum by-products), metals, and nutrients. Chemical fractions targeted in the ITM are summarized in Table 1-1. Elevated concentrations of the target compounds may indicate a potential for toxicity to living organisms and a potential to bioaccumulate. Detected concentrations of the target compounds are often compared to screening criteria such as Sediment Quality Guidelines (SQG) (USACE-WES, 1998b; Buchman 1999). Detected concentrations are also used to calculate the Theoretical Bioaccumulation Potential (TBP) for organic constituents. The TBP of the dredged material is compared to reference sediment TBP values or literature values.

1.4.4 Elutriate Testing

Elutriate testing is required for open water and ocean placement of dredged material. Elutriates are created by mixing sediments and site water at a known ratio, allowing the particulates to settle, then testing the overlying water for dissolved constituents (USEPA/USACE 1998). The test simulates mixing and release of contaminants that would occur in the water column if the sediments were released or pumped into an aquatic environment. Water column effects are evaluated by measuring dissolved analytes and comparing the concentration to national Water

Quality Criteria (WQC) and state Water Quality Standards (WQS) after allowance for mixing. A numerical mixing model (STFATE) (Johnson and Fong 1995) is used to calculate analyte concentrations in the water column under various mixing scenarios. Standard guidelines for elutriate preparation are described in the ITM.

1.4.5 Bioassays and Bioaccumulation Studies

Depending upon the results of bulk sediment chemistry, biological testing may be required for open water placement. Bioassays include water column toxicity tests, solid phase toxicity tests, and bioaccumulation studies. The ITM contains USEPA-developed and approved bioassay protocols and recommended benchmark species. Benchmark species are either easily cultured in a laboratory or easily collected in the field from undisturbed environments, respond to contaminants, and are relevant from an ecological perspective. Estuarine or marine species that would be appropriate for an estuarine or marine testing program are provided in Table 1-1. Water column tests measure the acute toxicity of elutriates to water column species and simulate impacts that would be expected to occur during a placement event. Solid phase tests measure the toxicity of the sediments to bottom-dwelling species that would be expected to live within the sediment afterplacement. Bioassay results are based on percent effect or survival and are statistically compared to the results for a laboratory control (elutriate testing) or to the reference sediment (solid phase testing). LC50 concentrations (the elutriate concentration that is lethal to 50% of the organisms) or EC50 concentrations (the elutriate concentration that is sub-lethal to 50% of the organisms) are calculated.

Bioaccumulation tests are conducted to determine the uptake (or bioavailability) of contaminants into organism tissue when exposed to sediments for 28 days. Tissue concentrations are statistically compared to reference tissue concentrations and to U.S. Food and Drug Administration (USFDA) Action Levels and USEPA Tolerance Values. Tissue-residue concentrations that statistically exceed the reference values may be compared to residue-effects data (if available) to identify potential physiological, morphological, and reproductive impacts to the organism. For constituents where few or no effect data are available, other approaches are used to evaluate the potential for toxic response in the organism.

1.5 EVALUATION CRITERIA

Each tier of testing includes evaluation criteria to determine if the existing information is sufficient to make a factual determination regarding unacceptable adverse impact or to determine if additional testing is required. The evaluation criteria for each tier are presented in the following sections. Criteria presented are specific to guidance in the ITM. Unless otherwise noted, the criteria for both open water and ocean placement are equivalent.

1.5.1 Tier I

According to the ITM (USEPA/USACE 1998), after consideration of all available Tier I information, one of the following conclusions is reached:

1) Existing information does not provide a sufficient basis for making factual determinations. In this case, further evaluation in higher tiers (Tier II, Tier III, etc.) is appropriate.

2) Existing information provides a sufficient basis for making factual determinations. In this case, one of the following decisions is reached:

   (a) The material meets the criteria for exclusion from testing and proposed placement proceeds with no additional testing.

   (b) The material does not meet the criteria for exclusion from testing, but information concerning the potential impact of the material is sufficient to make a factual determination regarding potential for water column impact, benthic toxicity, and benthic bioaccumulation.

1.5.2 Tier II

1.5.2.1 Water Quality

According to the ITM (USEPA/USACE 1998), after consideration of the Tier II water quality data, one of two possible conclusions is reached regarding the potential water column impact of the proposed dredged material:

1) The available water quality requirements are met. Further information on water column toxicity must be evaluated in Tier III when there are contaminants of concern for which applicable water quality criteria or standards are not available or where interactive effects are of concern.

2) Concentrations of one or more of the dissolved contaminants of concern, after allowance for mixing that would occur in the water column at the placement site, exceeds applicable water quality criteria or standards beyond the boundaries of the mixing zone. In this case, the proposed discharge of dredged material does not comply with the water quality criteria or standards.

1.5.2.2 Benthos

According to the ITM (USEPA/USACE 1998), after comparison of the Tier II TBP data for nonpolar organic contaminants in the proposed dredged material and reference sediment, one of the following two conclusions is reached:

1) The dredged material is predicted to not result in unacceptable adverse effects due to bioaccumulation of the measured non-polar organic compounds (i.e., TBP for dredged material does not exceed TBP for reference). However, further evaluation of *biological effects* in Tier III is necessary to furnish information to make determinations under the Guidelines.

2) The available information is not sufficient to predict whether the dredged material will result in unacceptable adverse effects due to bioaccumulation of non-polar organic compounds (i.e., TBP for dredged material exceeds TBP for reference). Further evaluation of *bioaccumulation* in Tier III is necessary to furnish information to make determinations under the Guidelines.

1.5.3 Tier III

1.5.3.1 Water Column Toxicity

According to the ITM (USEPA/USACE 1998), after considering water column test results and mixing at the placement site, one of the following conclusions is reached:

1) The 100% dredged material elutriate toxicity is not statistically higher than the laboratory dilution water. Therefore, the dredged material is not predicted to be acutely toxic to water column organisms. However, benthic impact must also be evaluated.

2) The concentration of dissolved plus suspended contaminants, after allowance for mixing, does not exceed 0.01 (1%) of the toxic LC50 or EC50 concentration beyond the boundaries of the mixing zone. Therefore, the dredged material is not predicted to be acutely toxic to water column organisms.

3) The concentration of dissolved plus suspended contaminants, after allowance for mixing in the water column, exceeds 0.01 (1%) of the toxic LC50 or EC50 concentration beyond the boundaries of the mixing zone. Therefore, the dredged material is predicted to be acutely toxic to water column organisms.

1.5.3.2 Benthic Toxicity

According to the ITM (USEPA/USACE 1998), benthic toxicity testing of contaminants in the dredged material in Tier III will result in one of the following possible conclusions:

1) Mean test organism mortality in the dredged material is not statistically greater than in the reference sediment, or does not exceed mean mortality in the reference sediment by at least 10 percentage points (or 20 percentage points for amphipods). Therefore, the dredged material is predicted not to be acutely toxic to benthic organisms. However, bioaccumulation of contaminants and water quality effects must also be considered.

2) Mean test organism mortality in the dredged material is statistically greater than in the reference sediment *and* exceeds mortality in the reference sediment by at least 10 percentage points (or 20 percentage points for amphipods). In this case, the dredged material is predicted to be acutely toxic to benthic organisms.

1.5.3.3 Bioaccumulation

According to the ITM (USEPA/USACE 1998), tissue residues are compared to FDA levels and one of the following conclusions is reached:

1) Tissue concentrations of one or more contaminants are not statistically less than the FDA levels. Therefore, the dredged material is predicted to result in unacceptable benthic bioaccumulation of contaminants.

2) Tissue concentrations of all contaminants are either statistically less than FDA levels or there are no FDA levels for the contaminants. In this case, the information is insufficient to make a factual determination with respect to benthic bioaccumulation of contaminants. The dredged material requires further evaluation under Tier III as described below to make a factual determination under the Guidelines.

Contaminant concentrations in tissues exposed to dredged material that are statistically lower than FDA levels, or for which no FDA levels exist, are compared to tissue contaminant concentrations for organisms exposed to reference sediment. One of the following conclusions is reached:

1) Tissue concentrations of contaminants of concern in organisms exposed to dredged material do not statistically exceed those of organisms exposed to reference sediment. Therefore, the dredged material is not predicted to result in unacceptable benthic bioaccumulation of contaminants. However, benthic toxicity tests must also be evaluated.

2) Tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to reference sediment. The final conclusion regarding benthic bioaccumulation of contaminants requires region-specific technical evaluation. Additional testing (Tier IV) may be required and benthic toxicity must be evaluated.

Region-specific technical evaluation of bioaccumulation data for contaminants in dredged material tests that statistically exceed the reference may include the following:

1) What is the toxicological importance of the contaminants that statistically exceed the reference? (Do they biomagnify? Do they have effects at low concentrations?)

2) By what magnitude does bioaccumulation from the dredged material exceed bioaccumulation of the reference material?

3) What is the propensity for the contaminants with statistically significant bioaccumulation to biomagnify within food webs?

4) What is the magnitude by which contaminants, whose bioaccumulation from the dredged material exceeds that from the reference material, also exceed the concentrations found in comparable species living in the vicinity of the proposed placement site?

5) For how many contaminants is bioaccumulation from the dredged material statistically greater than bioaccumulation from the reference?

According to the ITM (USEPA/USACE 1998), after considering of all of the above evaluation factors, one of the following conclusions is reached:

1) Placement of the dredged material is predicted to not result in above-reference toxicity or unacceptable benthic bioaccumulation of contaminants.

2) Placement of the dredged material is predicted to result in above-reference toxicity or unacceptable bioaccumulation of contaminants.

3) Further information is needed to make factual determination, specifically in Tier IV.

1.5.4 Tier IV

Tier IV involves the use of case-specific toxicity and bioaccumulation studies designed to answer case-specific questions (e.g., risk assessment, calculation of steady-state bioaccumulation, field assessments of resident biological communities, or food web modeling). The evaluation criteria and conclusions reached in Tier IV will be specific to the type of study or assessment conducted. Ultimately, if Tier IV studies are conducted, they should be designed to such that results should provide sufficient information to determine the potential for impact to the ecological or human environment.

1.6 DECISION PROCESS

The tiered evaluation process provides decision-makers with the weight of evidence regarding the potential for short-term, long-term, or unacceptable contaminant-related impacts as a result of dredged material placement. The results of the evaluation process may be used to facilitate dredged material management options, implement a proposed open water placement program, or identify alternative placement locations or dredging and discharge methods. Results may demonstrate that open water placement is a viable placement alternative, or results may demonstrate that alternative placement location or dredging and discharge methods are required to comply with 404(b)(1) Guidelines.

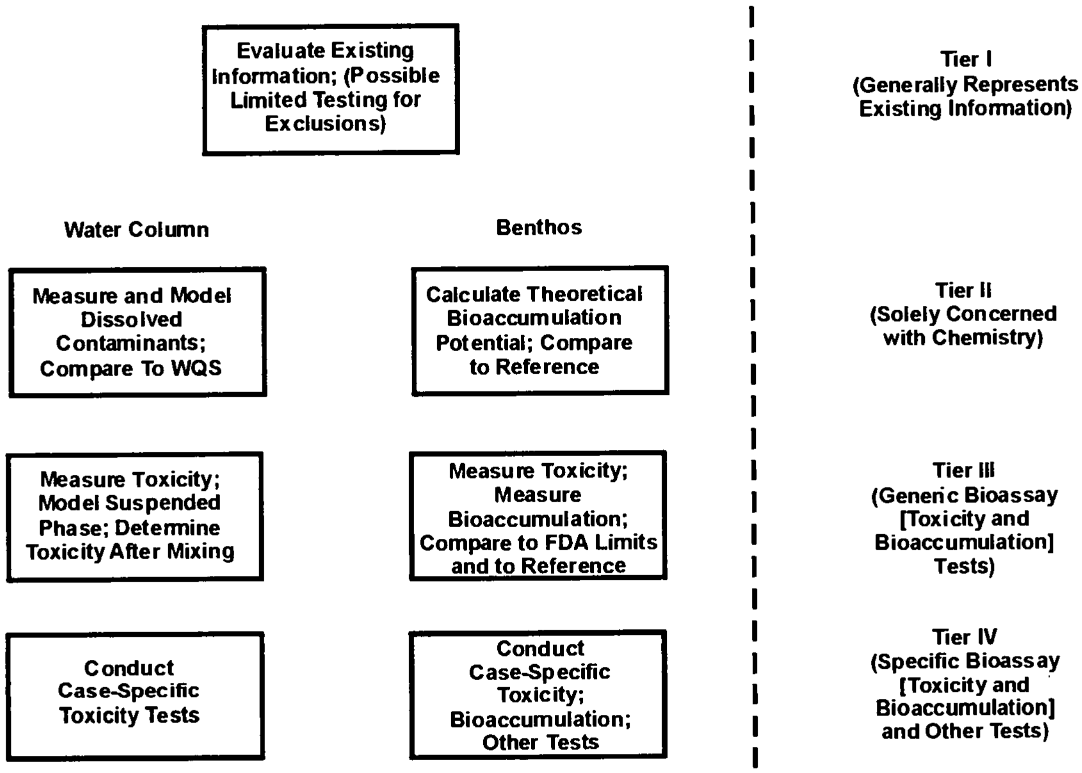

Figure 1-1 *Inland Testing Manual* Tiered Approach for Evaluating Potential Impacts Related to Dredged Material Placement (USEPA/USACE 1998).

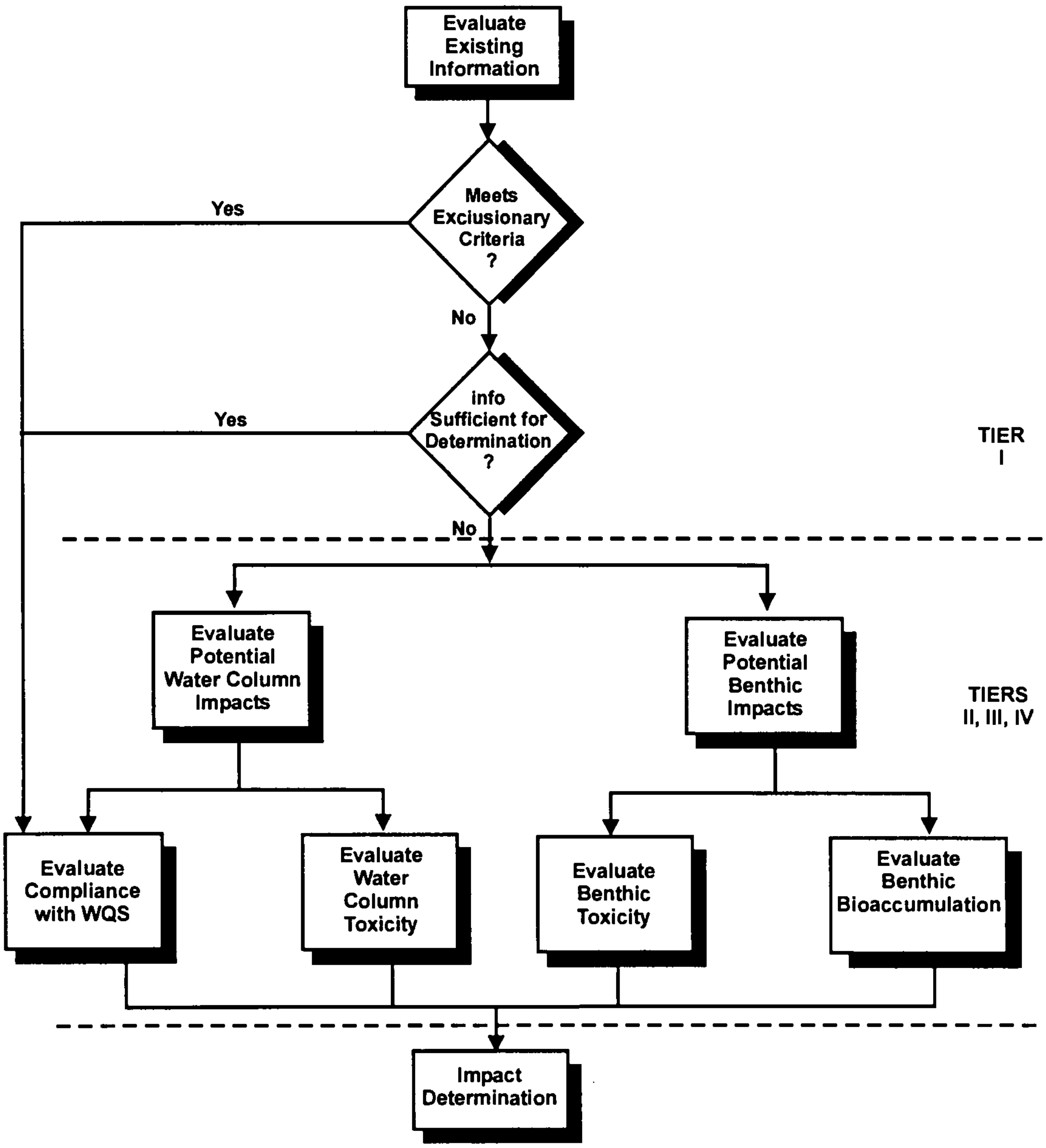

Figure 1-2. Simplified Tiered Testing Flow Diagram.

Modified from: USEPA/USACE, 1998.

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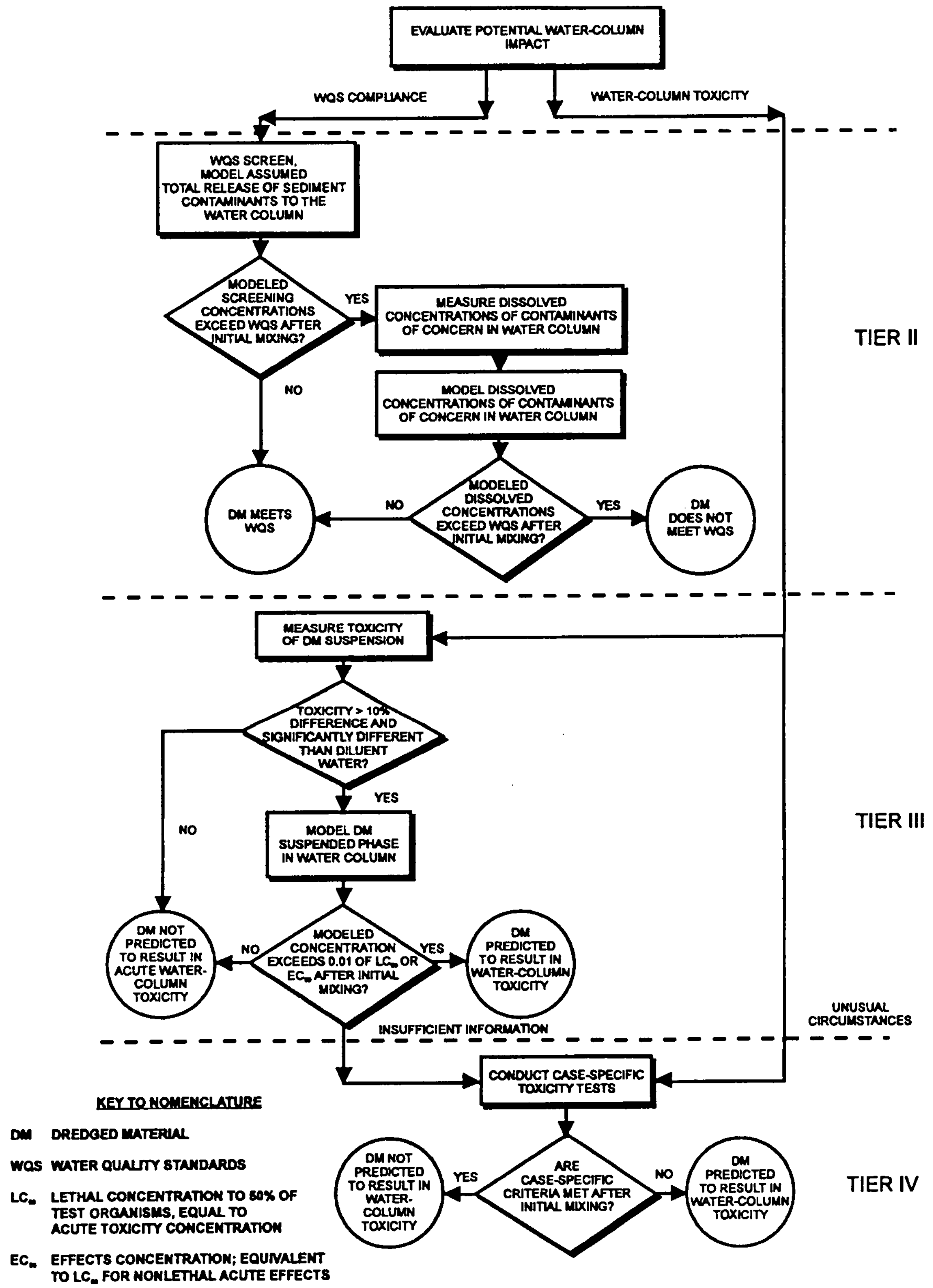

Figure 1-3. Illustration of Tiered Approach to Evaluating Potential Water Column Impacts of Deposited Dredged Material (Modified from USEPA/USACE 1998).

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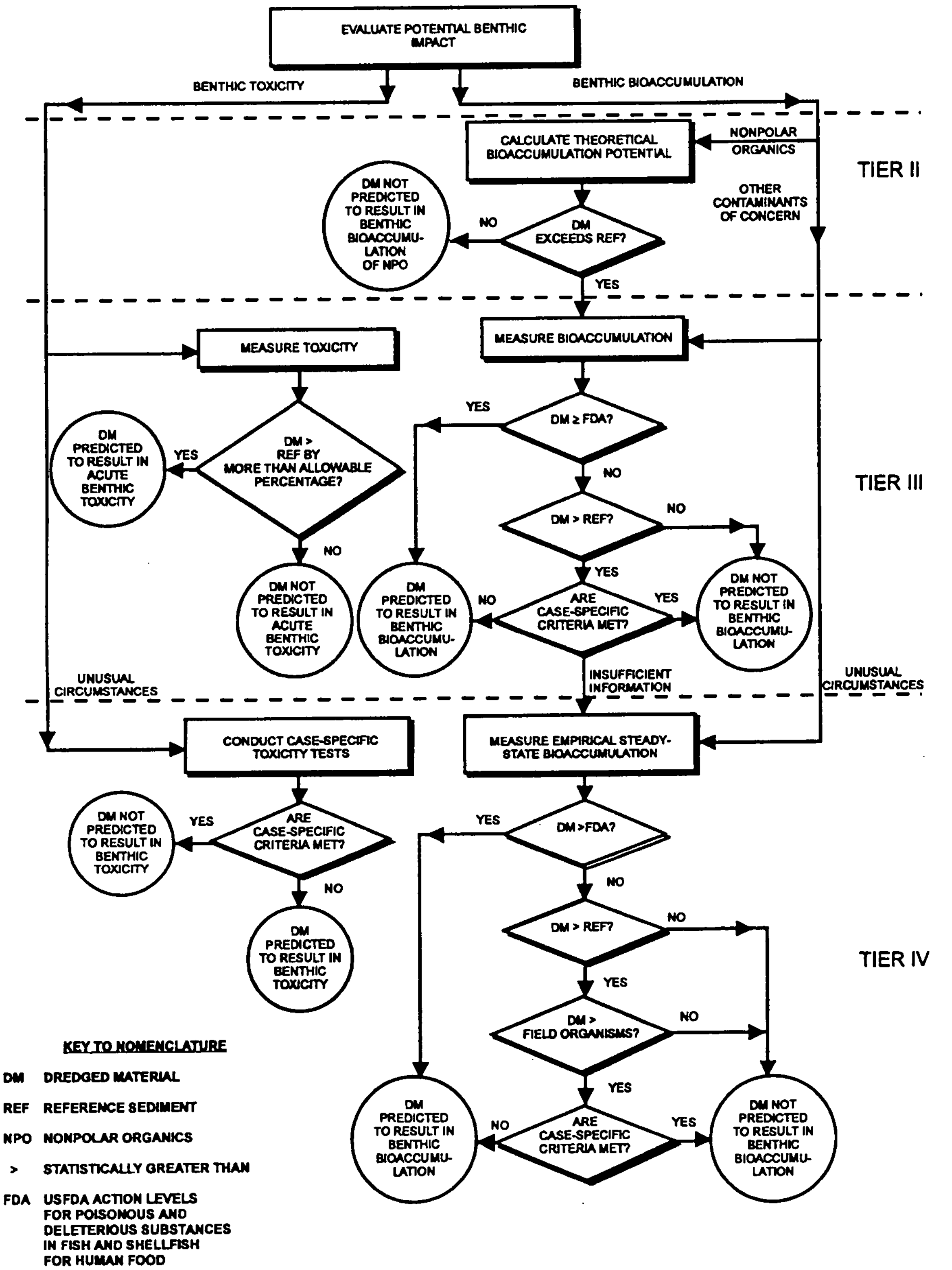

Figure 1-4. Illustration of Tiered Approach to Evaluating Potential Benthic Impacts of Deposited Dredged Material (Modified from USEPA/USACE 1998).

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TABLE 1-1 SUMMARY OF TARGET ANALYTES FOR PHYSICAL AND CHEMICAL TESTING AND BENCHMARK SPECIES FOR BIOLOGICAL TESTING[a]

Physical Analysis	Bulk Sediment Chemistry	Elutriate Testing	Bioassays/Bioaccumulation Studies
• Grain Size • Moisture Content • Atterberg Limits • Specific Gravity	• Volatile Organic Compounds (VOCs) • Semivolatile Organic Compounds (SVOCs) • Chlorinated Pesticides • Organophosphorus Pesticides • Polychlorinated Biphenyl (PCB) Aroclors • Polychlorinated Biphenyl (PCB) Congeners • Polynuclear Aromatic Hydrocarbons (PAHs) • Metals • Butyltins • Dioxin and Furan Congeners • Nutrients (ammonia, nitrate, nitrite, TKN, total phosphorus) • Cyanide • Simultaneously Extracted Metals (SEM) / Acid Volatile Sulfides (AVS) • Biological Oxygen Demand (BOD) • Chemical Oxygen Demand (COD) • Total Organic Carbon (TOC)	Same as bulk sediment chemistry or dependent upon federal or state water quality criteria	Water column bioassays • *Mysidopsis bahia* (opossum shrimp) • *Cyprinodon variegatus* (sheepshead minnow) • *Menidia beryllina* (inland silverside) • *Mytilus* sp. (blue mussel) Whole sediment bioassays • *Leptocheirus plumulosus* (estuarine amphipod) • *Mysidopsis bahia* (opposum shrimp) • *Neanthes arenaceodentata* (estuarine polychaete) Bioaccumulation studies • *Nereis virens* (sand worm) • *Macoma nasuta* (blunt-nose clam)

(a) From USEPA/USACE 1998; benchmark species appropriate for estuarine or marine placement alternatives

CHAPTER 2 -
PROJECT DESCRIPTION

DRAFT

2. STUDY DESCRIPTION

2.1 STUDY BACKGROUND

Site 104 is a formerly used open-water dredged material placement site in the upper Chesapeake Bay. The Maryland Port Administration (MPA) proposed to reuse the site to meet the short-term placement needs generated by scheduled maintenance dredging and new work dredging of the mainstem Chesapeake Bay navigation channels. In accordance with the State's request, the Baltimore District USACE undertook physical, chemical, and biological studies to characterize the sediment and comply with Section 404 of the CWA and to determine if the sediments were appropriate for open-water placement. The State has since withdrawn Site 104 from consideration. Although this series of studies was originally intended to provide information related to dredged material placement at Site 104, the information derived from the studies is provided in this report and is intended to be used to assist with the evaluation of dredged material proposed for placement elsewhere.

EA Engineering, Science, and Technology, Inc. was contracted by the USACE–Baltimore District to conduct an evaluation of dredged material that was originally proposed for placement at Site 104. A tiered evaluation of the sediment proposed for dredging was conducted to determine if materials from the upper Chesapeake Bay approach channels to the Port of Baltimore were appropriate for open-water placement. In addition to evaluating the sediments with regard to open-water placement, the sediments were also evaluated with regard to ocean placement at the Norfolk Ocean Disposal Site (NODS) in the Atlantic Ocean. The study consisted of a tiered evaluation that included review of existing information; collection of sediment and site water; chemical analysis of sediment, site water, and elutriates; and water column bioassays, sediment bioassays, and bioaccumulation studies.

2.2 STUDY PURPOSE

The purpose of this study was (1) to document existing sediment quality conditions and potential impacts related to open water placement of dredged material; (2) to determine if the sediments are appropriate for open-water (Chesapeake Bay) placement; (3) to evaluate the feasibility of certain placement alternatives (such as ocean placement); and (4) to facilitate dredged material management decisions.

This study provides the data necessary to document the existing physical, chemical, and biological characteristics of sediments and water in the channels, in the previously proposed placement area, and in two additional reference areas (outside Site 104 and the Ocean Reference site).

2.3 STUDY OBJECTIVES

The overall objective of the study was to obtain, analyze, and evaluate sediment and water samples that are representative of the areas proposed for dredging during the period that Site 104 was originally intended to be proposed for placement. The results of this investigation document the existing physical, chemical, and biological characteristics of sediment and water from the approach channels proposed for maintenance dredging during FY00 through FY02 and the area proposed for new work dredging.

Specific objectives of the project were to:

- Collect the required volume of sediment and site water for physical, chemical, and biological analyses, and for elutriate preparation.
- Collect samples from specified locations with sufficient distribution to characterize dredging sites within positioning accuracy appropriate for the study objectives.
- Collect and transfer sediment to appropriate, laboratory-prepared containers and preserve/hold samples for analysis according to protocols that ensure sample integrity.
- Test and characterize sediments with regard to physical characteristics, chemical contamination, biological toxicity, and the potential for bioaccumulation.
- Test site water, elutriates, and placement site/reference site water with regard to potential chemical contamination.
- Evaluate the results of the sediment chemistry, elutriate, toxicity, and bioaccumulation data with regard to open-water and ocean placement alternatives.

2.4 DESCRIPTION OF STUDY AREA

The study area is located in the upper Chesapeake Bay, Maryland, as shown in Figure 2-1. A total of 56 locations were targeted for sampling in the testing program. Sampling stations were located in Chesapeake Bay approach channels proposed for maintenance dredging (28 stations), in approach channels recently dredged (17 stations), in one new work area (2 stations), inside Site 104 (5 stations), and outside Site 104 (4 stations). Chesapeake Bay approach channels proposed for dredging in FY00 and FY01 include: Craighill Entrance, Craighill Angle, Swan Point Channel, Tolchester Channel, and the southern Chesapeake and Delaware (C&D) approaches. Channels that have been recently dredged include: Craighill, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, and areas of the southern C&D Approach Channels. The proposed straightening of the Tolchester Channel s-turn represents a new work dredging project.

2.4.1 Baltimore Harbor Approach Channels

This project includes the upper Chesapeake Bay approach channels to the Port of Baltimore located east of Rock Point/North Point at the mouth of the Patapsco River. The approach channels maintained by USACE–Baltimore District include: Craighill Entrance, Craighill

Channel, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, Tolchester Channel, and Swan Point Channel. In addition, several locations in the C&D Canal approach channels have been included in this study. The channels are maintained to a depth of -50 ft Mean Lower Low Water (MLLW), with the exception of the Brewerton Channel Eastern Extension, Tolchester Channel, C&D Canal approaches, and Swan Point Channel, which are maintained to a depth of -35 ft MLLW. Shoaled areas within the channels are typically dredged every 2-5 years, depending upon the shoaling rate as indicated by periodic USACE bathymetric surveys.

Previous investigations (EA 1996a and 2000c) have characterized the physical and chemical characteristics of surficial sediments in the approach channels. The channel sediments generally consist of fine-grained silt and clay materials. Detected chemical constituents include metals, PAHs, and chlorinated organic compounds (pesticides and polychlorinated biphenyls (PCBs). Results from previous investigations are described in Chapter 3.

2.4.2 Proposed Site 104 Placement Area

Site 104 is a previously used, 1800-acre site located approximately one-half mile north of the Bay Bridge and one mile west of Kent Island. The site was established as a placement area in 1924 by USACE and was used for dredged material placement through 1975. The site is approximately 4.2 miles long and 0.65 mile wide. Depths range from -42 to -78 ft MLLW.

The physical and chemical characteristics of surficial sediments within and directly outside of the Site 104 boundaries were characterized by a previous study in 1997 (EA 1998a). One station, KI-7, located in the southern end of Site 104, exhibited concentrations of PAHs and metals that were elevated above channel sediments, other areas if the Upper Bay, and sediment quality guidelines values for aquatic life. Results from previous investigations are described in Chapter 3.

2.4.3 Reference Areas

Originally, the proposed placement site (Inside Site 104) was chosen as the area for channel comparisons of chemical and biological data. An upper Chesapeake Bay reference area (Outside Site 104) was added to the evaluation process at the request of USEPA Region III. The Outside Site 104 reference area represents an area that is physically and hydrologically similar to Inside Site 104, but has not been impacted by historical dredged material placement activities. The outside reference sampling locations corresponded to stations KI-11, KI-14, KI-15, and KI-16 that were sampled in previous sediment investigations (EA 1998a) (see Figure 4-13). Sediment form each individual location was analyzed for chemical constituents. A composite sample, consisting of sediment from each sampling location, was submitted for elutriate, toxicity, and bioacucmulation testing. Depths in the Outside Site 104 reference area ranged from -35 to -90 ft MLLW. Channel comparisons to Inside Site 104 were important for determining how sediment quality at the actual site would have been impacted by the proposed placement activities. Channel comparisons to Outside Site 104 were important for determining if the materials proposed for placement were of a quality that was similar to areas where placement had not previously occurred and for assessing individual and cumulative impacts.

In addition to the inside and outside Site 104 areas, an Atlantic Ocean reference area (specified by USEPA Region III) was chosen as the point of comparison for the ocean placement alternative. The Norfolk Ocean Disposal Site reference area was located approximately 14 miles southwest of the NODS and 2 miles southeast of the Chesapeake Light Tower in the Atlantic Ocean (see Figure 4-14). Water depths in the area ranged from -71 to -75 ft. Sampling and analysis of sediment from the NODS reference area were conducted in conjunction with a sediment evaluation for the Woodrow Wilson Bridge Project (EA 2000b) and was conducted subsequent to the approach channel, Inside Site 104, and Outside Site 104 testing.

2.5 EXPERIMENTAL DESIGN

The analytical and ecotoxicological components of the approach channel and Site 104 dredged material evaluation followed the tiered testing guidance described in the following documents:

- USEPA/USACE, 1998 (EPA-823-B-98-004). *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.–Testing Manual (Inland Testing Manual).*

- USEPA/USACE, 1991 (EPA-503/8-91/001). *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual (The Green Book).*

- USEPA/USACE, 1995 (EPA-823-B-95-001). *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations.*

In addition, regional recommendations were provided by USEPA Region III during the collection, testing, and evaluation process.

The analytical testing program included the following components:

- Physical analyses of bulk sediment (grain size, Atterberg Limits, specific gravity, and total solids determinations).

- Chemical analysis of bulk sediment, site water, and elutriates for project-specific target analytes: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, chlorinated and organophosphorus pesticides, PAHs, PCB aroclors and congeners, dioxin and furan congeners, butyltins, cyanide, total sulfides, simultaneously extracted metals (SEM)/acid volatile sulfides (AVS), ammonia, total Kjeldahl nitrogen (TKN), total organic carbon (TOC), total phosphorus (TP), and nitrate + nitrite.

The ecotoxicological testing program included the following components:

- Water column bioassays with *Mysidopsis bahia* (opossum shrimp), *Cyprinodon variegatus* (sheepshead minnow), *Mytilus* sp. (blue mussel), and *Menidia beryllina* (inland silverside).

- 10-day whole sediment bioassays with *Leptocheirus plumulosus* (estuarine amphipod) and *Neanthes arenaceodentata* (estuarine polychaete).

- 28-day whole sediment bioaccumulation studies with *Nereis virens* (sand worm) and *Macoma nasuta* (blunt-nose clam).

Data analysis and evaluation included the following components:

- Chemical data collected in 1997 and 1998 for Site 104 (EA 1998a) and for the upper Chesapeake Bay approach channels to the Port of Baltimore (EA 2000c), respectively, were reviewed to identify contaminants of concern and to determine if testing in subsequent tiers was necessary.

- Chemical concentrations in bulk sediment collected in 1999 studies were compared to reference sediment concentrations and to published Sediment Quality Guidelines (SQGs) (Buchman 1999; MacDonald 1994; MacDonald et al. 1996).

- TBP was calculated for pesticides, PAHs, PCB aroclors and congeners, and dioxin and furan congeners.

- Chemical concentrations in elutriate samples were compared to concentrations in potential receiving waters (Site 104 and the Ocean Reference site) and to USEPA saltwater acute and chronic Water Quality Criteria (WQC) for protection of aquatic life and to USEPA WQC for human health (consumption of aquatic organisms).

- Water quality modeling was conducted using the STFATE model to determine the maximum expected time and distance required to comply with applicable water quality criteria. Placement events at both Site 104 and the NODS were modeled.

- For the water column bioassays, LC50 (lethal concentration) and EC50 (effect concentration) values were calculated for survival and effect data, respectively. In addition, results were statistically analyzed to determine whether survival or development in the channel, placement site, or reference sediments was significantly lower than the laboratory control.

- For the whole sediment bioassays, survival data were statistically compared to the reference site survival data to determine whether channel sediments were acutely toxic to benthic organisms.

- 28-day bioaccumulation survival in the channel sediments was statistically compared to survival in the reference sediments to determine if organism survival in the channel sediments was significantly lower than organism survival in the reference sediment.

- Concentrations of pesticides and PCBs in the worm and clam tissue were statistically compared against USFDA Action Levels and USEPA Guidance/Tolerance Values (USFDA 1998) to determine if analyte concentrations in tissues were significantly lower than FDA Action Levels, USEPA Guidance / Tolerance Levels (for food consumption) at the 95% confidence level.

- Chemical concentrations in worms and clams exposed to the channel sediments were statistically compared to chemical concentrations in organisms exposed to the placement site reference sediments (Inside Site 104, Outside Site 104, and the Ocean Reference) to determine if contaminant tissue-residues were significantly higher in the channel-exposed organisms.

- Tissue-residue concentrations that were significantly higher than placement site/reference tissue-residue concentrations were compared to residue-effects data derived from the USACE–Waterways Experiment Station (WES) Environmental Residue Effects Database (ERED) and from a tissue residue-effects database compiled by Jarvinen and Ankley (1999).

- Tissue-residue concentrations that were significantly higher than reference tissue residue concentrations for which FDA Action Levels and EPA Tolerance Values or Guidance Levels did not exist were compared to EPA Fish Tissue Advisory Screening Values (SVs) (USEPA 1995A) and USEPA Region III Risk Based Criteria (RBCs) for fish tissue (USEPA 2000a).

- Critical Body Residue (CBR) was calculated to assess the potential impact of PAHs and pesticide body burden in aquatic organisms.

- Uptake Ratios (UR), comparing day 0 to day 28 tissue-residues, were calculated to quantify the magnitude of contaminant accumulation in tissues.

- COPCs in tissue-residues were identified for further evaluation.

2.6 REPORT ORGANIZATION

This report contains a comprehensive summary of historical data and field activities; results of bulk sediment testing, elutriate testing, ecotoxicological testing, and bioaccumulation studies; and evaluation of the data with respect to open water and ocean placement alternatives. Bulk sediment and elutriate data collected during previous investigations in 1997 and 1998 are summarized in Chapter 3. The field sampling program for the project is described in Chapter 4. Analytical methodologies for the testing of bulk sediment, site water, elutriates, and tissue are provided in Chapter 5. Results for the bulk sediment testing, site water and elutriate testing, ecotoxicological testing, and bioaccumulation studies are provided in Chapters 6, 7, 8, and 9, respectively. A list of cited references is provided in Chapter 10. Chapter 11 provides a list of persons who assisted with the preparation and review of this document.

The project Field Sampling Plan (FSP), Quality Assurance Project Plans (QAPPs) for analytical and ecotoxicological testing, supplemental reports, and raw data tables are appended to this report. Field logbooks, field and laboratory data sheets, chain-of-custody documentation, and analytical narratives are included as attachments in subsequent volumes of this report.

2.7 DEFINITIONS OF TERMS

The following words and terms are used throughout this document. Definitions are provided as follows:

sampling reach refers to a channel, placement site, or reference area where samples were collected. Sediment from each channel reach was tested and evaluated separately to determine if material from a particular reach was suitable for open water or ocean placement.

placement site refers to either the proposed Site 104 (Inside Site 104), or the Norfolk Ocean Disposal Site (NODS).

reference sites refers collectively to either the Outside Site 104 (Figure 4-13) and the Ocean Reference areas (Figure 4-14), unless individually specified.

maintenance dredging area refers to an area that is routinely dredged every 2-5 years; typically 1-4 ft of deposited unconsolidated material or shoaled material is removed to maintain channel depths.

new work dredging refers to dredging required for new projects where dredging has not previously occurred (i.e., new channels, channel deepening, channel widening, or channel straightening); consolidated, native or historical sediments are removed to depths dictated by project requirements.

reference sediment refers to sediment that the channel sediments are compared to (Outside Site 104 or Ocean Reference).

control sediment or control refers to a natural sediment or control media that is used in the biological laboratory to assess the health of the test organisms and acceptability of a test.

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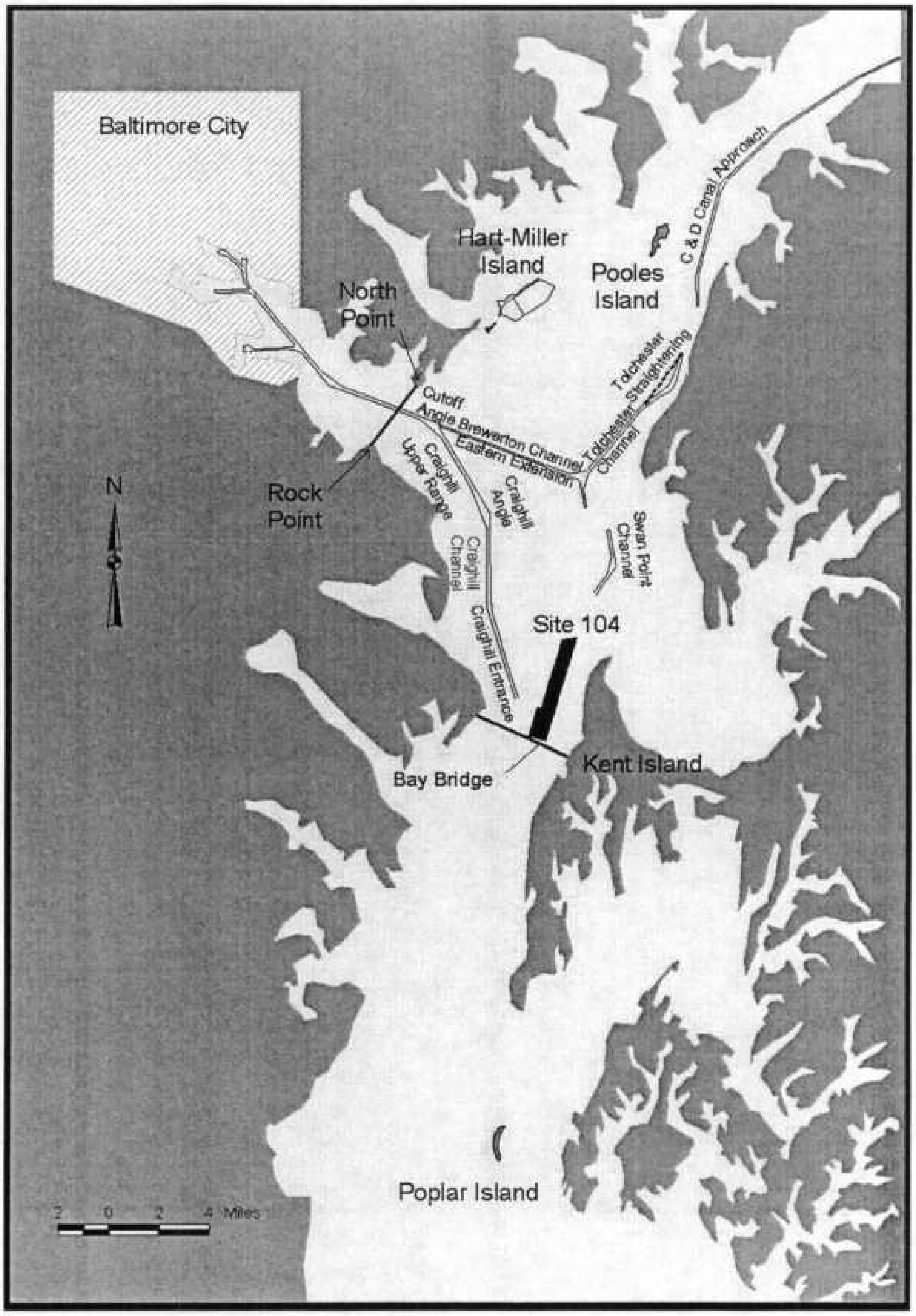

Figure 2-1. Location Map: Upper Chesapeake Bay Approach Channels to the Port of Baltimore and Site 104.

CHAPTER 3 -
AVAILABLE INFORMATION

3. AVAILABLE TIER I INFORMATION

Existing sediment quality data sets for the upper Chesapeake Bay approach channels to the Port of Baltimore and existing sediment quality data sets for the vicinity of Site 104 were reviewed to determine the need for additional data and to identify COPCs.

3.1 HISTORICAL DATA SETS

A Tier I evaluation requires the review of available data that are representative of the areas proposed for dredging and/or placement. The objective of the review is to identify contaminants of potential concern (COPCs) and to determine if additional testing in subsequent tiers is necessary. Two previous studies by USACE–Baltimore District have documented sediment quality/chemistry in the Baltimore Harbor and in the Chesapeake Bay approach channels to the Port of Baltimore (EA 1996a and EA 2000c). One previous study conducted in 1997 has also documented sediment quality/chemistry inside Site 104 and in the vicinity immediately outside Site 104 (EA 1998a). Data from these studies is reviewed in the following section.

In 1995 (EA 1996a) and 1998 (EA 2000c), USACE–Baltimore District conducted routine sediment chemistry and elutriate studies in the Chesapeake Bay Baltimore Harbor approach channels. Because maintenance dredging occurs frequently (approximately every 2-5 years) in the approach channels, USEPA Region III considers data collected no longer than within the past 3 years prior to dredging to be most representative of existing conditions within proposed dredging areas. In addition, the analytical methodology for sediment testing has improved substantially within the past 5 years. Analytical testing laboratories are able to identify and report analyte concentrations to lower detection limits, and they have a better understanding of the complexities of matrix and moisture interferences associated with sediment testing. Based on this information, the 1998 channel data most accurately identify and represent the existing conditions within the areas proposed for dredging, and the 1997 data best represent the conditions inside Site 104 and the vicinity outside Site 104. Therefore, only the 1998 channel data are discussed in this chapter; the 1995 channel data are appended to this report for historical reference (Appendix E). The approach channels tested in 1998 that are included in this evaluation include: Brewerton Channel Eastern Extension, Craighill Channel, Craighill Entrance, Craighill Upper Range, Cutoff Angle, Swan Point Channel, and the Tolchester Channel. Samples collected in each of the channels represent maintenance dredging only.

3.2 DATA ANALYSIS

3.2.1 Bulk Sediment Data

For sediments, data were evaluated based on mean concentrations of constituents detected within each channel. The mean concentrations best represent the concentrations that would be expected when the material is dredged, mixed together, and placed in large volumes.

3.2.1.1 Mean Calculations

Mean concentrations of detected analytes were calculated for each of the eight sampling reaches tested by USACE–Baltimore in 1998 (Brewerton Channel Eastern Extension, Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle, Swan Point Channel, and Tolchester Channel) (EA 2000c) and for the Inside Site 104 and Outside Site 104 areas tested in 1997 (EA 1998b). The detection limit was substituted for non-detected analytes in the calculations of the mean. If an analyte was not detected in any sample tested within a sampling reach, the mean detection limit was reported and qualified with a "U". A field duplicate sample was included in the means calculations for the Tolchester Channel.

For individual samples, PCB concentrations were determined by summing the 18 summation congeners (as specified in Table 9-3 of the ITM). The total summed concentration was then multiplied by a factor of 2 following the National Oceanic and Atmospheric Administration (NOAA) (1993) standard approach for total PCB determinations. Total PAHs were determined by summing the concentrations of PAHs in each sample. In the summation calculations for both Total PCBs and Total PAHs, three total values are presented in the data tables:

- Non-detects = zero (ND=0);
- Non-detects = ½ of the detection limit (ND=½ DL); and
- Non-detects = the detection limit (ND=DL).

The substitution of the detection limit (ND=DL) provides the most conservative approach to calculating and evaluating the data. However, in cases where few PCB congeners or PAHs are detected, the detection limit drives the total value and overestimates the actual expected concentration.

3.2.1.2 Comparisons to Sediment Quality Guidelines

Mean concentrations of detected analytes in sediment samples were compared against SQG for marine sediments. Among the most commonly used of the methods that attempt to provide sediment contaminant concentration values that differentiate sediments of little concern from those predicted to have adverse biological effects are the Threshold Effect Level (TEL) and Probable Effect Level (PEL) (Buchman 1999; MacDonald 1994; MacDonald et al. 1996).

TELs represent the contaminant concentration below which adverse biological effects rarely occur. PELs represent the contaminant concentration above which adverse biological effects frequently occur. Values that fall between the TEL and PEL represent the concentrations at which adverse biological effects occasionally occur. TEL and PEL screening values are provided in Table 3-1.

O'Connor et al. (1998) and O'Connor and Paul (1999) quantitatively evaluated the reliability of sediment toxicity predictions based on Effect Range Low (ERL) / Effect Range Median (ERM) values, which are derived by a process very similar to the TEL/PEL process and have similar values. Both papers attempt to validate the values using large independent datasets that contain both sediment chemistry and sediment toxicity data for each sample. Both papers define a toxic sediment as one that produces less than 80 % survival of amphipods after a 10-day exposure to whole sediment, the same criterion of whole sediment toxicity used in the ITM. Both papers reach the same conclusions. O'Connor and Paul (1999) found that within a 2,475-sample dataset, 2,087 (84%) of the samples were not toxic. A total of 730 samples did not exceed any ERL (comparable to TEL), and 697 (95.5%) of these were not toxic. This indicates that not exceeding an ERL is a reliable predictor of non-toxicity, and the same should be true for the closely related TEL. Of the 453 samples that exceeded at least one ERM, 186 (41%) actually produced toxicity. Therefore, exceeding an ERM (much less an ERL) is less than 50% accurate as a predictor of sediment toxicity, and the same is expected to be true for the closely related PEL (and TEL). This independent evaluation indicates that:

- not exceeding a TEL should reliably predict the absence of whole sediment toxicity,
- exceeding a PEL (much less a TEL) does not reliably indicate toxicity, and
- many, perhaps even most, sediments that exceed one or more PELs are not toxic.

Because TEL/PEL have been widely used despite their recently demonstrated low reliability in predicting toxicity, the mean concentrations of contaminants in the sediments sampled in this project were compared to the TEL and PEL values for all analytes for which TEL/PEL values have been developed. Comparison of sediment chemistry to SQGs is not a part of the tiered testing evaluations in the ITM (USEPA/USACE 1998) or the Green Book (USEPA/USACE 1991). For dredged material evaluations, SQG are used as a tool to assist with identification of COPCs and to provide additional weight of evidence in the evaluation (USACE–WES 1998b). Comparisons to TEL/PEL values were used only for these purposes in the evaluation of the sediments sampled in this project.

3.2.2 Elutriate Data

Analytes detected in the elutriates were compared to Maryland Department of the Environment (MDE) *proposed* water quality criteria [Maryland Register 27(17):1628-1636] and to USEPA saltwater acute and chronic aquatic life water quality criteria and water quality criteria for the protection of human health from the consumption of aquatic organisms (USEPA 1998 *National Recommended Water Quality Criteria* [63 Federal Register 68354 – 68364; 10 December 1998]). MDE's *proposed* criteria are more extensive than the State of Maryland's current standards, and the *proposed* criteria are identical/equivalent to the USEPA criteria. Applicable USEPA/ *proposed* MDE water quality criteria values (for detected analytes only) are provided in Table 3-2. Human health criteria are based on MDE's risk-factor of 10^{-5}.

The acute, chronic, and human health criteria are based on the following assumptions:

- acute criteria: 1-hr average exposure concentrations;
- chronic criteria: 4-day average exposure concentrations; and

- human health criteria: daily lifetime (70 years) consumption of aquatic organisms (10^{-5} risk-level).

Total PCB concentrations in the elutriates were determined by summing the 18 summation congeners (as specified in Table 9-3 of the ITM). The total summed concentration was then multiplied by a factor of 2 following the NOAA (1993) standard approach for total PCB determinations. Total PAHs were determined by summing the concentrations of PAHs in each sample. In the summation calculations for both Total PCBs and Total PAHs, three total values are presented in the data tables:

- Non-detects = zero (ND=0);
- Non-detects = ½ of the detection limit (ND=½ DL); and
- Non-detects = the detection limit (ND=DL).

The substitution of the detection limit (ND=DL) provides the most conservative approach to calculating and evaluating the data. However, in cases where few PCB congeners or PAHs are detected, the detection limit drives the total value and overestimates the actual expected concentration.

3.3 BULK SEDIMENT RESULTS

Results of the bulk sediment chemistry analyses are presented in the following subsections. Sample weights were adjusted for percent moisture (up to 50% moisture) prior to analysis to achieve the lowest possible detection limits. Because sediments contain a large proportion of moisture, each analyte has a sample-specific detection limit. The detection limit range within each reach is provided within each analytical summary table. Analytical results are reported on a dry weight basis. Definitions of organic and inorganic data qualifiers are presented in Tables 3-3 and 3-4, respectively. Station locations and analytical methodology utilized in the 1997 and 1998 sampling efforts are provided in EA (1998a) and EA (2000c), respectively. Analytical data for individual stations within each channel reach are provided in Appendix E.

Analytical results (mean concentrations) are provided in Tables 3-5 through 3-15. Results of TEL and PEL comparisons for mean concentrations are provided in Tables 3-16 and 3-17, respectively. Frequency of detection (number of detected analytes / total number of tested analytes) by analytical fraction is provided in Table 3-18.

3.2.2 Physical Analysis

Results of the physical analyses are provided in Table 3-5. Grain size determinations indicated that the channel sediments and sediment Inside Site 104 and Outside Site 104 were primarily comprised of silt and clay. Sediments in the Craighill Channel, Craighill Entrance, and Craighill Angle contained the highest proportions of sand (36%, 24%, and 14%, respectively). Sand comprised less than 8% of the sediments in the other tested channels.

3.2.3 Inorganic Non-Metals and Nutrients

Results of inorganic (non-metal) analyses and nutrients are provided in Table 3-6. Mean TOC in the channels ranged from 3.4% (Craighill Channel) to 14.1% (Cutoff Angle). Mean TOC concentrations were 6.8% and 8.9% for Inside and Outside Site 104, respectively. Overall, the highest ammonia-nitrogen concentration was reported for Outside Site 104 (137.7 mg/kg). Mean ammonia-nitrogen concentrations in the channels varied widely, ranging from 2.47 to 127.9 mg/kg, with the highest mean value at Swan Point. Mean nitrate + nitrite concentrations in the channels ranged from 0.12 to 4.7 mg/kg, with the values in the shallowest channels on the eastern side of the Upper Bay (Swan Point Channel and Tolchester Channel) ranging from 14 to 40 times higher than the other channels. The highest channel TKN (organic nitrogen + nitrogen-ammonia) concentrations were reported for Swan Point (1,430.0 mg/kg), Tolchester (2,407.5 mg/kg), and Craighill Angle (1565.0 mg/kg). Total phosphorus in the channels ranged from 161.8 mg/kg (Craighill Channel) to 320.3 mg/kg (Brewerton Channel Eastern Extension). Total sulfides were substantially higher in Inside and Outside Site 104 sediments (1,804 and 1,692 mg/kg, respectively) than in the channel sediments (range of 39.17 to 612.3 mg/kg).

3.3.3 Volatile Organic Compounds

Mean concentrations of VOCs are provided in Table 3-7. Only 3 of 34 tested VOCs were detected in the channel sediments (carbon disulfide, chloromethane, and dichloromethane). In the 8 channel reaches combined, VOCs were detected in 20 of 850 analyses (2.4%) in the channel sediments (Table 3-18). VOCs were not detected Inside or Outside Site 104 (0 of 136 cases for each location). None of the tested VOCs was detected in sediments from the Cutoff Angle, Swan Point, or Inside and Outside Site 104. Mean concentrations of the VOCs that were detected were generally low within the channels. Although none of the compounds was detected in the laboratory method blanks, both carbon disulfide and dichloromethane (methylene chloride) can be laboratory contaminants.

3.3.4 Semivolatile Organic Compounds

Mean concentrations of SVOCs are provided in Table 3-8. Fifty-one SVOCs were tested in the 1998 channel sediments and 49 SVOCs were tested in the 1997 Site 104 sediments. 1-methylnaphathalene and 2-methylnaphthalene were the two constituents that were not included in the 1997 testing program. Only 7 of 51 of the tested SVOCs were detected in the channel sediments. Only 3 of 49 tested SVOCs were detected within the Inside and Outside Site 104 sediments. In the 8 channel reaches, SVOCs were detected in 28 of 1,275 cases (2.1%) (Table 3-18). In the Inside and Outside Site 104 sediments, SVOCs were detected in 2 of 208 possible cases (1%) in each area, respectively.

The detection limit for 2-methylnaphalene exceeded the TEL value (Table 3-16); therefore, it is not possible to determine whether concentrations of 2-methylnaphalene exceeded the TEL in channels where it was not detected. 2-Methylnaphalene was detected above the TEL in Brewerton Channel Eastern Extension, Craighill Angle, and Tolchester Channel, but the mean concentrations did not exceed the PEL value (Table 3-17). Mean concentrations of bis(2-

ethylhexyl) phthalate exceeded the TEL value (Table 3-16) in each reach where it was detected (Craighill Channel, Craighill Entrance, and Tolchester Channel) except Inside Site 104.

3.3.5 Chlorinated Pesticides

Mean concentrations of chlorinated pesticides are provided in Table 3-9. Seventy-three percent of the tested chlorinated pesticides were not detected in the sediments. Six of 22 tested chlorinated pesticides were detected in sediments from the channels and from Inside Site 104. Three of 22 tested chlorinated pesticides were detected in sediments from Outside Site 104. In the eight channel reaches, chlorinated pesticides were detected in 20 of 550 cases (3.6%). Chlorinated pesticides were detected in 7 of 88 possible cases Inside Site 104 (8%) and in 4 of 88 cases (4.5%) Outside Site 104 (Table 3-18). The Brewerton Channel Eastern Extension and Inside Site 104 had the highest number of detected pesticides (six). Mean concentrations of 4,4'DDD and gamma-BHC in the Craighill Entrance were the only detected pesticides that exceeded TEL values (Table 3-16). The mean detection limit for chlordane was above the TEL and PEL values in all channels and Inside and Outside Site 104, so it is not possible to determine whether chlordane exceeded the TEL or PEL in any sample.

3.3.6 Organophosphorus Pesticides

Mean concentrations of organophosphorus pesticides are provided in Table 3-10. Organophosphorus pesticides were not detected in either the channel, Inside Site 104, or Outside Site 104 sediments (0 of 165 cases).

3.3.7 PCB Aroclors and Congeners

PCB aroclors are commercially manufactured products that consist of mixtures of multiple PCB congeners. PCB congeners are individual biphenyl compounds; there are 209 PCB congeners each having a different molecular configuration. Four of seven PCB aroclors (aroclors 1242, 1248, 1254, and 1260) were detected in the channel sediments, and two PCB aroclors (1254 and 1260) were detected in sediments from Inside and Outside Site 104 (Table 3-11). Aroclors were detected in 27 of 174 cases (15.5%) in the channel sediments, in 3 of 28 cases (11%) Inside Site 104 and in 2 of 28 cases (7%) Outside Site 104 (Table 3-18). Of the eight channels, PCB aroclors were not detected in Craighill Channel or Craighill Entrance.

Mean concentrations of PCB congeners are provided in Table 3-12. Congeners were not tested in Craighill Channel, Craighill Entrance, Swan Point Channel, or Tolchester Channel in the 1998 study, because PCB congener analysis was only conducted if the total aroclor concentration in an individual sample exceeded11.6 ug/kg (approximately one-half of the TEL value).In the four channels that were tested, PCB congeners were detected in only 11 of 182 cases (6%). Eight of the 26 target PCB congeners were detected in the channel sediments (BZ#101, BZ#138, BZ#153, BZ#170, BZ#180, BZ#187, BZ#206, and BZ#209). None of the 26 tested congeners was detected in sediments from Inside Site 104 or Outside Site 104 (0 of 50 cases). Total PCB calculations indicated that if the detection limit was substituted for non-detected analytes (ND=DL), the total PCB concentration in 4 of the 8 channels, exceeded the TEL, including one of the channels that had no detected congeners (Cutoff Angle). Total PCB calculations using ND=1/2 DL and ND=0 indicate that only Brewerton Channel Eastern Externsion exceeded the TEL. Brewerton Channel Eastern Extension had the greatest number of detected congeners, and the mean total PCB concentrations (ND=1/2 DL and ND=DL) for Brewerton Channel Eastern Extension exceeded the TEL value of 21.55 µg/kg (Table 3-16).

3.3.8 PAHs

Mean concentrations of PAHs are provided in Table 3-13. In the eight channels, PAHs were detected 282 of 400 cases (71%). PAHs were detected in 55 of 64 cases (86%) Inside Site 104 and in 43 of 64 cases (67%) Outside Site 104 (Table 3-18). Of the 16 PAHs tested, acenaphthylene was the only PAH not detected in any of the channel sediments. The detection limits for acenaphthene and acenaphthylene exceeded the TEL values, but did not exceed the PEL values (Tables 3-16 and 3-17, respectively). Although flourene, naphthalene, and phenanthrene exceeded the TEL in several channels (Brewerton Channel Eastern Extension, Craighill Angle, and Tolchester Channel), none of the concentrations exceeded the PEL. The highest mean total PAH concentrations were reported in sediments from Brewerton Channel Eastern Extension, Tolchester Channel, and Inside Site 104, but all total PAH concentrations were substantially lower than the TEL. The total PAH concentration (Inside Site 104) was approximately one-half the TEL value.

3.3.9 Metals

Mean concentrations of metals are provided in Table 3-14. Fourteen of the 15 tested metals were detected in the channel sediments. Cadmium was the only tested metal that was not detected in the channel sediments. In the eight tested channels, metals were detected in 337 of 400 cases (84%) (Table 3-18). Metals were detected in 57 of 60 cases (95%) Inside Site 104 and in 56 of 60 cases (93%) Outside Site 104 (Table 3-18). Seven metals that were detected in the channels and Outside Site 104 exceeded TEL values, and eight metals that were detected Inside Site 104 exceeded TEL values (Table 3-16). Copper and nickel exceeded the TEL in all eight of the channels, and Inside Site 104 and Outside Site 104. Arsenic, lead, mercury, and zinc exceeded the TEL in seven of the eight channel sediments (not exceeded in Craighill Channel) and Inside and Outside Site 104. Mean cadmium concentrations Inside and Outside Site 104 exceeded the TEL, but cadmium was not detected in the channels. Chromium exceeded the TEL only Inside Site 104.

Only two metals (nickel and zinc) exceeded PEL values in the channel sediments (Table 3-17). Mean concentrations of six metals (arsenic, cadmium, copper, lead, mercury, and zinc) exceeded the PEL Inside Site 104 (Table 3-16). Cadmium was the only metal that exceeded the PEL in the Outside Site 104 sediment.

3.3.10 Butyltins

Results of butyltin analyses are provided in Table 3-15. Tributyltin (TBT) was detected in seven of the eight tested channel sediments. Only one sample from each channel was analyzed for butyltins. Butyltins were not tested aspart of the 1997 Inside and Outside Site 104 sampling program. Mean concentrations in the channels ranged from 2.09 µg/kg (Brewerton Channel Eastern Extension) to 94.27 µg/kg (Tolchester Channel). TBT is a common component of anti-fouling paint. There are no TEL/PEL values for TBT.

3.3.11 Summary of Bulk Sediment Results

Overall, only 61 of 189 tested organic and inorganic constituents (32%) (VOCs, SVOCs, PAHs, chlorinated and organophosphorus pesticides, PCB aroclors and congeners, metals, and butyltins) were detected at least once in sediment from the approach channels.

Forty-three of the 186 tested organic constituents (23%) were detected at least once in sediments from the vicinity of Site 104.

For the approach channels, 82% of the total number of tests conducted did not yield detectable concentrations of organic or inorganic constituents (Table 3-18). Eighty percent and 83% of the total number of tests conducted for Inside Side 104 and Outside Site 104, respectively, yielded detectable concentrations of organic or inorganic constituents (Table 3-18). Metals and PAHs were the frequently detected constituents in the sediments from both the approach channels and the vicinity of Site 104.

Evaluation of the 1997 and 1998 sediment data set indicated that at least one analyte exceeded TEL and PEL values in every tested channel reach. The number of exceedances for TELs and PELs are summarized by reach in Tables 3-18 and 3-19, respectively. Sediments from Inside Site 104 exhibited more TEL and PEL exceedances than Outside Site 104 and the channel reaches. Inside Site 104 sediments had nearly twice as many PEL exceedances as any of the channel reaches. Overall, copper andnickel exceeded the TELs in every channel reach and both Inside and Outside Site 104. Arsenic and zinc exceeded the TELs in 7 of the 8 tested channels and both Inside and Outside Site 104. Of all the channel reaches, Brewerton Channel Eastern Extension exhibited the highest number of TEL and PEL exceedances, followed by Tolchester Channel and Craighill Entrance.

Of the 189 tested organic and inorganic constituents, a total of 15 constituents (8% of total tested) exceeded TELs in the channel sediments (7 metals, 3 PAHs, 2 pesticides, total PCBs, and 2 SVOCs). Of the 189 organic and inorganic constituents tested, only 2 constituents (1% of total tested), nickel and zinc, exceeded the PEL value in the channel sediments. The detection limit for one PAH (acenaphthene) exceeded the TEL, so is it not known whether concentrations of this constituent in the channel sediments exceeded the TEL. The detection limit for one pesticide (chlordane) exceeded the TEL and PEL, so it is not known whether concentrations of this constituent in the channel sediments exceeded the TEL or PEL.

Although toxicity cannot be predicted by the number of TEL or PEL exceedances within a given channel reach, none of the tested sediments may be ruled out as non-toxic without additional evaluation (O'Connor et al. 1998).

3.4 ELUTRIATE RESULTS

Results of the 1998 elutriate analyses are presented in the following subsections. A total of six elutriates were tested for the approach channels. One individual elutriate was created for each of the following channels: Brewerton Channel Eastern Extension, Craighill Channel, Swan Point Channel, and Tolchester Channel. One combined elutriate was created for Craighill Entrance and Craighill Channel and one combined elutriate was created for Craighill Upper Range and Cutoff Angle. No elutriates were prepared for the Inside and Outside Site 104 sediments. Definitions of organic and inorganic data qualifiers are presented in Tables 3-3 and 3-4, respectively. Station locations, analytical methodologies, and elutriate preparation procedures for the 1998 sampling effort are provided by EA (2000c) and EA Laboratories (1998). Analytical results for elutriate analyses are provided in Tables 3-21 through 3-28. Frequency of detection for each analytical fraction is provided in Table 3-29. Concentrations of 100% elutriate that exceed applicable WQC are provided in Tables 3-30A (acute WQC), 3-31A (chronic WQC), and 3-32A (human health). Mixing factors that would be required to comply with WQC are provided in Tables 3-30B (acute WQC), 3-31B (chronic WQC), and 3-32B (human health).

3.4.1 Inorganic Non-Metals/Nutrients

Results of inorganic analyses are provided in Table 3-21. Overall, the elutriate from the Craighill Angle had the highest ammonia-nitrogen, TKN, and total phosphorus (TP) concentrations. Ammonia-nitrogen concentrations in the elutriates ranged from 1.7 mg/L (Craighill Entrance/Craighill Channel) to 8.8 mg/L (Craighill Angle). None of the ammonia-nitrogen concentrations exceeded the USEPA acute saltwater criterion of 43 mg/L (Table 3-30A). Ammonia-nitrogen in the Craighill Angle and Swan Point Channel elutriates exceeded the chronic saltwater criterion of 6.4 mg/L (based on salinity=10 ppt, water temperature =10°C, and pH=7.4) (Table 3-31A). However, mixing factor of only one-fold of the 100% elutriate would be required to achieve compliance with the saltwater chronic criterion (which is based on a 4-day average exposure concentration).

Detected concentrations of TKN ranged from 0.26 mg/L (Brewerton Channel Eastern Extension) to 7.3 mg/L (Craighill Angle). TP ranged from 0.09 mg/L (Brewerton Channel Eastern Extension) to 0.38 mgL (Craighill Angle). The results for the TKN analyses are below the reported ammonia values in every reach except Craighill Entrance/Craighill Channel. The TKN results may be biased low due to chloride interferences or interference from inorganic salts in the elutriates. Cyanide and total sulfide were not detected in any of the channel elutriates.

3.4.2 Volatile Organic Compounds

Results of Volatile Organic Analyses (VOAs) are provided in Table 3-22. VOCs were detected in 4 of 210 cases (2%) in the channel elutriates. Of the 35 tested VOCs, dichloromethane (methylene chloride) was the only analyte detected in the elutriates. Methylene chloride is a common laboratory contaminant, and the detected concentrations did not exceed the human health criterion (Table 3-32A).

3.4.3 Semivolatile Organic Compounds

Results of Semivolatile Organic Analyses (SVOAs) are provided in Table 3-23. None of the 54 tested SVOCs was detected in the channel elutriates (0 of 324 cases).

3.4.4 Chlorinated Pesticides

Results of chlorinated pesticides and PCB aroclors are provided in Table 3-24. Eight of the 22 tested chlorinated pesticides were detected in the channel elutriates (alpha-BHC, beta-BHC, chlorbenside, delta-BHC, endosulfan I, gamma-BHC, heptachlor, heptachlor epoxide). Overall, chlorinated pesticides were detected in 30 of 132 cases (23%). Beta-BHC, gamma-BHC, heptachlor and heptachlor epoxide were detected in method blanks run with the samples; therefore the reported concentrations were flagged with a “B” indicating that the concentrations may have originated from laboratory contamination. Detected concentrations of alpha-BHC, beta-BHC, gamma-BHC, and endosulfan I in the 100% elutriate did not exceed applicable water quality criteria (Tables 3-30A, 3-31A, and 3-32A).

Both heptachlor and heptachlor epoxide in the 100% elutriate exceeded the saltwater chronic criteria for aquatic life and the human health criteria for consumption of aquatic organisms (Tables 3-31A and 3-32A). These constituents were detected in the laboratory method blank, and therefore, the concentrations do not accurately represent release of these constituents in the field during open-water placement. If the detected concentrations were representative of in-situ release, a maximum mixing factor of 10 for heptachlor and 7 for heptachlor epoxide would be required to achieve compliance with the most stringent criteria.

3.4.5 Organophosphorus Pesticides

Results for organophosphorus pesticides are provided in Table 3-25. None of the tested organophosphorus pesticides was detected in the channel elutriates (0 of 30 cases).

3.4.6 PCB Aroclors and Congeners

Results for PCB aroclors are provided in Table 3-26. None of the seven tested PCB aroclors was detected in the elutriate samples (0 of 42 cases).

PCB congeners were not tested in the 1998 channel elutriate samples.

3.4.7 Polynuclear Aromatic Hydrocarbons

Results for PAHs are provided in Table 3-27. None of the 15 tested PAH compounds was detected in the channel elutriates (0 of 90 cases).

3.4.8 Metals

Results of the metals analyses are provided in Table 3-28. Ten of the 16 tested metals were detected in the channel elutriates. Metals were detected in the channel elutriates in 43 of 96 cases (45%). Aluminum, antimony, arsenic, and manganese were detected in each of the channel elutriates. Selenium was detected in 5 of the 6 channel elutriates, and chromium and silver were detected in 4 of the 6 channel elutriates. Neither antimony, chromium, nor selenium concentrations in the 100% elutriate exceeded applicable water quality criteria (Tables 3-30A, 3-31A, and 3-32A). Silver concentrations in the 100% elutriate from Craighill Upper Range/Cutoff Angle and Tolchester Channel elutriates were slightly higher than the acute saltwater criteria. Mercury and nickel concentrations in the 100% elutriate from Craighill Entrance/Craighill Channel and Craighill Angle elutriates, respectively, exceeded the chronic saltwater criteria. Compliance with the acute and chronic criteria would require a mixing factor of 2 (Tables 3-30B and 3-31B).

Manganese and arsenic exceeded the human health criteria for consumption of aquatic organisms in 100% elutriates from all of the channel reaches. A maximum mixing factor of 112 for manganese (Swan Point Channel) would be required to achieve compliance with human health criterion for consumption of aquatic organisms (3-32B).

3.4.9 Summary of Elutriate Results

Only 77 of 924 total analyses (8%) conducted on the channel elutriate samples contained measurable concentrations of organic or inorganic constituents (VOCs, SVOCs, chlorinated and organophosphorus pesticides, PCB aroclors, PAHs, and metals) (Table 3-27). The majority of detected constituents were metals and chlorinated pesticides.

Evaluation of the 1998 elutriate data set indicates that at least several chemical constituents detected in the 100% elutriate from each channel reach exceed applicable WQC (Table 3-33). Overall, the human health criteria for consumption of aquatic organisms were the criteria that was most frequently exceeded. The 100% elutriate from Craighill Angle exhibited the greatest number of WQC exceedances (5). Manganese, a naturally occurring trace metal was the constituent that required the highest mixing factor in 5 of the 6 tested elutriates (Brewerton Eastern Extension, Craighill Angle, Craighill Upper Range/Cutoff Angle, Swan Point, and Tolchester). Mercury required the highest mixing factor in the Craighill Entrance/Craighill Channel elutriate.

Of the 152 organic and inorganic constituents tested, only 8 constituents (5%) in the 100% elutriate exceeded WQC. Only 1 constituent (silver) exceeded acute WQC; 5 constituents (ammonia-nitrogen, heptachlor, heptachlor epoxide, mercury, and nickel) exceeded chronic WQC; and 6 constituents (heptachlor, heptachlor epoxide, arsenic, manganese, mercury, and nickel) exceeded human health criteria for the consumption of aquatic organisms. Both heptachlor and heptachlor epoxide were detected in the laboratory method blank; thus, the detected concentrations do not accurately represent release of these constituents from sediments to the water column during open-water placement.

It is important to note that the acute, chronic, and human health criteria are based on the following assumptions:

- acute criteria: 1-hr average exposure concentrations;
- chronic criteria: 4-day average exposure concentrations; and
- human health criteria: daily lifetime (70 years) consumption of aquatic organisms (10^{-5} risk-level).

The maximum mixing factors required to achieve the acute, chronic, and human health criteria would be 2 (silver), 10 (heptachlor) (although detected in laboratory blank, and 112 (manganese), respectively.

Overall, during open-water placement, the majority of constituents would be expected to meet WQC at the point of release. The few constituents that would not meet compliance at the point of release would be expected to reach the WQC quickly in relation to the times implicit in the WQC (i.e., 1-hr average, 4-day average, daily lifetime consumption of aquatic organisms). Based on the assumptions associated with the WQC, the nature of the detected constituents, and the concentrations of the detected constituents, none of the constituents detected in the elutriates would be expected to cause "significant degradation" [33 CFR 230.1(c)] in the aquatic environment.

3.5 TIER I EVALUATION

According to the ITM (USEPA/USACE 1998), after consideration of all available Tier I information, one of the following conclusions is reached.

1. Existing information does not provide a sufficient basis for making factual determinations. In this case, further evaluation in higher tiers is appropriate.

2. Existing information provides a sufficient basis for making factual determinations. In this case, one of the following decisions is reached:

   (a) The material meets the criteria for exclusion from testing.

   (b) The material does not meet the criteria for exclusion from testing, but information concerning the potential impact of the material is sufficient to make factual determinations.

Review and evaluation of the 1997 and 1998 data sets indicates that the channel sediments do not qualify for exclusion from additional testing. None of the sediments is exclusively comprised of sand, and several chemical constituents were detected above TEL or PEL values in each tested channel. Although toxicity cannot be predicted from TEL and PEL comparisons, none of the sediments can be ruled out as non-toxic without additional information.

Detected constituents in the 100 percent elutriate samples exceeded one or more applicable water quality criteria for each of the tested channel reaches. Although the majority of detected constituents meet WQC at the point of release, water quality modeling in subsequent tiers will predict the expected water column mixing at the placement site and will allow for determination of the distance and time required to achieve applicable water quality criteria.

Evaluation in higher tiers is appropriate because the existing information does not provide a sufficient basis for making factual determinations regarding potential water column and benthic impacts.

TABLE 3-1 MARINE SEDIMENT QUALITY GUIDELINES (SQG)

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

Source: Buchman 1999

(a) MG/KG = parts per million; UG/KG = parts per billion; units expressed as dry weight

TABLE 3-2 USEPA/ *(PROPOSED)* MDE WATER QUALITY CRITERIA*

ANALYTE	UNITS	SALTWATER CRITERIA		
		ACUTE [a]	CHRONIC [b]	HUMAN HEALTH [c]
NON-METALS				
CYANIDE	UG/L	1 [d]	1 [d]	
AMMONIA-NITROGEN	MG N/L	43 [q]	6.4 [q]	
SULFIDE, TOTAL	UG/L		2 [t]	
VOCs				
DICHLOROMETHANE	UG/L			16000 [v]
SVOCs				
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L			59 [v]
PESTICIDES				
ALPHA-BHC	UG/L			0.13 [v]
BETA-BHC	UG/L			0.46 [v]
ENDOSULFAN I	UG/L	0.034 [l]	0.0087 [l]	240
GAMMA-BHC	UG/L	0.16		0.63 [v]
HEPTACHLOR	UG/L	0.053	0.0036	0.0021 [v]
HEPTACHLOR EPOXIDE	UG/L	0.053	0.0036	0.0011 [v]
PCBs				
TOTAL PCBs	UG/L		0.03 [e]	0.0017 [fv]
PAHs				
FLUORENE	UG/L			14,000
PYRENE	UG/L			11000
METALS				
ANTIMONY	UG/L			4300
ARSENIC	UG/L	69 [g]	36 [g]	0.14 [h]
BERYLLIUM	UG/L			0.117 [i]
CHROMIUM	UG/L	1100 [j]	50 [j]	
COPPER	UG/L	4.8 [k]	3.1 [k]	
LEAD	UG/L	210 [m]	8.1 [m]	
MANGANESE	UG/L			100
MERCURY	UG/L	1.8 [n]	0.94 [n]	0.051
NICKEL	UG/L	74 [p]	8.2 [p]	4600
SELENIUM	UG/L	290 [r]	71 [r]	
SILVER	UG/L	1.9 [s]		
ZINC	UG/L	90 [u]	81 [u]	
ORGANOTINS				
TRIBUTYLTIN	UG/L	0.37 [o]	0.01 [o]	

* = Applicable to detected analytes in 1998 elutriate samples.

Source: USEPA 1998 [63 Federal Register 68354-68364] and Maryland Register 2000 [27(17):1628-1636].

Superscripts:

a = acute aquatic life criteria based on 1-hr average exposure concentrations.
b = chronic aquatic life criteria based on 4-day average exposure concentrations.
c = human health criteria based on daily lifetime (70-year) average consumption of aquatic organisms; criteria based on 10^{-5} risk for carcinogens.
d = ug free cyanide as CN/L.
e = applies to aroclors 1242, 1254, 1221, 1232, 1248, 1260, and 1016.
f = applies to Total PCBs (sum of all congeners or isomer analyses).
g = total dissolved arsenic.
h = inorganic arsenic only.
i = from EPA 1986 Gold Book; no EPA 1998 number.
j = dissolved chromium; hexavalent.
k = dissolved copper.
l = most appropriately applied to sum of alpha (I) and beta (II) endosulfan.
m = dissolved lead.
n = dissolved total mercury.
o = proposed criteria.
p = dissolved nickel.
q = total ammonia as nitrogen; criterion assumes cold weather conditions: salinity = 10 ppt, water temperature = 10 C, and pH=7.4
r = dissolved selenium.
s = dissolved silver.
t = undissociated hydrogen sulfide (H2S).
u = dissolved zinc.
v = carcinogen

TABLE 3-3 ORGANIC DATA QUALIFIERS

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

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

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

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

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

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

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

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

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

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

TABLE 3-4 INORGANIC DATA QUALIFIERS

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

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

U Analyte analyzed for, but not detected (concentration is less than the method-specified IDL or MDL.

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

E Reported value is estimated because of presence of interference.

M Duplicate injection precision not met.

N Spiked sample recovery is not within control limits.

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

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

* Duplicate analyses not within control limits.

\+ Correlation coefficient for MSA is less than 0.995.

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

P Inductively Coupled Plasma (ICP)

A Flame AAS

F Furnace AAS

CV Cold Vapor AAS

AV Automated Cold Vapor AAS

AS Semiautomated Spectrophotometric

C Manual Spectrophotometric

T Titrimetric

NR Analyte is not required to be determined.

TABLE 3-5 MEAN VALUES FOR PHYSICAL CHARACTERISTICS IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

REACH ID:		Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
SAMPLE TYPE:		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
SAMPLE SIZE (N):		4	4	4	3	2	3	3	3	3	4
ANALYTE	**UNIT**										
MOISTURE CONTENT	%	67.5	71.9	74.0	46.33	69.6	70.67	69.4	72.67	71.9	69.3
SPECIFIC GRAVITY	T/4C	1.26	1.24	1.2	2.61	1.2	2.7	1.33	1.2	1.23	1.4
CLAY	%	43.88	33.85	35.95	28.6	21.3	27.83	28.9	21.47	26.93	46.8
GRAVEL	%	0.0	0.0	0.47	0.33	0.0	1.9	0.0	0.0	0.0	0.0
SAND	%	10.7	5.18	4.15	35.83	14.35	24.37	7.77	4.03	0.42	1.17
SILT	%	45.17	60.97	59.43	35.23	64.35	45.9	63.34	74.5	72.63	52.02

TABLE 3-6 MEAN CONCENTRATIONS OF INORGANIC NON-METALS (MG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

ANALYTE	UNIT	DL (RANGE)	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
SAMPLE TYPE:			Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
SAMPLE SIZE (N):			4	4	4	3	2	3	3	3	3	4
CHROMIUM (HEXAVALENT)	MG/KG	0.13 - 0.56	**0.44**	0.31 U	0.4 U	0.19 U	0.34 U	0.37 U	0.33 U	0.36 U	0.37 U	0.31 U
CYANIDE	MG/KG	0.21 - 2.1	**0.83**	0.78 U	0.22 U	0.23 U	**0.44**	**0.28**	**0.22**	0.21 U	0.21 U	**0.22**
NITROGEN, AMMONIA	MG/KG	0.05 - 2.8	**51.23**	**137.68**	**43.9**	**19.13**	**7.35**	**78.43**	**64.53**	**2.47**	**127.9**	**16.57**
NITROGEN, NITRATE AND NITRITE	MG/KG	0.01 - 2.3	**1.02**	**0.97**	**0.33**	0.01 U	**0.23**	**0.08**	**0.13**	**0.12**	**4.7**	**4.05**
NITROGEN, TOTAL KJELDAHL	MG/KG	23 - 30.8	**1240.5**	**1000.75**	**1413.5**	**307.0**	**1565.0**	**963.67**	**667.67**	**700.67**	**1430.0**	**2407.5**
OXYGEN DEMAND, BIOCHEMICAL	MG/KG	120 - 1200	**10042.5**	**5245.0**	**754.75**	**315.0**	**995.5**	**1229.0**	**1516.0**	**964.0**	**1218.33**	**1323.75**
OXYGEN DEMAND, CHEMICAL	MG/KG	990 - 2070	**84375.0**	**73925.0**	**51925.0**	**32526.67**	**80300.0**	**45036.67**	**90966.67**	**86900.0**	**67466.67**	**51550.0**
PHOSPHORUS, TOTAL	MG/KG	4.2 - 5.6	NA	NA	**320.32**	**161.83**	**312.5**	**227.0**	**280.33**	**311.33**	**251.6**	**301.75**
SULFIDE, TOTAL	MG/KG	0.1 - 10.6	**1803.75**	**1692.0**	**76.55**	**39.17**	**414.45**	**527.33**	**612.33**	**239.0**	**392.37**	**78.52**
TOTAL ORGANIC CARBON	MG/KG	6920 - 19500	**67975.0**	**89825.0**	**123500.0**	**33813.33**	**107800.0**	**113100.0**	**97533.33**	**140666.67**	**103166.67**	**102675.0**

U = not detected in any sample within reach; value represents mean detection limit (DL).

NA = not analyzed.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-7 MEAN CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

ANALYTE	UNIT	DL(RANGE)	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	4	4	4	3	2	3	3	3	3	4
1,1,1-TRICHLOROETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
1,1,2,2-TETRACHLOROETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
1,1,2-TRICHLOROETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
1,1-DICHLOROETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
1,1-DICHLOROETHYLENE	UG/KG	0.8 - 3	0.8 U	1.1 U	0.83 U	0.8 U	0.8 U	0.8 U	0.8 U	3.0 U	0.8 U	0.8 U
1,2-DICHLOROBENZENE	UG/KG	0.9 - 3	0.9 U	1.18 U	0.93 U	0.9 U	0.9 U	0.9 U	0.9 U	3.0 U	0.9 U	0.9 U
1,2-DICHLOROETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
1,4-DICHLOROBENZENE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
2-CHLOROETHYL VINYL ETHER	UG/KG	49 - 190	50.0 U	62.5 U	51.25 U	49.0 U	50.0 U	49.67 U	50.33 U	180.0 U	50.0 U	50.0 U
ACROLEIN	UG/KG	12 - 46	12.0 U	15.0 U	12.25 U	12.0 U	12.0 U	12.0 U	12.0 U	43.33 U	12.0 U	12.0 U
ACRYLONITRILE	UG/KG	14 - 54	14.0 U	17.5 U	14.25 U	14.0 U	14.0 U	14.0 U	14.0 U	50.67 U	14.0 U	14.0 U
BENZENE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
BROMODICHLOROMETHANE	UG/KG	0.9 - 3	0.9 U	1.18 U	0.93 U	0.9 U	0.9 U	0.9 U	0.9 U	3.0 U	0.9 U	0.9 U
BROMOMETHANE	UG/KG	3 - 11	3.0 U	3.75 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	10.67 U	3.0 U	3.0 U
CARBON DISULFIDE	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	**4.0**	2.0 U	**2.33**	2.0 U	7.33 U	2.0 U	2.0 U
CARBON TETRACHLORIDE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
CFC-11	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U
CFC-12	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U
CHLOROBENZENE	UG/KG	0.9 - 3	0.9 U	1.18 U	0.93 U	0.9 U	0.9 U	0.9 U	0.9 U	3.0 U	0.9 U	0.9 U
CHLORODIBROMOMETHANE	UG/KG	0.8 - 3	0.8 U	1.1 U	0.83 U	0.8 U	0.8 U	0.8 U	0.8 U	3.0 U	0.8 U	0.8 U
CHLOROETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
CHLOROFORM	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
CHLOROMETHANE	UG/KG	2 - 8	2.0 U	2.5 U	**8.25**	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U
CIS-1,3-DICHLOROPROPENE	UG/KG	0.8 - 3	0.8 U	1.1 U	0.83 U	0.8 U	0.8 U	0.8 U	0.8 U	3.0 U	0.8 U	0.8 U
DICHLOROMETHANE	UG/KG	1 - 4	1.0 U	1.25 U	**11.75**	**1.33**	**1.5**	**1.33**	**1.33**	3.67 U	1.0 U	**15.75**
ETHYLBENZENE	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U
M-DICHLOROBENZENE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
METHYLBENZENE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
TETRACHLOROETHENE	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U
TRANS-1,2-DICHLOROETHENE	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	0.8 - 3	0.8 U	1.1 U	0.83 U	0.8 U	0.8 U	0.8 U	0.8 U	3.0 U	0.8 U	0.8 U
TRIBOMOMETHANE	UG/KG	1 - 4	1.0 U	1.25 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.67 U	1.0 U	1.0 U
TRICHLOROETHYLENE	UG/KG	0.9 - 3	0.9 U	1.18 U	0.93 U	0.9 U	0.9 U	0.9 U	0.9 U	3.0 U	0.9 U	0.9 U
VINYL CHLORIDE	UG/KG	2 - 8	2.0 U	2.5 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	7.33 U	2.0 U	2.0 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-8 MEAN CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

ANALYTE	UNIT	DL (RANGE)	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	4	4	4	3	2	3	3	3	3	4
1,2,4-TRICHLOROBENZENE	UG/KG	98 - 100	100.0 U	100.0 U	99.0 U	99.67 U	99.5 U	99.67 U	100.0 U	99.33 U	99.33 U	99.5 U
1,2-DIPHENYLHYDRAZINE	UG/KG	91 - 95	93.0 U	93.0 U	92.5 U	93.0 U	93.5 U	92.67 U	93.67 U	93.0 U	93.0 U	93.25 U
1-METHYLNAPHTHALENE	UG/KG	25 - 27	NA	NA	29.0	26.0 U	26.0 U	26.0 U	26.0 U	25.67 U	25.67 U	30.75
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	220 - 230	230.0 U	230.0 U	227.5 U	230.0 U	230.0 U	230.0 U	230.0 U	230.0 U	230.0 U	230.0 U
2,4,5-TRICHLOROPHENOL	UG/KG	97 - 100	99.0 U	99.0 U	98.25 U	99.0 U	99.0 U	98.67 U	99.67 U	99.0 U	99.0 U	99.0 U
2,4,6-TRICHLOROPHENOL	UG/KG	90 - 94	92.0 U	92.0 U	91.5 U	92.0 U	92.5 U	91.67 U	92.67 U	92.0 U	92.0 U	92.25 U
2,4-DICHLOROPHENOL	UG/KG	80 - 84	82.0 U	82.0 U	81.5 U	82.0 U	82.0 U	81.67 U	82.67 U	82.33 U	82.0 U	82.25 U
2,4-DIMETHYLPHENOL	UG/KG	90 - 94	92.0 U	92.0 U	91.5 U	92.0 U	92.5 U	91.67 U	92.67 U	92.0 U	92.0 U	92.25 U
2,4-DINITROPHENOL	UG/KG	190 - 190	190.0 U	190.0 U	190.0 U	190.0 U	190.0 U	190.0 U	190.0 U	190.0 U	190.0 U	190.0 U
2,4-DINITROTOLUENE	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
2,6-DINITROTOLUENE	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
2-CHLORONAPHTHALENE	UG/KG	120 - 120	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U
2-CHLOROPHENOL	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
2-METHYL-4,6-DINITROPHENOL	UG/KG	230 - 240	240.0 U	240.0 U	237.5 U	240.0 U	240.0 U	240.0 U	240.0 U	240.0 U	240.0 U	240.0 U
2-METHYLNAPHTHALENE	UG/KG	28 - 30	NA	NA	77.25	29.0 U	38.5	29.0 U	29.0 U	28.67 U	29.0 U	75.5
2-METHYLPHENOL	UG/KG	89 - 93	91.0 U	93.25	90.5 U	91.0 U	91.5 U	90.67 U	91.67 U	91.33 U	91.0 U	91.25 U
2-NITROANILINE	UG/KG	94 - 98	96.0 U	96.0 U	95.5 U	96.0 U	96.5 U	95.67 U	96.67 U	96.0 U	96.0 U	96.25 U
2-NITROPHENOL	UG/KG	98 - 650	100.0 U	100.0 U	99.0 U	99.67 U	99.5 U	99.67 U	100.0 U	99.33 U	99.33 U	237.5 U
3,3'-DICHLOROBENZIDINE	UG/KG	69 - 72	71.0 U	71.0 U	70.5 U	71.0 U	71.0 U	70.67 U	71.67 U	71.33 U	71.33 U	71.0 U
3,4-METHYLPHENOL	UG/KG	98 - 100	192.5	137.5	114.25	99.67 U	735.0	160.0	130.0	176.67	126.0	417.5
3-NITROANILINE	UG/KG	89 - 93	91.0 U	91.0 U	90.5 U	91.0 U	91.5 U	90.67 U	91.67 U	91.33 U	91.0 U	91.25 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	120 - 120	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U	120.0 U
4-CHLORO-3-METHYLPHENOL	UG/KG	94 - 98	96.0 U	96.0 U	95.5 U	96.0 U	96.5 U	95.67 U	96.67 U	96.0 U	96.0 U	96.25 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	130 - 130	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U
4-NITROPHENOL	UG/KG	85 - 89	87.0 U	87.0 U	86.5 U	87.0 U	87.0 U	86.67 U	87.67 U	87.33 U	87.0 U	87.25 U
BENZIDINE	UG/KG	58 - 60	59.0 U	59.0 U	58.75 U	59.0 U	59.5 U	58.67 U	59.67 U	59.0 U	59.33 U	59.0 U
BENZYL ALCOHOL	UG/KG	80 - 84	82.0 U	82.0 U	81.5 U	82.0 U	82.0 U	81.67 U	82.67 U	82.33 U	82.0 U	82.25 U
BENZYL BUTYL PHTHALATE	UG/KG	87 - 91	89.0 U	89.0 U	88.5 U	459.67	89.0 U	88.67 U	89.67 U	89.33 U	89.0 U	89.25 U

TABLE 3-8 (CONTINUED)

ANALYTE	UNIT	DL (RANGE)	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		# STATIONS SAMPLED:	4	4	4	3	2	3	3	3	3	4
BIS(2-CHLOROETHOXY)METHANE	UG/KG	98 - 100	100.0 U	100.0 U	99.0 U	99.67 U	99.5 U	99.67 U	100.0 U	99.33 U	99.33 U	99.5 U
BIS(2-CHLOROETHYL) ETHER	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	92 - 96	**115.5**	94.0 U	93.5 U	**203.0**	94.5 U	**212.67**	94.67 U	94.0 U	94.0 U	**235.5**
CARBAZOLE	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
CYCLOHEXANONE	UG/KG	86 - 90	88.0 U	88.0 U	87.5 U	88.0 U	88.0 U	87.67 U	88.67 U	88.33 U	88.0 U	88.25 U
DI-N-BUTYL PHTHALATE	UG/KG	150 - 150	150.0 U	150.0 U	150.0 U	150.0 U	150.0 U	150.0 U	150.0 U	150.0 U	150.0 U	150.0 U
DI-N-OCTYL PHTHALATE	UG/KG	83 - 87	85.0 U	85.0 U	84.5 U	**223.67**	85.0 U	84.67 U	85.67 U	85.33 U	85.0 U	85.25 U
DIBENZOFURAN	UG/KG	130 - 130	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U	130.0 U
DIETHYL PHTHALATE	UG/KG	86 - 90	88.0 U	88.0 U	87.5 U	88.0 U	88.0 U	87.67 U	88.67 U	88.33 U	88.0 U	88.25 U
DIMETHYL PHTHALATE	UG/KG	82 - 86	84.0 U	84.0 U	83.5 U	84.0 U	84.0 U	83.67 U	84.67 U	84.33 U	84.0 U	84.25 U
HEXACHLORO-1,3-BUTADIENE	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
HEXACHLOROBENZENE	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	93 - 97	95.0 U	95.0 U	94.5 U	95.0 U	95.5 U	94.67 U	95.67 U	95.0 U	95.0 U	95.25 U
HEXACHLOROETHANE	UG/KG	110 - 110	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U	110.0 U
METHANAMINE, N-METHYL-N-NITROSO	UG/KG	84 - 88	86.0 U	86.0 U	85.75 U	86.0 U	86.0 U	85.67 U	86.67 U	86.33 U	86.0 U	86.25 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	97 - 100	99.0 U	99.0 U	98.25 U	99.0 U	99.0 U	98.67 U	99.67 U	99.0 U	99.0 U	99.0 U
N-NITROSODIPHENYLAMINE	UG/KG	85 - 89	87.0 U	87.0 U	86.5 U	87.0 U	87.0 U	86.67 U	87.67 U	87.33 U	87.0 U	87.25 U
NITROBENZENE	UG/KG	98 - 100	100.0 U	100.0 U	99.0 U	99.67 U	99.5 U	99.67 U	100.0 U	99.33 U	99.33 U	99.5 U
P-CHLOROANILINE	UG/KG	83 - 87	85.0 U	85.0 U	84.5 U	85.0 U	85.0 U	84.67 U	85.67 U	85.33 U	85.0 U	85.25 U
P-NITROANILINE	UG/KG	75 - 79	77.0 U	77.0 U	76.5 U	77.0 U	77.0 U	76.67 U	77.67 U	77.33 U	77.0 U	77.25 U
PENTACHLOROPHENOL	UG/KG	140 - 140	140.0 U	140.0 U	140.0 U	140.0 U	140.0 U	140.0 U	140.0 U	140.0 U	140.0 U	140.0 U
PHENOL	UG/KG	87 - 91	89.0 U	89.0 U	88.5 U	89.0 U	**129.0**	88.67 U	89.67 U	89.33 U	89.0 U	89.25 U
PYRIDINE	UG/KG	210 - 210	210.0 U	210.0 U	210.0 U	210.0 U	210.0 U	210.0 U	210.0 U	210.0 U	210.0 U	210.0 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

NA = not analyzed.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-9 MEAN CONCENTRATIONS OF CHLORINATED PESTICIDES IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

ANALYTE	UNIT	DL (RANGE)	104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	4	4	4	3	2	3	3	3	3	4
4,4'-DDD	UG/KG	0.49 - 1.2	**0.63**	0.5 U	**0.78**	0.5 U	0.51 U	**1.27**	0.5 U	0.5 U	0.5 U	0.5 U
4,4'-DDE	UG/KG	0.93 - 2.3	**1.27**	0.96 U	**1.0**	0.95 U	0.96 U	**1.99**	0.96 U	0.96 U	0.96 U	0.96 U
4,4'-DDT	UG/KG	0.64 - 1.6	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.98 U	0.66 U	0.66 U	0.66 U	0.66 U
ALDRIN	UG/KG	0.23 - 0.58	**0.33**	0.24 U	**0.31**	0.24 U	0.24 U	0.35 U	0.24 U	0.24 U	0.24 U	0.24 U
ALPHA-BHC	UG/KG	0.29 - 0.71	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.43 U	0.29 U	0.3 U	0.3 U	0.29 U
BETA-BHC	UG/KG	0.21 - 0.53	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.32 U	0.22 U	0.22 U	0.22 U	0.22 U
CHLORDANE	UG/KG	6.3 - 16	6.4 U	6.4 U	6.38 U	6.37 U	6.4 U	9.63 U	6.43 U	6.43 U	6.43 U	6.42 U
CHLOROBENSIDE	UG/KG	0.65 - 1.6	3.3 U	3.3 U	0.66 U	0.66 U	0.67 U	0.98 U	0.67 U	0.66 U	0.67 U	0.67 U
DACTHAL	UG/KG	0.65 - 1.6	10.0 U	10.0 U	0.66 U	0.66 U	0.67 U	0.98 U	0.67 U	0.66 U	0.67 U	0.67 U
DELTA-BHC	UG/KG	0.18 - 0.44	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.27 U	0.18 U	0.18 U	0.18 U	0.18 U
DIELDRIN	UG/KG	0.43 - 1.1	0.44 U	0.44 U	0.44 U	0.44 U	0.45 U	0.66 U	0.44 U	0.44 U	0.44 U	0.44 U
ENDOSULFAN I	UG/KG	0.25 - 0.63	**0.28**	0.26 U	**0.41**	0.26 U	0.26 U	0.38 U	0.26 U	0.26 U	0.26 U	0.26 U
ENDOSULFAN II	UG/KG	0.42 - 1	0.43 U	0.43 U	0.43 U	0.43 U	0.44 U	0.62 U	0.43 U	0.43 U	0.43 U	0.43 U
ENDOSULFAN SULFATE	UG/KG	0.57 - 1.4	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.85 U	0.58 U	0.59 U	0.58 U	0.58 U
ENDRIN	UG/KG	0.41 - 1	0.42 U	0.5	0.42 U	0.42 U	0.42 U	0.61 U	0.42 U	0.42 U	0.42 U	0.42 U
ENDRIN ALDEHYDE	UG/KG	0.68 - 1.7	**0.81**	**0.91**	**0.71**	0.7 U	0.71 U	1.04 U	0.71 U	0.71 U	0.71 U	0.71 U
GAMMA-BHC	UG/KG	0.23 - 0.58	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.35 U	0.24 U	0.24 U	0.24 U	0.24 U
HEPTACHLOR	UG/KG	0.29 - 0.73	0.3 U	0.3 U	0.31	0.3 U	0.3 U	0.44 U	0.3 U	0.3 U	0.3 U	0.3 U
HEPTACHLOR EPOXIDE	UG/KG	0.21 - 0.51	**1.08**	**0.41**	**1.03**	0.21 U	0.21 U	0.31 U	**0.24**	0.21 U	**0.22**	**0.44**
METHOXYCHLOR	UG/KG	3.1 - 7.8	3.2 U	**3.65**	3.2 U	3.2 U	3.2 U	4.73 U	3.2 U	3.17 U	3.2 U	3.2 U
MIREX	UG/KG	0.65 - 1.6	3.3 U	3.3 U	0.66 U	0.66 U	0.67 U	0.98 U	0.67 U	0.66 U	0.67 U	0.67 U
TOXAPHENE	UG/KG	62 - 150	63.0 U	63.0 U	62.75 U	62.67 U	63.0 U	92.33 U	63.33 U	63.33 U	63.33 U	63.25 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-10 MEAN CONCENTRATIONS OF ORGANOPHOSPHORUS PESTICIDES (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

		REACH ID:	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	4	4	4	3	2	3	3	3	3	4
ANALYTE	UNIT	DL (RANGE)										
AZINPHOS METHYL	UG/KG	33 - 34	33.0 U	33.0 U	33.0 U	33.0 U	33.5 U	33.33 U	33.67 U	33.67 U	33.67 U	33.75 U
DEMETON	UG/KG	33 - 34	33.0 U	33.0 U	33.0 U	33.0 U	33.5 U	33.33 U	33.67 U	33.67 U	33.67 U	33.75 U
ETHYL PARATHION	UG/KG	33 - 34	33.0 U	33.0 U	33.0 U	33.0 U	33.5 U	33.33 U	33.67 U	33.67 U	33.67 U	33.75 U
MALATHION	UG/KG	33 - 34	33.0 U	33.0 U	33.0 U	33.0 U	33.5 U	33.33 U	33.67 U	33.67 U	33.67 U	33.75 U
METHYL PARATHION	UG/KG	33 - 34	33.0 U	33.0 U	33.0 U	33.0 U	33.5 U	33.33 U	33.67 U	33.67 U	33.67 U	33.75 U

TABLE 3-11 MEAN CONCENTRATIONS OF PCB AROCLORS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

		REACH ID:	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	4	4	4	3	2	3	3	3	3	4
ANALYTE	UNIT	DL (RANGE)										
AROCLOR 1016	UG/KG	1.1 - 1.2	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.13 U
AROCLOR 1221	UG/KG	9.8 - 11	10.0 U	10.0 U	9.93 U	9.93 U	9.95 U	9.97 U	10.0 U	9.93 U	9.93 U	10.25 U
AROCLOR 1232	UG/KG	2.9 - 3.3	3.0 U	3.0 U	2.98 U	3.0 U	3.0 U	3.0 U	3.0 U	2.97 U	3.0 U	3.08 U
AROCLOR 1242	UG/KG	0.98 - 1.1	1.0 U	1.0 U	0.99 U	0.99 U	1.0 U	1.0 U	**7.1**	0.99 U	0.99 U	1.02 U
AROCLOR 1248	UG/KG	1.8 - 2	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	**2.53**	1.8 U	1.85 U
AROCLOR 1254	UG/KG	2.5 - 2.9	**4.7**	**3.33**	**3.52**	2.6 U	2.6 U	**7.93**	**12.33**	**5.1**	2.6 U	2.67 U
AROCLOR 1260	UG/KG	1.1 - 1.2	**4.03**	**2.4**	**6.88**	1.1 U	1.1 U	**3.57**	**7.6**	**2.63**	**1.33**	**1.43**

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-12 MEAN CONCENTRATIONS OF PCB CONGENERS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

		REACH ID:	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	1	1	1	0	0	2	3	1	0	0
ANALYTE	UNIT	DL (RANGE)										
BZ# 8*	UG/KG	0.95 - 0.98	0.97 U	0.97 U	0.95 U	NA	NA	0.96 U	0.98 U	0.98 U	NA	NA
BZ# 18*	UG/KG	0.71 - 0.73	0.72 U	0.72 U	0.71 U	NA	NA	0.71 U	0.73 U	0.73 U	NA	NA
BZ# 28*	UG/KG	0.82 - 0.85	0.84 U	0.84 U	0.82 U	NA	NA	0.83 U	0.85 U	0.85 U	NA	NA
BZ# 44*	UG/KG	0.71 - 0.73	0.72 U	0.72 U	0.71 U	NA	NA	0.71 U	0.73 U	0.73 U	NA	NA
BZ# 49	UG/KG	0.95 - 0.98	0.97 U	0.97 U	0.95 U	NA	NA	0.96 U	0.98 U	0.98 U	NA	NA
BZ# 52*	UG/KG	1.3 - 1.3	1.3 U	1.3 U	1.3 U	NA	NA	1.3 U	1.3 U	1.3 U	NA	NA
BZ# 66*	UG/KG	0.87 - 0.9	0.89 U	0.89 U	0.87 U	NA	NA	0.89 U	0.9 U	0.9 U	NA	NA
BZ# 77*	UG/KG	1.8 - 1.8	1.8 U	1.8 U	1.8 U	NA	NA	1.8 U	1.8 U	1.8 U	NA	NA
BZ# 87	UG/KG	0.8 - 0.83	0.82 U	0.82 U	0.8 U	NA	NA	0.81 U	0.83 U	0.83 U	NA	NA
BZ# 101*	UG/KG	0.81 - 0.84	0.83 U	0.83 U	0.81 U	NA	NA	**0.88**	0.84 U	0.84 U	NA	NA
BZ# 105*	UG/KG	0.84 - 0.87	0.86 U	0.86 U	0.84 U	NA	NA	0.85 U	0.87 U	0.87 U	NA	NA
BZ# 118*	UG/KG	0.98 - 1	1.0 U	1.0 U	0.98 U	NA	NA	1.0 U	1.0 U	1.0 U	NA	NA
BZ# 126*	UG/KG	1.3 - 1.3	1.3 U	1.3 U	1.3 U	NA	NA	1.3 U	1.3 U	1.3 U	NA	NA
BZ# 128*	UG/KG	0.98 - 1	1.0 U	1.0 U	0.98 U	NA	NA	1.0 U	1.0 U	1.0 U	NA	NA
BZ# 138*	UG/KG	0.98 - 1	1.0 U	1.0 U	**1.6**	NA	NA	1.0 U	1.0 U	1.0 U	NA	NA
BZ# 153*	UG/KG	0.98 - 4.8	0.99 U	0.99 U	**2.7**	NA	NA	0.98 U	1.0 U	1.0 U	NA	NA
BZ# 156	UG/KG	1.2 - 1.2	1.2 U	1.2 U	1.2 U	NA	NA	1.2 U	1.2 U	1.2 U	NA	NA
BZ# 169*	UG/KG	1.6 - 1.6	1.6 U	1.6 U	1.6 U	NA	NA	1.6 U	1.6 U	1.6 U	NA	NA
BZ# 170*	UG/KG	0.96 - 0.99	0.98 U	0.98 U	**1.0**	NA	NA	0.97 U	0.99 U	0.99 U	NA	NA
BZ# 180*	UG/KG	1.1 - 1.1	1.1 U	1.1 U	**2.1**	NA	NA	1.1 U	1.1 U	1.1 U	NA	NA
BZ# 183	UG/KG	0.62 - 0.64	0.63 U	0.63 U	0.62 U	NA	NA	0.63 U	0.64 U	0.64 U	NA	NA
BZ# 184	UG/KG	0.77 - 0.8	0.79 U	0.79 U	0.77 U	NA	NA	0.79 U	0.8 U	0.8 U	NA	NA
BZ# 187*	UG/KG	0.76 - 0.79	0.78 U	0.78 U	**1.4**	NA	NA	0.78 U	0.79 U	0.79 U	NA	NA
BZ# 195	UG/KG	1.2 - 1.2	1.2 U	1.2 U	1.2 U	NA	NA	1.2 U	1.2 U	1.2 U	NA	NA
BZ# 206	UG/KG	1.2 - 1.2	1.2 U	1.2 U	1.2 U	NA	NA	1.2 U	**1.27**	1.2 U	NA	NA
BZ# 209	UG/KG	0.98 - 1	NA	NA	0.98 U	NA	NA	**1.25**	**1.47**	1.0 U	NA	NA
TOTAL PCB (ND=0)**	UG/KG	-	0.0	0.0	17.6	NA	NA	0.9	0.0	0.0	NA	NA
TOTAL PCB (ND=1/2DL)**	UG/KG	-	18.7	18.7	31.3	NA	NA	19.13	18.7	18.8	NA	NA
TOTAL PCB (ND=DL)	UG/KG	-	37.4	37.4	44.9	NA	NA	37.3	37.5	37.6	NA	NA

U = not detected in any sample within reach; value represents mean detection limit (DL).

* = PCB congeners used for total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998). Total multipled by a factor of 2 as per NOAA 1993.

** = Note that the mean of total PCBs for individual samples is not equivalent to the sum of mean individual PCBs for ND=0 and ND=1/2DL.

NA = not analyzed.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-13 MEAN CONCENTRATIONS OF PAHs (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

ANALYTE	UNIT	DL (RANGE)	I Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		SAMPLE SIZE (N):	4	4	4	3	2	3	3	3	3	4
ACENAPHTHENE	UG/KG	16 - 16	16.0 U	16.0 U	**73.5**	16.0 U	**20.5**	16.0 U	16.0 U	16.0 U	16.0 U	**65.5**
ACENAPHTHYLENE	UG/KG	35 - 45	**40.0**	35.75 U	37.75 U	36.0 U	36.5 U	35.67 U	36.0 U	35.67 U	36.0 U	36.0 U
ANTHRACENE	UG/KG	0.86 - 0.9	**27.82**	**2.91**	**20.23**	**1.52**	**5.75**	**2.53**	**2.53**	**3.4**	**2.86**	**14.0**
BENZ[A]ANTHRACENE	UG/KG	0.79 - 0.83	**36.95**	**7.6**	**32.67**	**1.44**	**12.75**	**5.9**	**8.4**	**8.33**	**5.43**	**24.9**
BENZO[A]PYRENE	UG/KG	0.76 - 2.8	**42.2**	**11.88**	**47.0**	1.45 U	**16.0**	**5.97**	**9.33**	**9.8**	**5.5**	**34.52**
BENZO[B]FLUORANTHENE	UG/KG	1.7 - 1.7	**73.33**	**15.43**	**104.0**	**9.43**	**29.5**	**13.83**	**13.33**	**12.33**	**9.7**	**105.0**
BENZO[G,H,I]PERYLENE	UG/KG	1.9 - 1.9	**27.65**	**9.4**	**36.2**	1.9 U	**11.95**	**3.4**	**5.83**	**6.03**	**3.33**	**31.5**
BENZO[K]FLUORANTHENE	UG/KG	0.81 - 0.85	**19.0**	**5.23**	**19.55**	**0.92**	**8.5**	**3.0**	**4.37**	**4.6**	**2.43**	**16.18**
CHRYSENE	UG/KG	1.1 - 1.1	**65.67**	**13.38**	**25.82**	**1.7**	**10.75**	**5.3**	**7.0**	**6.87**	**5.97**	**34.53**
DIBENZ[A,H]ANTHRACENE	UG/KG	1.9 - 1.9	**5.13**	**2.6**	**3.58**	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**2.78**
FLUORANTHENE	UG/KG	2.8 - 3	**95.9**	**15.82**	**79.75**	**4.1**	**33.0**	**11.33**	**15.33**	**15.0**	**11.3**	**66.45**
FLUORENE	UG/KG	3.5 - 3.7	**115.55**	**10.15**	**99.25**	3.6 U	**21.35**	**8.37**	**6.73**	**10.17**	**12.53**	**84.4**
INDENO[1,2,3-CD]PYRENE	UG/KG	1.7 - 1.7	**20.6**	**7.45**	**22.35**	**2.13**	**9.15**	**4.07**	**5.67**	**6.77**	1.7 U	**22.13**
NAPHTHALENE	UG/KG	17 - 17	**79.0**	**18.75**	**93.0**	17.0 U	**37.0**	**19.33**	**22.67**	**20.0**	**19.0**	**65.25**
PHENANTHRENE	UG/KG	0.68 - 0.82	**87.13**	**10.3**	**57.25**	**2.24**	**23.0**	**8.47**	**9.77**	**8.97**	**7.53**	**48.9**
PYRENE	UG/KG	0.83 - 0.87	**102.5**	**16.1**	**72.5**	**1.93**	**21.5**	**6.27**	**9.43**	**9.13**	**9.53**	**63.17**
TOTAL PAH (ND=0)*	UG/KG		807	129	782	18.3	251	83.8	112	109	82	665
TOTAL PAH (ND=1/2DL)*	UG/KG	-	830.56	164.11	803.05	60.79	274.98	117.55	143.16	141.93	116.20	690.03
TOTAL PAH (ND=DL)	UG/KG	-	854.42	198.75	824.40	103.25	299.10	151.33	174.30	174.97	150.73	715.20

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

* = Note that the mean of total PAHs for individual samples is not equivalent to the sum of mean individual PAHs for ND=0 and ND=1/2DL.

TABLE 3-14 MEAN CONCENTRATIONS OF METALS (MG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

REACH ID:			Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
SAMPLE TYPE:			Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
SAMPLE SIZE (N):			4	4	4	3	2	3	3	3	3	4
ANALYTE	**UNIT**	**DL (RANGE)**										
ALUMINUM	MG/KG	5.5 - 127	12245.0	13425.0	26250.0	9146.67	10725.0	12583.33	17033.33	18766.67	18400.0	20000.0
ANTIMONY	MG/KG	0.09 - 0.11	3.96	0.96	1.26	0.62	1.02	0.85	1.0	1.02	0.93	0.79
ARSENIC	MG/KG	0.2 - 0.22	42.38	13.38	14.03	6.67	13.55	12.87	11.63	12.67	10.63	11.85
BERYLLIUM	MG/KG	0.02 - 0.02	1.28	1.33	1.77	0.72	1.25	1.09	1.4	1.6	1.43	1.88
CADMIUM	MG/KG	0.06 - 0.67	15.13	8.73	0.62 U	0.06 U	0.3 U	0.08 U	0.3 U	0.3 U	0.61 U	0.46 U
CHROMIUM	MG/KG	0.39 - 0.45	68.3	37.52	41.92	18.1	37.25	34.13	45.77	51.73	33.83	33.05
COPPER	MG/KG	0.2 - 0.22	135.07	38.22	45.27	20.17	37.75	34.87	38.5	45.17	37.23	44.95
IRON	MG/KG	5.1 - 520	58175.0	34625.0	56425.0	27980.0	34600.0	33533.33	33566.67	39166.67	36166.67	42100.0
LEAD	MG/KG	0.09 - 0.11	246.82	42.83	56.4	16.9	47.05	40.0	47.2	57.33	39.6	40.2
MANGANESE	MG/KG	0.78 - 8	894.0	2037.5	1095.0	548.67	1050.0	1014.0	3096.67	3756.67	1090.0	1006.0
MERCURY	MG/KG	0.04 - 0.05	1.14	0.23	0.23	0.05 U	0.17	0.2	0.24	0.26	0.15	0.18
NICKEL	MG/KG	0.49 - 0.56	36.52	40.63	56.43	19.97	36.75	31.93	42.23	50.07	39.57	53.73
SELENIUM	MG/KG	0.2 - 0.22	4.95	1.75	1.83	0.2 U	1.4	0.8	0.92	1.01	0.87	0.69
SILVER	MG/KG	0.09 - 0.11	NA	NA	1.05	0.1 U	0.34	0.1 U	0.19	0.27	0.74	0.48
THALLIUM	MG/KG	0.08 - 0.55	0.16	0.15 U	0.14	0.15	0.11	0.17	0.11	0.15	0.13	0.23
ZINC	MG/KG	1.2 - 1.3	640.25	228.25	279.0	99.73	233.0	183.0	235.0	260.33	198.33	206.43

U = not detected in any sample within reach; value represents mean detection limit (DL).

NA = not analyzed.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 3-15 CONCENTRATIONS OF BUTYLTINS* (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS (1998) AND SITE 104 (1997)

REACH ID:			Inside Site 104	Outside Site 104	Brewerston Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
SAMPLE TYPE:			Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
SAMPLE SIZE (N):			0	0	1	1	1	1	1	1	1	1
ANALYTE	**UNIT**	**DL**										
MONOBUTYLTIN	UG/KG	2.05	NA	NA	2.05 U	2.05 U	2.05 U	2.05 U	2.05 U	2.05 U	2.05 U	2.05 U
DIBUTYLTIN	UG/KG	3.11	NA	NA	3.11 U	**3.63**	**3.4**	3.11 U	**5.03**	3.11 U	3.11 U	3.11 U
TRIBUTYLTIN	UG/KG	1.88	NA	NA	**2.09**	**7.07**	**5.05**	1.88 U	**7.65**	**3.12**	**3.68**	**94.27**

U = not detected.

* = Butyltin analyzed only at one location within each channel reach.

NA = not analyzed.

NOTE: Shaded and bolded values represent detected concentrations.

TABLE 3-16 MEAN CONCENTRATIONS OF ANALYTES IN SEDIMENTS EXCEEDING TELs (1997-1998)

ANALYTE	UNIT	TEL VALUE	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
ARSENIC	MG/KG	7.24	42.38	13.38	14.03		13.55	12.87	11.63	12.67	10.63	11.85
CADMIUM	MG/KG	0.676	15.13	8.73								
CHROMIUM	MG/KG	52.3	68.30									
COPPER	MG/KG	18.7	135.08	38.23	45.28	20.17	37.75	34.87	38.50	45.17	37.23	44.95
LEAD	MG/KG	30.24	246.83	42.83	56.40		47.05	40.0	47.20	57.33	39.60	40.20
MERCURY	MG/KG	0.13	1.14	0.23	0.23		0.18	0.20	0.24	0.26	0.15	0.18
NICKEL	MG/KG	15.9	36.53	40.63	56.43	19.97	36.75	31.93	42.23	50.07	39.57	53.73
SILVER	MG/KG	0.73			1.05						0.74	
ZINC	MG/KG	124	640.25	228.25	279.0		233.0	183.0	235.0	260.33	198.33	206.43
ACENAPHTHENE	UG/KG	6.71	16.0 U	16.0 U	73.5	16.0 U	20.5	16.0 U	16.0U	16.0 U	16.0 U	65.5
ACENAPHTHYLENE	UG/KG	5.87	40.0	35.75 U	37.75 U	36.0U	36.5U	35.67 U	36.67U	36.67 U	36.0 U	36.0 U
ANTHRACENE	UG/KG	46.85										
BENZ[A]ANTHRACENE	UG/KG	74.83										
BENZO[A]PYRENE	UG/KG	88.81										
CHRYSENE	UG/KG	107.77										
DIBENZ[A,H]ANTHRACENE	UG/KG	6.22										
FLUORANTHENE	UG/KG	112.82										
FLUORENE	UG/KG	21.17	115.55		99.25		21.35					84.40
NAPHTHALENE	UG/KG	34.57	79.0		93.0		37.0					65.25
PHENANTHRENE	UG/KG	86.68	87.13									
PYRENE	UG/KG	152.66										
TOTAL PAH (ND=0)	UG/KG	1684.06										
TOTAL PAH (ND=1/2DL)	UG/KG	1684.06										
TOTAL PAH (ND=DL)	UG/KG	1684.06										
4,4'-DDD	UG/KG	1.22						1.27				
4,4'-DDE	UG/KG	2.07										
4,4'-DDT	UG/KG	1.19										
CHLORDANE	UG/KG	2.26	6.40 U	6.40 U	6.40 U	6.40 U	6.40 U	9.60 U	6.40 U	6.40 U	6.40 U	6.40 U
DIELDRIN	UG/KG	0.715										
GAMMA-BHC	UG/KG	0.32						0.35				
TOTAL PCB (ND=0)	UG/KG	21.55										
TOTAL PCB (ND=1/2DL)	UG/KG	21.55			31.27							
TOTAL PCB (ND=DL)	UG/KG	21.55	37.36 U	37.36 U	44.94			37.33	37.49	37.56 U		
2-METHYLNAPHTHALENE	UG/KG	20.21			77.25	29.0 U	38.5	29.0 U	29.0 U	28.67 U	29.0 U	75.5
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	182.16				203.0		212.67				235.50

U = not detected; mean detection limit exceeds TEL value.

Blank cells indicate that mean concentration detected in sediment did not exceed TEL.

TABLE 3-17 MEAN CONCENTRATIONS OF ANALYTES IN SEDIMENT EXCEEDING PELs (1997-1998)

ANALYTE	UNIT	PEL VALUE	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
ARSENIC	MG/KG	41.6	42.38									
CADMIUM	MG/KG	4.21	15.13	8.73								
CHROMIUM	MG/KG	160.4										
COPPER	MG/KG	108.2	135.08									
LEAD	MG/KG	112.18	246.83									
MERCURY	MG/KG	0.696	1.14									
NICKEL	MG/KG	42.8			56.43					50.07		53.73
SILVER	MG/KG	1.7										
ZINC	MG/KG	271	640.25		279.0							
ACENAPHTHENE	UG/KG	88.9										
ACENAPHTHYLENE	UG/KG	127.87										
ANTHRACENE	UG/KG	245										
BENZ[A]ANTHRACENE	UG/KG	692.53										
BENZO[A]PYRENE	UG/KG	763.22										
CHRYSENE	UG/KG	845.98										
DIBENZ[A,H]ANTHRACENE	UG/KG	134.61										
FLUORANTHENE	UG/KG	1493.54										
FLUORENE	UG/KG	144.35										
NAPHTHALENE	UG/KG	390.64										
PHENANTHRENE	UG/KG	543.53										
PYRENE	UG/KG	1397.6										
TOTAL PAH (ND=0)	UG/KG	16770.4										
TOTAL PAH (ND=1/2DL)	UG/KG	16770.4										
TOTAL PAH (ND=DL)	UG/KG	16770.4										
4,4'-DDD	UG/KG	7.81										
4,4'-DDE	UG/KG	374.17										
4,4'-DDT	UG/KG	4.77										
CHLORDANE	UG/KG	4.79	6.40 U	6.40 U	6.40 U	6.40 U	6.40 U	9.63 U	6.40 U	6.40 U	6.40 U	6.40 U
DIELDRIN	UG/KG	4.3										
GAMMA-BHC	UG/KG	0.99										
TOTAL PCB (ND=0)	UG/KG	188.79										
TOTAL PCB (ND=1/2DL)	UG/KG	188.79										
TOTAL PCB (ND=DL)	UG/KG	188.79										
2-METHYLNAPHTHALENE	UG/KG	201.28										
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2646.51										

U = not detected; detection limit exceeds PEL value.

Blank cells indicate that mean concentration detected in sediment did not exceed PEL.

TABLE 3-18 FREQUENCY OF DETECTION [a] BY ANALYTICAL FRACTION FOR SEDIMENTS FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, AND OUTSIDE SITE 104 (1997-1998)

	DETECTION FREQUENCY			PERCENT DETECT		
ANALYTICAL FRACTION	**Approach Channels [b]**	**Inside Site 104**	**Outside Site 104**	**Approach Channels [b]**	**Inside Site 104**	**Outside Site 104**
VOCs	20/850	0/136	0/136	2.4%	0%	0%
SVOCs	28/1275	2/208	2/208	2.1%	1%	1%
Chlorinated Pesticides	20/550	7/88	4/88	3.6%	8%	4.5%
Organophosphorus Pesticides	0/145	0/20	0/20	0%	0%	0%
PCB Aroclors	27/174	3/28	2/28	15.4%	11%	7%
PCB Congeners	11/182	0/25	0/25	6%	0%	0%
PAHs	282/400	55/64	43/64	71%	86%	67.2%
Metals	337/400	57/60	56/60	84%	95%	93%
Butyltins	9/24	NT	NT	37.5%	NT	NT
TOTAL	734/4000	124/629	107/629	18.4%	19.7%	17.0%

(a) = total number of detected analytes / total number of analytical tests.

(b) = combined total for all approach channels.

NT = not tested

TABLE 3-19 NUMBER OF MEAN CONCENTRATIONS IN TARGET ANALYTE FRACTIONS IN SEDIMENTS THAT EXCEED TELs (1997-1998)

ANALYTE	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
METALS	8	7	7	2	6	6	6	6	7	6
PAHs	5	2	4	2	4	2	2	2	2	4
PESTICIDES	1	1	1	1	1	3	1	1	1	1
TOTAL PCBs (ND=DL)	0	0	1	0	0	0	0	0	0	0
SEMIVOLATILE ORGANIC COMPOUNDS	0	0	1	2	1	2	1	1	1	2
TOTAL # OF TEL EXCEEDANCES	14	10	14	7	12	13	10	10	11	13

TABLE 3-20 NUMBER OF MEAN CONCENTRATIONS IN TARGET ANALYTE FRACTIONS IN SEDIMENTS THAT EXCEED PELs (1997-1998)

ANALYTE	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	Craighill Channel	Craighill Angle	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel
METALS	6	1	2	0	0	0	0	1	0	1
PAHs	0	0	0	0	0	0	0	0	0	0
PESTICIDES	1	1	1	1	1	1	1	1	1	1
PCBs, TOTAL	0	0	0	0	0	0	0	0	0	0
SEMIVOLATILE ORGANIC COMPOUNDS	0	0	0	0	0	0	0	0	0	0
TOTAL # OF PEL EXCEEDANCES	7	2	3	1	1	1	1	2	1	2

TABLE 3-21 CONCENTRATIONS OF INORGANIC NON-METALS (MG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
		REACH ID:						
CHROMIUM (HEXAVALENT)	MG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
CYANIDE	MG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
NITROGEN, AMMONIA	MG/L	0.1	**6.3**	**8.8**	**1.7**	**5.8**	**7**	**3.3**
NITROGEN, NITRATE AND NITRITE	MG/L	0.05	**0.13**	**0.07**	0.05U	**0.09**	**0.07**	**0.14**
NITROGEN, TOTAL KJELDAHL	MG/L	0.25	**0.26**	**7.3**	**1.9**	**2.2**	0.25U	**1.7**
OXYGEN DEMAND, BIOCHEMICAL	MG/L	1	**4**	**4.6**	**5.3**	**6.8**	**4.8**	**4.1**
OXYGEN DEMAND, CHEMICAL	MG/L	10	**99.5**	**124**	**113**	**384**	**102**	**137**
PHOSPHORUS, TOTAL	MG/L	0.05	**0.09**	**0.38**	**0.21**	**0.24**	**0.31**	0.05U
SULFIDE, TOTAL	MG/L	1	2U	2U	2U	2U	1U	1U
TOTAL ORGANIC CARBON	MG/L	1	**1.8**	1U	1U	1U	**1.2**	**1.6**

U = not detected.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-22 CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
1,1,1-TRICHLOROETHANE	UG/L	2	2U	2U	2U	2U	2U	2U
1,1,2,2-TETRACHLOROETHANE	UG/L	0.9	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U
1,1,2-TRICHLOROETHANE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,1-DICHLOROETHANE	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
1,1-DICHLOROETHYLENE	UG/L	1	1U	1U	1U	1U	1U	1U
1,2-DICHLOROBENZENE	UG/L	2	2U	2U	2U	2U	2U	2U
1,2-DICHLOROETHANE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
1,2-DICHLOROPROPANE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,4-DICHLOROBENZENE	UG/L	3	3U	3U	3U	3U	3U	3U
2-CHLOROETHYL VINYL ETHER	UG/L	2	2U	2U	2U	2U	2U	2U
ACROLEIN	UG/L	18	18U	18U	18U	18U	18U	18U
ACRYLONITRILE	UG/L	12	12U	12U	12U	12U	12U	12U
BENZENE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
BROMODICHLOROMETHANE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
BROMOMETHANE	UG/L	2	2U	2U	2U	2U	2U	2U
CARBON DISULFIDE	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
CARBON TETRACHLORIDE	UG/L	1	1U	1U	1U	1U	1U	1U
CFC-11	UG/L	2	2U	2U	2U	2U	2U	2U
CFC-12	UG/L	1	1U	1U	1U	1U	1U	1U
CHLOROBENZENE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
CHLORODIBROMOMETHANE	UG/L	4	4U	4U	4U	4U	4U	4U
CHLOROETHANE	UG/L	2	2U	2U	2U	2U	2U	2U
CHLOROFORM	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
CHLOROMETHANE	UG/L	1	1U	1U	1U	1U	1U	1U
CIS-1,3-DICHLOROPROPENE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
DICHLOROMETHANE	UG/L	0.7	**27**	0.7U	**6**	0.7U	**8**	**6**
ETHYLBENZENE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
M-DICHLOROBENZENE	UG/L	3	3U	3U	3U	3U	3U	3U
METHYLBENZENE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
TETRACHLOROETHENE	UG/L	0.6	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U
TRANS-1,2-DICHLOROETHENE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
TRIBOMOMETHANE	UG/L	0.4	0.4U	0.4U	0.4U	0.4U	0.4U	0.4U
TRICHLOROETHYLENE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
VINYL CHLORIDE	UG/L	0.9	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U

U = not detected.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-23 CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
		REACH ID:						
1,2,4-TRICHLOROBENZENE	UG/L	3	3U	3U	3U	3U	3U	3U
1,2-DIPHENYLHYDRAZINE	UG/L	5	5U	5U	5U	5U	5U	5U
1-METHYLNAPHTHALENE	UG/L	5	5U	5U	5U	5U	5U	10U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/L	4	4U	4U	4U	4U	4U	4U
2,4,5-TRICHLOROPHENOL	UG/L	3	3U	3U	3U	3U	3U	3U
2,4,6-TRICHLOROPHENOL	UG/L	3	3U	3U	3U	3U	3U	3U
2,4-DICHLOROPHENOL	UG/L	3	3U	3U	3U	3U	3U	3U
2,4-DIMETHYLPHENOL	UG/L	3	3U	3U	3U	3U	3U	3U
2,4-DINITROPHENOL	UG/L	6	6U	6U	6U	6U	6U	6U
2,4-DINITROTOLUENE	UG/L	4	4U	4U	4U	4U	4U	4U
2,6-DINITROTOLUENE	UG/L	4	4U	4U	4U	4U	4U	4U
2-CHLORONAPHTHALENE	UG/L	3	3U	3U	3U	3U	3U	3U
2-CHLOROPHENOL	UG/L	3	3U	3U	3U	3U	3U	3U
2-METHYL-4,6-DINITROPHENOL	UG/L	6	6U	6U	6U	6U	6U	6U
2-METHYLNAPHTHALENE	UG/L	3	3U	3U	3U	3U	3U	3U
2-METHYLPHENOL	UG/L	4	4U	4U	4U	4U	4U	4U
2-NITROANILINE	UG/L	5	5U	5U	5U	5U	5U	5U
2-NITROPHENOL	UG/L	3	3U	3U	3U	3U	3U	3U
3,3'-DICHLOROBENZIDINE	UG/L	4	4U	4U	4U	4U	4U	4U
3,4-METHYLPHENOL	UG/L	4	4U	4U	4U	4U	4U	4U
3-NITROANILINE	UG/L	4	4U	4U	4U	4U	4U	4U
4-BROMOPHENYL PHENYL ETHER	UG/L	5	5U	5U	5U	5U	5U	5U
4-CHLORO-3-METHYLPHENOL	UG/L	4	4U	4U	4U	4U	4U	4U
4-CHLOROPHENYL PHENYL ETHER	UG/L	4	4U	4U	4U	4U	4U	4U
4-NITROPHENOL	UG/L	5	5U	5U	5U	5U	5U	5U
BENZIDINE	UG/L	18	18U	18U	18U	18U	18U	18U
BENZYL ALCOHOL	UG/L	4	4U	4U	4U	4U	4U	4U
BENZYL BUTYL PHTHALATE	UG/L	4	4U	4U	4U	4U	4U	4U
BIS(2-CHLOROETHOXY)METHANE	UG/L	4	4U	4U	4U	4U	4U	4U
BIS(2-CHLOROETHYL) ETHER	UG/L	4	4U	4U	4U	4U	4U	4U

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TABLE 3-23 (CONTINUED)

ANALYTE	UNIT	DL	REACH ID: Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	7	7U	7U	7U	7U	7U	7U
CARBAZOLE	UG/L	5	5U	5U	5U	5U	5U	5U
CYCLOHEXANONE	UG/L	5	5U	5U	5U	5U	5U	5U
DI-N-BUTYL PHTHALATE	UG/L	4	4U	4U	4U	4U	4U	4U
DI-N-OCTYL PHTHALATE	UG/L	4	4U	4U	4U	4U	4U	4U
DIBENZOFURAN	UG/L	4	4U	4U	4U	4U	4U	4U
DIETHYL PHTHALATE	UG/L	3	3U	3U	3U	3U	3U	3U
DIMETHYL PHTHALATE	UG/L	3	3U	3U	3U	3U	3U	3U
HEXACHLORO-1,3-BUTADIENE	UG/L	4	4U	4U	4U	4U	4U	4U
HEXACHLOROBENZENE	UG/L	6	6U	6U	6U	6U	6U	6U
HEXACHLOROCYCLOPENTADIENE	UG/L	2	2U	2U	2U	2U	2U	2U
HEXACHLOROETHANE	UG/L	3	3U	3U	3U	3U	3U	3U
METHANAMINE, N-METHYL-N-NITROSO	UG/L	4	4U	4U	4U	4U	4U	4U
N-NITROSODI-N-PROPYLAMINE	UG/L	4	4U	4U	4U	4U	4U	4U
N-NITROSODIPHENYLAMINE	UG/L	4	4U	4U	4U	4U	4U	4U
NITROBENZENE	UG/L	4	4U	4U	4U	4U	4U	4U
P-CHLOROANILINE	UG/L	5	5U	5U	5U	5U	5U	5U
P-NITROANILINE	UG/L	4	4U	4U	4U	4U	4U	4U
PENTACHLOROPHENOL	UG/L	5	5U	5U	5U	5U	5U	5U
PHENOL	UG/L	4	4U	4U	4U	4U	4U	4U
PYRIDINE	UG/L	4	4U	4U	4U	4U	4U	4U

U = not detected.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-24 CONCENTRATIONS OF CHLORINATED PESTICIDES (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	REACH ID: Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
4,4'-DDD	UG/L	0.002	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U
4,4'-DDE	UG/L	0.004	0.004U	0.004U	0.004U	0.004U	0.004U	0.004U
4,4'-DDT	UG/L	0.003	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U
ALDRIN	UG/L	0.009	0.00899U	0.00899U	0.00899U	0.00899U	0.00899U	0.00899U
ALPHA-BHC	UG/L	0.001	0.001U	**0.0034J**	**0.0042J**	**0.0061J**	**0.0051J**	**0.0094J**
BETA-BHC	UG/L	0.001	**0.0037B**	0.001UJ	**0.0047B**	**0.0025B**	**0.0049J**	**0.0046B**
CHLORDANE	UG/L	0.04	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U
CHLORBENSIDE	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	**0.02**	**0.03**
DACTHAL	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
DELTA-BHC	UG/L	0.001	0.001U	**0.0011J**	0.001U	0.001U	0.001U	0.001U
DIELDRIN	UG/L	0.003	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U
ENDOSULFAN I	UG/L	0.001	**0.0063J**	0.001UJ	0.001UJ	0.001UJ	**0.0077J**	**0.0067J**
ENDOSULFAN II	UG/L	0.004	0.004U	0.004U	0.004U	0.004U	0.004U	0.004U
ENDOSULFAN SULFATE	UG/L	0.004	0.004U	0.004U	0.004U	0.004U	0.004U	0.004U
ENDRIN	UG/L	0.003	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U
ENDRIN ALDEHYDE	UG/L	0.006	0.006U	0.006U	0.006U	0.006U	0.006U	0.006U
GAMMA-BHC	UG/L	0.001	0.001U	0.001U	0.001U	**0.0027B**	0.001U	**0.01B**
HEPTACHLOR	UG/L	0.006	**0.00869B**	**0.01B**	**0.01B**	**0.02B**	**0.02B**	**0.02B**
HEPTACHLOR EPOXIDE	UG/L	0.001	**0.0071B**	**0.0067B**	**0.0027B**	**0.0076B**	**0.0042B**	**0.0031B**
METHOXYCHLOR	UG/L	0.009	0.00899U	0.00899U	0.00899U	0.00899U	0.00899U	0.00899U
MIREX	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
TOXAPHENE	UG/L	0.47	0.47U	0.47U	0.47U	0.47U	0.47U	0.47U

U = not detected. **B** = found in blank. **J** = estimated value.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-25 CONCENTRATIONS OF ORGANOPHOSPHORUS PESTICIDES (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	REACH ID: Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
AZINPHOS METHYL	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
DEMETON	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
ETHYL PARATHION	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
MALATHION	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
METHYL PARATHION	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U

U = not detected.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-26 CONCENTRATIONS OF PCB AROCLORS (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

		REACH ID:	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
ANALYTE	**UNIT**	**DL**						
AROCLOR 1016	UG/L	0.12	0.12U	0.12U	0.12U	0.12U	0.12U	0.12U
AROCLOR 1221	UG/L	0.12	0.12U	0.12U	0.12U	0.12U	0.12U	0.12U
AROCLOR 1232	UG/L	0.15	0.15U	0.15U	0.15U	0.15U	0.15U	0.15U
AROCLOR 1242	UG/L	0.11	0.11U	0.11U	0.11U	0.11U	0.11U	0.11U
AROCLOR 1248	UG/L	0.11	0.11U	0.11U	0.11U	0.11U	0.11U	0.11U
AROCLOR 1254	UG/L	0.14	0.14U	0.14U	0.14U	0.14U	0.14U	0.14U
AROCLOR 1260	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U

U = not detected. **B** = found in blank. **J** = estimated value.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-27 CONCENTRATIONS OF PAHs (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	REACH ID: Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
ACENAPHTHENE	UG/L	3	3U	3U	3U	3U	3U	3U
ACENAPHTHYLENE	UG/L	4	4U	4U	4U	4U	4U	4U
ANTHRACENE	UG/L	4	4U	4U	4U	4U	4U	4U
BENZ[A]ANTHRACENE	UG/L	3	3U	3U	3U	3U	3U	3U
BENZO[A]PYRENE	UG/L	4	4U	4U	4U	4U	4U	4U
BENZO[B]FLUORANTHENE	UG/L	4	4U	4U	4U	4U	4U	4U
BENZO[G,H,I]PERYLENE	UG/L	5	5U	5U	5U	5U	5U	5U
BENZO[K]FLUORANTHENE	UG/L	3	3U	3U	3U	3U	3U	3U
CHRYSENE	UG/L	3	3U	3U	3U	3U	3U	3U
DIBENZ[A,H]ANTHRACENE	UG/L	4	4U	4U	4U	4U	4U	4U
FLUORANTHENE	UG/L	5	5U	5U	5U	5U	5U	5U
FLUORENE	UG/L	4	4U	4U	4U	4U	4U	4U
INDENO[1,2,3-CD]PYRENE	UG/L	4	4U	4U	4U	4U	4U	4U
NAPHTHALENE	UG/L	3	3U	3U	3U	3U	3U	3U
PHENANTHRENE	UG/L	5	5U	5U	5U	5U	5U	5U
PYRENE	UG/L	4	4U	4U	4U	4U	4U	4U
TOTAL PAH (ND=0)**	UG/L	-	0	0	0	0	0	0
TOTAL PAH (ND=1/2DL)**	UG/L	-	31	31	31	31	31	31
TOTAL PAH (ND=DL)	UG/L	-	62	62	62	62	62	62

U = not detected.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

** = Note that the mean of total PAHs for individual samples is not equivalent to the sum of mean individual PAHs for ND=0 and ND=1/2DL.

TABLE 3-28 CONCENTRATIONS OF METALS (UG/L) IN ELUTRIATES* FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTE	UNIT	DL	REACH ID: Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
ALUMINUM	UG/L	56	**145J**	**153J**	**176J**	**168J**	**183J**	**162J**
ANTIMONY	UG/L	1	**4.2B**	**4B**	**2.2B**	**3.2B**	**3.9B**	**4B**
ARSENIC	UG/L	2	**13.1**	**21.7**	**7.4J**	**17.8**	**23**	**9.8J**
BERYLLIUM	UG/L	0.2	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
CADMIUM	UG/L	0.6	0.6UJ	0.6UJ	0.6UJ	0.6UJ	0.6UJ	0.6UJ
CHROMIUM	UG/L	0.7	**1.9B**	**45B**	0.7UE	0.7UE	**1.8B**	**1.7B**
COPPER	UG/L	2	2U	2U	2U	2U	2U	2U
IRON	UG/L	52	52U	**1000B**	52U	**684B**	52U	52U
LEAD	UG/L	1	1U	1U	1U	1U	1U	1U
MANGANESE	UG/L	8	**8260J**	**7180E**	**746J**	**6980J**	**11200J**	**6850J**
MERCURY	UG/L	0.1	0.1U	**0.82J**	**0.97B**	**0.12B**	0.1U	0.1U
NICKEL	UG/L	2	2U	**20.2B**	2UJ	2UJ	2U	2UJ
SELENIUM	UG/L	2	**5.1B**	**3.9B**	2U	**2.7B**	**7.2B**	**3B**
SILVER	UG/L	1	**1.6B**	1U	1U	**2.1B**	**1.6B**	**2.1B**
THALLIUM	UG/L	1	10UJ	1UJ	1UJ	1UJ	20UJ	10UJ
ZINC	UG/L	12	12U	12U	12U	12U	12U	12U

U = not detected. **B** = value <RL but >IDL/MDL. **E** = amount detected is > Method Calibration Limit. **J** = estimated value.

DL = detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

* = Results from one elutriate sample per reach.

TABLE 3-29 FREQUENCY OF DETECTION [a][b] BY ANALYTICAL FRACTION FOR ELUTRIATES FROM BALTIMORE HARBOR APPROACH CHANNELS (1998)

ANALYTICAL FRACTION	FREQUENCY	PERCENT DETECT
VOCs	4/210	2%
SVOCs	0/324	0%
Chlorinated Pesticides	30/132	22.7%
Organophosphorus Pesticides	0/30	0%
PCB Aroclors	0/42	0%
PCB Congeners	NT	NT
PAHs	0/90	0%
Metals	43/96	45%
Butyltins	NT	NT
TOTAL	77/924	8.3%

(a) = total number of detected analytes / total number of analytical tests.

(b) = combined total for all approach channels.

NT = not tested

TABLE 3-30A CONCENTRATIONS OF DETECTED ANALYTES IN ELUTRIATES EXCEEDING USEPA ACUTE SALTWATER CRITERIA - 1998 CHANNEL DATA

ANALYTE	UNIT	EPA SALTWATER ACUTE	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
Non-Metals								
NITROGEN, AMMONIA	MG/L	43						
VOCs								
DICHLOROMETHANE	UG/L	a						
Pesticides								
ALPHA-BHC	UG/L	a						
BETA-BHC	UG/L	a						
ENDOSULFAN I	UG/L	0.034						
GAMMA-BHC	UG/L	0.16						
HEPTACHLOR	UG/L	0.053						
HEPTACHLOR EPOXIDE	UG/L	0.053						
Metals								
ANTIMONY	UG/L	a						
ARSENIC	UG/L	69						
CHROMIUM	UG/L	1100						
MANGANESE	UG/L	a						
MERCURY	UG/L	1.8						
NICKEL	UG/L	74						
SELENIUM	UG/L	290						
SILVER	UG/L	1.9				2.1		2.1

a = no USEPA acute saltwater criterion.

Acute criteria based on 1-hour average exposure concentrations.
Comparisons to criteria for detected concentrations only.

TABLE 3-30B MIXING FACTORS REQUIRED TO COMPLY WITH USEPA ACUTE SALTWATER CRITERIA - 1998 CHANNEL DATA

ANALYTE	UNIT	EPA SALTWATER ACUTE	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
Non-Metals								
NITROGEN, AMMONIA	MG/L	43						
VOCs								
DICHLOROMETHANE	UG/L	a						
Pesticides								
ALPHA-BHC	UG/L	a						
BETA-BHC	UG/L	a						
ENDOSULFAN I	UG/L	0.034						
GAMMA-BHC	UG/L	0.16						
HEPTACHLOR	UG/L	0.053						
HEPTACHLOR EPOXIDE	UG/L	0.053						
Metals								
ANTIMONY	UG/L	a						
ARSENIC	UG/L	69						
CHROMIUM	UG/L	1100						
MANGANESE	UG/L	a						
MERCURY	UG/L	1.8						
NICKEL	UG/L	74						
SELENIUM	UG/L	290						
SILVER	UG/L	1.9				1		1

a = no USEPA acute saltwater criterion.

Acute criteria based on 1-hour average exposure concentrations.

Comparisons to criteria for detected concentrations only.

TABLE 3-31A CONCENTRATIONS OF DETECTED ANALYTES IN ELUTRIATE EXCEEDING USEPA CHRONIC SALTWATER CRITERIA - 1998 CHANNEL DATA

ANALYTE	UNIT	EPA SALTWATER CHRONIC	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
Non-Metals								
NITROGEN, AMMONIA	MG/L	6.4		8.8			7	
VOCs								
DICHLOROMETHANE	UG/L	a						
Pesticides								
ALPHA-BHC	UG/L	a						
BETA-BHC	UG/L	a						
ENDOSULFAN I	UG/L	0.0087						
GAMMA-BHC	UG/L	a						
HEPTACHLOR	UG/L	0.0036	0.00869 B	0.01 B	0.01 B	0.02 B	0.02 B	0.02 B
HEPTACHLOR EPOXIDE	UG/L	0.0036	0.0071 B	0.0067 B		0.0076 B	0.0042 B	
Metals								
ANTIMONY	UG/L	a						
ARSENIC	UG/L	36						
CHROMIUM	UG/L	50						
MANGANESE	UG/L	a						
MERCURY	UG/L	0.94			0.97			
NICKEL	UG/L	8.2		20.2				
SELENIUM	UG/L	71						
SILVER	UG/L	a						

a = no USEPA chronic saltwater criterion.

B= detected in laboratory blank

Chronic criteria based on 4-day average exposure concentrations.

Comparisons to criteria for detected concentrations only.

TABLE 3-31B MIXING FACTORS REQUIRED TO COMPLY WITH USEPA CHRONIC SALTWATER CRITERIA - 1998 CHANNEL DATA

ANALYTE	UNIT	EPA SALTWATER CHRONIC	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
Non-Metals								
NITROGEN, AMMONIA	MG/L	6.4		1			1	
VOCs								
DICHLOROMETHANE	UG/L	a						
Pesticides								
ALPHA-BHC	UG/L	a						
BETA-BHC	UG/L	a						
ENDOSULFAN I	UG/L	0.0087						
GAMMA-BHC	UG/L	a						
HEPTACHLOR	UG/L	0.0036	3 B	3 B	3 B	6 B	6 B	6 B
HEPTACHLOR EPOXIDE	UG/L	0.0036	2 B	2 B		2 B	1 B	
Metals								
ANTIMONY	UG/L	a						
ARSENIC	UG/L	36						
CHROMIUM	UG/L	50						
MANGANESE	UG/L	a						
MERCURY	UG/L	0.94			1			
NICKEL	UG/L	8.2		2				
SELENIUM	UG/L	71						
SILVER	UG/L	a						

a = no USEPA chronic saltwater criterion.

B = constituent dected in laboratory blank.

Chronic criteria based on 4-day average exposure concentrations.

Comparisons to criteria for detected concentrations only.

TABLE 3-32A MEAN CONCENTRATIONS OF DETECTED ANALYTES IN ELUTRIATE EXCEEDING USEPA HUMAN HEALTH CRITERIA - 1998 CHANNEL DATA

ANALYTE	UNIT	EPA HUMAN HEALTH	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
Non-Metal								
NITROGEN, AMMONIA	MG/L	a						
VOCs								
DICHLOROMETHANE	UG/L	16,000						
Pesticides								
ALPHA-BHC	UG/L							
BETA-BHC	UG/L							
ENDOSULFAN I	UG/L							
GAMMA-BHC	UG/L							
HEPTACHLOR	UG/L	0.0021	0.00869 B	0.01 B	0.01B	0.02 B	0.02 B	0.02 B
HEPTACHLOR EPOXIDE	UG/L	0.0011	0.0071 B	0.0067 B	0.0027 B	0.0076 B	0.0042 B	0.0031 B
Metals								
ANTIMONY	UG/L	4,300						
ARSENIC	UG/L	1.4	13.1	21.7	7.4	17.8	23	9.8
CHROMIUM	UG/L	a						
MANGANESE	UG/L	100	8,260	7,180	746	6,980	11,200	6,850
MERCURY	UG/L	0.051		0.82	0.97	0.12		
NICKEL	UG/L	4,600		20.2				
SELENIUM	UG/L	a						
SILVER	UG/L	a						

a = no USEPA human health criterion.

B = detected in laboratory blank

Human health criteria based on daily lifetime (70-year) average consumption of aquatic organisms.
Comparisons to criteria for detected concentrations only.

TABLE 3-32B MIXING FACTORS REQUIRED TO COMPLY WITH USEPA HUMAN HEALTH CRITERIA - 1998 CHANNEL DATA

ANALYTE	UNIT	EPA HUMAN HEALTH	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
Non-Metal								
NITROGEN, AMMONIA	MG/L	a						
VOCs								
DICHLOROMETHANE	UG/L	16,000						
Pesticides								
ALPHA-BHC	UG/L	0.13						
BETA-BHC	UG/L	0.46						
ENDOSULFAN I	UG/L	240						
GAMMA-BHC	UG/L	0.63						
HEPTACHLOR	UG/L	0.0021	4 B	5 B	5 B	10 B	10 B	10 B
HEPTACHLOR EPOXIDE	UG/L	0.0011	6 B	6 B	2 B	7 B	4 B	3 B
Metals								
ANTIMONY	UG/L	4,300						
ARSENIC	UG/L	1.4	9	16	5	13	16	7
CHROMIUM	UG/L	a						
MANGANESE	UG/L	100	83	72	7	70	112	69
MERCURY	UG/L	0.051		16	19	2		
NICKEL	UG/L	4,600						
SELENIUM	UG/L	a						
SILVER	UG/L	a						

a = no USEPA human health criterion.
B= constituent detected in laboratory blank.
Human health criteria based on daily lifetime (70-year) average consumption of aquatic organisms.
Comparisons to criteria for detected concentrations only.

TABLE 3-33 NUMBER OF CONSTITUENTS EXCEEDING APPLICABLE WQC*- 1998 ELUTRIATE DATA

WATER QUALITY CRITERIA	Brewerton Channel Eastern Extension	Craighill Angle	Craighill Entrance / Craighill Channel	Craighill Upper Range / Cutoff Angle	Swan Point Channel	Tolchester Channel
USEPA ACUTE EXCEEDANCES	0	0	0	1	0	1
USEPA CHRONIC EXCEEDANCES [(a)]	0	2	1	2	1	0
USEPA HUMAN HEALTH EXCEEDANCES [(a)]	2	3	3	5	2	2
TOTAL # OF WQC EXCEEDANCES*	2	5	4	8	3	3
MAXIMUM MIXING FACTOR (MF) REQUIRED TO MEET ALL APPLICABLE WQC	83	72	19	70	112	69
CONSTITUENT REQUIRING MAXIMUM MF	Manganese	Manganese	Mercury	Manganese	Manganese	Manganese

(a) constituents detected in laboratory blanks not included in exceedance count

* Exceedances based on 100% elutriate without consideration of mixing (see Tables 3-30B, 3-31B, and 3-32B for mixing factors)

CHAPTER 4 -
FIELD SAMPLING PROGRAM

4. FIELD SAMPLING PROGRAM

4.1 OVERVIEW OF FIELD SAMPLING ACTIVITIES

The field effort for the dredged material evaluation consisted of two separate rounds of sampling and subsequent chemical and biological testing. Mobilization for the first round of approach channel and Site 104 sediment sampling commenced on 13 September 1999. Sample collection was initiated on 15 September 1999 and continued through 28 September 1999. A total of 56 stations in the upper Chesapeake Bay were successfully sampled (Figures 4-1 through 4-13). Grab samples were collected at 26 locations in six reaches using a stainless steel Van Veen grab sampler, and sediment cores were collected at 30 locations in eight reaches with targeted lengths ranging from 2.5 to 15 ft, using a vibracoring system. A combined total of 30 grabs and 141 cores were collected from 14 sampling reaches in the upper Chesapeake Bay. Eight of the 141 cores (one from each coring reach) were submitted to the U.S. Army Engineer Research and Development Center–Waterways Experiment Station (WES) for particle settling tests.

In response to recommendations from USEPA Region III–Philadelphia for additional chemical and biological testing, a second round of sampling was conducted during the period of 8-15 December 1999. Sampling locations included those locations sampled in September 1999 in addition to an Outside Site 104 reference area. A total of 55 stations were successfully sampled in the second round of sampling. Grab samples were collected at 25 locations using a stainless steel Van Veen grab sampler, and sediment cores from 30 locations with targeted lengths of 2.5 to 15 ft, using a vibracoring system. A combined total of 29 grabs and 92 cores were collected from 15 sampling reaches in the second round of sampling.

Sediments from each station were submitted for chemical analyses, and a sediment composite from each sampling reach was prepared and submitted for biological testing. For both rounds of sampling, site water from each sampling reach was collected and submitted for the preparation of reach elutriates that were targeted for chemical and biological testing. In addition, receiving water samples, targeted for chemical analysis, were collected from Inside Site 104 during both rounds of sampling, and from Outside Site 104 during the second round of sampling.

Sediment and site water from the NODS reference area were collected on 01 February 2000 in conjunction with the Woodrow Wilson Bridge sediment sampling and testing program (EA 2000b).

The project Field Sampling Plan (FSP) (Appendix A) describes the field sampling and data-gathering methods for the Chesapeake Bay approach channels to the Port of Baltimore and Site 104 project. The FSP was prepared following guidance provided by the USACE Engineer Manual (EM) 200-1-3 *Requirements for the Preparation of Sampling and Analysis Plans* (1994). Sampling methodologies for sediment and water collection at an Atlantic Ocean reference site are documented in the FSP for the Woodrow Wilson Bridge Dredged Material Evaluation (EA 2000b).

4.2 SAMPLING OBJECTIVES

The field investigations consisted of obtaining sediment cores and surficial sediments from within the Chesapeake Bay approach channels to the Port of Baltimore , from inside and outside Site 104, and from the NODS reference area. In addition to collecting sediment, site water was collected for chemical analysis, elutriate preparation, and bioassay testing. Samples were submitted to Severn Trent Laboratories–Baltimore (STL–Baltimore) for physical and chemical analysis, to EA's Ecotoxicology Laboratory for ecotoxicological testing, and to the U.S. Army Waterways Experiment Station (USACE–WES) for specialized physical testing.

The overall objective of the sampling effort was to obtain and analyze sediment and water samples representative of the areas proposed for dredging during the period that Site 104 would have been used for placement.

The specific objectives of the field sampling and sample processing were:

Field Sampling

- Collect sediment cores from within channels proposed for upcoming maintenance dredging and new work dredging to depths ranging from -2.5 ft. to -15 ft. below the sediment surface (30 locations).

- Collect surficial sediments from within channels that have been recently dredged (17 locations), in new work areas (2 locations), from within Site 104 (5 locations), and from areas immediately surrounding Site 104 (outside reference – 4 locations).

- Obtain the required sediment volume necessary for physical, chemical, and biological testing.

- Collect one additional core in each channel reach (eight coring reaches only) for particle settling tests to be conducted by the USACE–WES.

- Sample 4 additional stations in the vicinity (north, south, east, and west) of station KI-7 in the southern portion of Site 104 to attempt to roughly delineate the geographic extent of contamination. Submit samples for physical and chemical analysis only.

- Collect site water for chemical analysis, elutriate preparation, and bioassay testing.

- Submit equipment blanks for analytical testing.

- Transport sediment cores to EA's office in Sparks, Maryland, under temperature-controlled conditions (4°C) and according to the requirements of chain-of-custody protocols.

- Complete appropriate chain-of-custody documentation.

Sample Processing

- Extrude sediment from core liners.
- Composite and homogenize core sediments and grab (surficial) sediments according to protocols that ensure sample integrity.
- Distribute homogenized and/or composited sediment samples into appropriate containers for submittal to appropriate laboratories (either EA's Ecotoxicology Laboratory, STL–Baltimore, or USACE–WES).
- Complete appropriate chain-of-custody documentation.

4.3 STATION LOCATION DETERMINATION

4.3.1 Station Locations

Stations were located in channels proposed for maintenance dredging (28 locations), in channels recently dredged (17 locations), in new work areas (2 locations), inside Site 104 (5 locations) and outside Site 104 (4 locations). Channels proposed for dredging in FY00 and FY01 include Tolchester Channel (Figure 4-9), Craighill Entrance (Figure 4-5), Craighill Angle (Figure 4-4), Swan Point Channel (Figure 4-8), and southern C&D approaches (Figure 4-2). The number of stations sampled in each channel was determined by the volume of material proposed for removal. For this project, one station was sampled for every 100,000 cubic yards (cy) of material proposed for removal. The channels proposed for dredging in FY00 and FY01, the estimated volume of material to be dredged, and the number of stations to be sampled in each FY00 and FY01channel are provided in Table 4-1. Station locations within the channels were chosen in consultation with USACE–Baltimore, and locations were targeted to specific channel areas proposed for dredging (i.e., shoaled locations).

The Craighill Angle (Figure 4-4) and the Tolchester Channel (Figure 4-9) were each broken into two sampling/testing reaches. The material proposed for dredging in these channels is geographically separated (east and west sides of the Craighill Angle; northern and southern areas of the Tolchester Channel). Dredging in these channels would likely result in separate placement events for the east/west (Craighill Angle) and north/south (Tolchester) regions; therefore, the biological testing results represent the potential impacts that could be associated with the separate placement events for each geographic region of the channels.

For channels that have been recently dredged (Craighill Channel (Figure 4-3), Craighill Upper Range (Figure 4-6), Cutoff Angle (Figure 4-7), Brewerton Channel Eastern Extension (Figure 4-1), and the southern C&D approach channel (Figure 4-2), the sampling locations corresponded to previously sampled locations in the FY95 and FY98 sediment characterization studies (EA 1996a and 2000c). Sampling locations in the C&D approach channels were chosen by USACE–Baltimore in consultation with USACE–Philadelphia (CENAP).

The C&D approach channel was divided into two sampling/testing reaches. The northern reach is proposed for dredging in FY00 or FY01, and the southern reach has been dredged recently. Biological testing was conducted separately for the northern and southern areas.

New work dredging was represented by two sampling locations adjacent to the Tolchester Channel where straightening of the Tolchester Channel S-Turn is proposed (Figure 4-10). These stations were targeted for vibracoring to a depth of 15 ft below the sediment surface.

Sampling locations inside Site 104 (Figure 4-11) included stations KI-3, KI-5, and KI-7 from the previous sediment characterization study (EA 1998a) and two additional stations located in the southern portion of the site (KI-S-1 and KI-S-2) where placement of material is proposed. Five additional samples from the southern portion of Site 104 in the vicinity of KI-7 (Figure 4-12) were collected and analyzed in an attempt to roughly delineate the extent of the previously documented contamination from KI-7 (KI-7REF, KI-7-N, KI-7-S, KI-7-E, and KI-7-W). Sampling locations outside Site 104 (Figure 4-13) corresponded to stations KI-11, KI-14, KI-15, and KI-16 that were sampled in a previous sediment investigation (EA 1998a).

Sampling in the Ocean Reference area consisted of grab sediment collection at each of four locations within the reference area (Figure 4-14). The sediment from the four locations was combined into one composite sample for physical, chemical, and biological testing.

Station locations for each sampling reach are depicted in alphabetical order in Figures 4-1 through 4-10. Station locations for Inside Site 104 and Outside Site 104 are depicted in Figures 4-11 and 4-13, respectively. Sampling station coordinates are provided in Table 4-2.

4.3.2 Global Positioning System Equipment

Core sampling was conducted from two vessels: the USACE vessel *Reynolds* and the University of Maryland (UMD) vessel *Aquarius*. For the first round of core sampling conducted from the USACE vessel *Reynolds*, stations were located using a Differential Global Positioning System (DGPS) mounted on the survey vessel *Linthicum*. The station locations were marked in the field by the *Linthicum* crew using the DGPS to locate the target position and by placing a buoy at the target location. The work platform (*Reynolds*) was positioned and maintained adjacent to the buoy to facilitate collection of cores at the target location. During the second round of sampling on the *Reynolds*, a Northstar DGPSwas utilized to locate target stations. The UMD *R/V Aquarius* utilized a Northstar 941XD DGPS for both the September and December sampling events.

4.4 SAMPLE VOLUME REQUIREMENTS

Approximately 20-25 gallons of sediment were required per sampling reach for the toxicity testing, bioaccumulation studies, sediment chemistry, and elutriate preparation. Approximately 137 cores and 22 grabs were required to meet the sediment volume requirements in the first round of sampling, and approximately 92 cores and 26 grabs were required to meet the sediment volume requirements in the second round of sampling. Eight additional cores were required in the first round of sampling for the WES particle settling tests. Fewer cores were required in the second round of sampling than in the first round of sampling due to greater sediment recovery during the December sampling effort. A station-by-station breakdown of the targeted core depth and quantity is provided in Table 4-3. The actual number of cores collected is provided in Tables 4-4A (September 1999) and 4-4B (December 1999). If sediment recovery was less than the target penetration depth, additional cores were collected to obtain the necessary sediment volume.

4.5 VIBRACORING PROCEDURES

In channels proposed for upcoming maintenance dredging and new work dredging (8 sampling reaches), sediment samples were collected using a Rossfelder-P3 vibracoring system capable of collecting sediment cores ranging from 2.5 to 15 ft in length. The targeted core depth was representative of the material to be removed, varied between stations, and was dependent upon the proposed dredging depth (Table 4-3). Core penetration depths and recovery lengths for each station are provided in Tables 4-4A and 4-4B for the September and December sampling, respectively. Cellulose Acetate Butylrate (CAB) core liners with an outer diameter of 4 inches and an inner diameter of 3.75 inches were used within the coring device. The core liners were fitted with a stainless steel catcher at the bottom to retain sediment during retrieval. The core barrel was fitted with a steel cutter head to facilitate sediment penetration. Sampling equipment coming into direct contact with the sediment was decontaminated prior to sampling using the protocol described in Section 4.10.

Coring equipment was provided by Aqua Survey, Inc. (Flemington, New Jersey) for both the September and December sampling events. Coring operations were conducted from the USACE vessel *Reynolds* in September 1999 and from the University of UMD *R/V Aquarius* in December 1999. Both vessels were outfitted with lifting equipment and electrical hook-ups to facilitate coring operations. The project staging areas for the vibracoring activities were located at Fort McHenry (Baltimore, Maryland) and Sandy Point State Park (Whitehall, Maryland) for the September and December coring efforts, respectively.

The following procedure was followed for core collection at each station:

- A clean, decontaminated section of cellulose acetate butyrate plastic liner was fitted with a clean, decontaminated stainless steel core catcher at the bottom.

- The liner was placed inside the outer steel core barrel.

- A clean stainless steel core cutter, or nose cone, was placed at the bottom of the core barrel.

- The boat was positioned at the target location and anchored.

- The core barrel was lowered until the bottom of the barrel was just above the sediment surface.

- The vibracoring motor was engaged and the core barrel was penetrated into the sediment to the target depth.

- The approximate water depth and the position were recorded.

- After the position was recorded, the core barrel was brought up on deck.

- The core liner was removed from the corer, the core catcher was removed from the bottom of the core, a core cap was placed on the bottom of the core and taped in place. The core was moved into a vertical position and excess liner above the sediment-water interface was cut off using a hacksaw. The top of the core was capped and taped. The depth of actual sediment recovery was measured and recorded.

- The liner and both caps were labeled. Labeling included the following:

  - Station Location/Site
  - Core Number out of Total Number of Cores for Station
  - Reference to top or bottom

- The process was repeated at the site until the required sediment volume was attained.

- The boat was relocated to the next station, and the process repeated.

In addition to collecting cores for analytical and ecotoxicological testing, one additional core was collected within each sampling reach (coring reach) for USACE–WES. These cores were used for particle settling tests that are not part of this evaluation.

Cores were chilled with bags of ice and kept on-board the work vessel until the end of each workday. A summary of coring activities is provided in Tables 4-4A (September) and 4-4B (December). Copies of the field logbooks and data sheets are provided in Attachment I.

4.6 GRAB SAMPLING PROCEDURES

Surficial sediments were collected from channels that have recently been dredged, from inside Placement Site 104, and from several locations outside Site 104 (7 sampling reaches). Surficial sediments in the channel locations are most representative of materials to be dredged in the future, and surficial sediments inside Site 104 are representative of the existing surficial conditions that will be disturbed as the result of placement. The surficial sediments in the Outside Site 104 area locations represent substrate used by biota and substrate to which biota are exposed. The Outside Site 104 sediments have not been influenced by previous dredged material placement activities.

The surficial sediments were collected using a stainless steel Van Veen grab sampler with a 10.5-gallon capacity. Grab sampling operations were conducted from the UMD's *R/V Aquarius* in September and from both the USACE vessel *Reynolds* (2 days) and the *R/V Aquarius* (1 day) in December. One grab was collected and composited from each station to obtain the necessary sample volume for physical, chemical, and biological analysis. Sediment targeted for analytical testing was thoroughly homogenized with a stainless steel spoon in a stainless steel mixing bowl on the work vessel. The homogenized sample was transferred to appropriate sample containers using a stainless steel spoon, samples were labeled, and chilled on ice on the work vessel. Sediment targeted for ecotoxicological testing was transferred directly from the sampling device to pre-cleaned, 5-gallon, polypropylene buckets with sealed lids. These samples were homogenized (composited) in the laboratory prior to initiation of ecotoxicological testing. The buckets were labeled and chilled with ice. In the second round of sampling, for samples targeted for volatiles analysis, a subsample from each station was directly removed from the undisturbed grab sampler and was placed immediately into the appropriate sample container prior to homogenization. To avoid the loss of volatiles from the sample, the volatiles sample container was filled to the top and capped, leaving minimal headspace and trapped air.

During the grab sampling effort inside Site 104, an attempt was made to determine the extent of surficial contamination at Site 104 in the vicinity of station KI-7. Surficial grabs were collected at approximate 5-10 m increments to the north, south, east, and west of KI-7. Previous sampling (in 1997) at this location indicated that the sediments were visibly different than at other locations within the site (EA 1998a). Grabs were inspected visually and stirred to reveal signs of visual contamination (i.e., oily residue or sheen, petroleum-like odors, unusual textures, foreign objects, etc).

No visual signs of contamination were evident in the surficial sediments collected at KI-7 during the September sampling effort (unlike the 1997 sampling event). Visual signs of contamination were observed, however, in surficial sediment that was collected approximately 10-15 m south of KI-7. Material from this location (KI-7REF) was submitted for analytical testing.
In addition, sub samples of sediment from KI-7REF were included in the sediment composite for the ecotoxicological testing and bioaccumulation studies.

Grabs were then collected at the 5-10 m distances (north, south, east, and west of KI-7REF) until no visual signs of surficial contamination existed. When the apparent boundary of surficial contamination was delineated, four grabs were collected (one to the north, south, east, and west) immediately outside the boundary for chemical analysis. These grabs were not utilized in the Inside Site 104 sediment composite for biological testing. In addition, site water was collected and an elutriate sample was created using sediment from KI-7REF. The intent of the elutriate test was to provide information regarding the potential release of contaminants from re-suspension of bottom sediments during material placement.

Summaries of the grab sampling activities are provided in Tables 4-5A and 4-5B for the September and December sampling events, respectively.

4.7 OCEAN REFERENCE SITE SAMPLING

Surficial sediments were collected the Norfolk Ocean Disposal Site reference area on 01 February 2000 (Figure 4-14). The sampling was conducted from a 45-ft vessel supplied and operated by Sea Search of Norfolk, Virginia. The surficial sediment was collected using a stainless steel Van Veen grab sampler with a 10.5-gallon capacity. The sampler was decontaminated prior to use following protocols described in Section 4.10. Four grabs were collected and composited into one sample for the analytical and ecotoxicological testing. The sample submitted for analytical testing consisted of an equal volume of surficial sediment subsampled from four grabs. The sample was composited and thoroughly homogenized with a stainless steel spoon in a stainless steel mixing bowl. The sample for volatiles analysis was removed from one undisturbed grab (prior to homogenizing) and was placed immediately into the appropriate sample container. To avoid the loss of volatiles from the sample, the volatiles sample container was filled to the top and capped leaving minimal headspace and trapped air. The containers were labeled, chilled on ice on the work vessel, and then hand delivered to STL–Baltimore for analytical testing. Holding times for the grab samples began when the samples were collected.

For the ecotoxicological testing, 5 gallons of sediment from each of the four grabs were placed in individual pre-cleaned, polypropylene buckets with sealed lids. The buckets were labeled and chilled on ice on the work vessel. The sediment was then transported to EA's ecotoxicological facility, stored at 4°C, and later composited and homogenized prior to ecotoxicological testing.

In addition to collecting ocean reference sediment, USEPA Region III requested that a lower Chesapeake Bay control sediment be collected for use as the laboratory control in the *Leptocheirus plumulosus* amphipod testing. Four grabs were also collected at a control site located approximately 5 miles northwest of Fisherman's Island in the southern Chesapeake Bay (Figure 4-14). The sediments were composited into one sample and were tested as the laboratory control in the whole-sediment bioassays only. A summary of station information for the ocean reference and lower Chesapeake Bay control site sampling is provided in Table 4-6.

4.8 SAMPLE STORAGE AND TRANSPORT

In the field, cores were capped at both ends, sealed, labeled, and bagged on the work vessel. Cores were chilled on the work vessel using bagged ice until the end of the workday. Cores were hand-delivered each evening to EA's facility in Sparks, Maryland where they were stored at 4°C until processing. A chain-of-custody form accompanied the cores during transport to Sparks, Maryland. The chain-of-custody form documented core name and date and time of collection. Copies of the chain-of-custody forms for the cores are provided in Attachment I.

For surficial sediments, one grab sample from each station was composited on-board the work vessel using pre-cleaned stainless steel bowls and spoons. These samples were placed in appropriate holding containers, labeled, chilled on ice, and hand-delivered to Severn Trent Laboratories (STL–Baltimore) each evening for analytical testing. The sediment for ecotoxicological testing was transported to EA's Ecotoxicological Laboratory each evening, stored at 4°C, and later composited for ecotoxicological testing. A chain-of-custody form accompanied the sediment samples during transport to STL and the Ecotoxicology Laboratory.

4.9 SITE WATER SAMPLING

Approximately 10 gallons of site water were collected from one specified station in each sampling reach for elutriate preparation and and bioassay testing. In addition, site water samples were collected from inside and outside Site 104 for chemical analysis. One site water sample was collected from station KI-3, one from station KI-7, and one from station KI-14. In addition, a duplicate water sample was collected at KI-7. Approximately 6 gallons of water were required for the chemical analyses. The water was collected from mid-depth of the water column using a peristaltic pump with Tygon tubing. Water targeted for chemical analysis was pumped directly into laboratory-prepared sample containers containing laboratory-specified preservatives. Elutriate preparation water was stored at 4° C in 1-gallon, pre-cleaned, amber glass bottles. Water for the bioassay testing was stored at 4° C in 5-gallon, pre-cleaned, high-density polyethylene containers. A summary of water sampling activities is provided in Table 4-7A (September) and 4-7B (December).

Holding times for water samples began when the water was collected. Site water targeted for chemical analysis was hand delivered to STL–Baltimore on the evening of the day of collection. Elutriate preparation water was hand delivered to the analytical laboratory with the sediment samples. A chain-of-custody form was submitted to STL–Baltimore with each delivery of samples. Required sample containers, preservation techniques, and holding time requirements for water samples are provided in Table 4-8.

4.10 EQUIPMENT DECONTAMINATION AND WASTE HANDLING PROCEDURES

Equipment that would come into direct contact with sediment was decontaminated prior to deployment in the field to minimize cross-contamination. This included CAB core liners, core caps, stainless steel cutters, stainless steel catchers, and stainless steel processing equipment (spoons, knives, bowls, extruder, etc.). Nose cones and core catchers that were re-used in the field were decontaminated on-board the work vessel between stations. While performing the decontamination procedure, phthalate-free nitrile gloves were used to prevent phthalate contamination of the sampling equipment or the samples.

The decontamination procedure described below was utilized:

- Rinse equipment using clean tap or site water;
- Wash and scrub with non-phosphate detergent (Alconox or other laboratory-grade detergent);
- Rinse with tap water;
- Rinse with 10 percent nitric acid (HNO_3);

- Rinse with distilled or de-ionized water;
- Rinse with methanol followed by hexane;
- Rinse with distilled or de-ionized water;
- Air dry (in area not adjacent to the decontamination area); and
- Wrap equipment in aluminum foil, shiny side out.

Waste liquids were contained during decontamination procedures and transferred to a 55-gallon drum for characterization and disposal at the end of the field effort. Waste liquids were disposed from EA's warehouse facility (in Hunt Valley, Maryland) using standard disposal procedures and contractors.

4.11 FIELD QC SAMPLES

4.11.1 Equipment Blanks

Equipment blanks were collected for the Site 104 study for each round of sampling. Equipment blanks were collected by pouring deionized (DI) water over sampling equipment that had been decontaminated using the procedure outlined in Section 4.10. The rinsate water was placed in laboratory-prepared containers, submitted to the analytical laboratory, and tested for the same chemical parameters as the sediments. One equipment blank was collected for the vibracoring equipment (core catchers, liners, etc.), one equipment blank was collected for the grab sampling equipment (grab, stainless steel bowls and spoons), and one equipment blank was collected for the water collection device (peristaltic pump tubing). Equipment blanks were hand-delivered to STL-Baltimore in the evening on the day of collection. Chain-of-custody documentation was submitted with the equipment blanks.

4.11.2 Field Duplicates

Three field duplicate sediment samples were collected for the Site 104 study. Field duplicates are samples collected simultaneously from the same sampling location and are used as measures of matrix homogeneity and sampling precision for the analytical testing. Duplicate samples were collected as individual, co-located samples (i.e., separate grabs from the same station location). The samples were homogenized separately and placed in separate containers. Field duplicate sediment samples were collected at stations CRU2, BE3, and KI-7 during both sampling efforts. A field duplicate water sample was collected at station KI-7 during the first round of sampling. Field duplicate samples were differentiated from other samples with an "FD" as the last two characters of the sample ID. Field duplicates were hand-delivered to the analytical laboratory with their corresponding co-located samples.

4.11.3 Trip Blanks

Trip blanks (also called transport blanks) were analyzed to evaluate the effect of ambient site conditions and sample transport on sample integrity and to ensure proper container preparation and handling techniques. Trip blanks consist of analyte-free water placed in organic vials (preserved with HCl) in the laboratory. Trip blanks are analyzed for VOCs. Trip blanks were only analyzed for the second round of sampling, because VOC analyses were only conducted on samples in the second round of sampling. One trip blank was analyzed per sampling day or sample processing day during the second round of sampling. All volatiles samples were stored in the same cooler as the trip blank.

4.12 SAMPLE PROCESSING

Sediments were processed in a designated area at EA's warehouse facility on 30 September and 01 October 1999, and 17 December 1999. Prior to processing, cores and surficial sediments were sorted and checked against the chain-of-custody forms.

4.12.1 Core Processing

Cores were processed in a designated area at EA's warehouse facility. Sediments were extracted from each core using a stainless-steel extrusion rod and were homogenized using pre-cleaned stainless-steel spoons in stainless-steel bowls. Multiple cores were homogenized for each station. Core samples from each station were composited and homogenized until the sediment was thoroughly mixed and of uniform consistency. For each station, samples for volatile analysis were removed from a longitudinal section of one core and immediately placed into sample containers to avoid loss of volatiles. These samples were not stirred or homogenized. When compositing and homogenization of sediment from each station was completed, sub-samples of sediment were placed in appropriate sample jars and submitted to STL–Baltimore for chemical analysis.

Holding times for the core sediment samples began when the sediment was removed from the core liner, composited, homogenized, and placed in the appropriate sample containers. Holding times for the surficial grabs began when the sediment was collected. Sample containers, preservation techniques, and analytical holding requirements for sediment samples are provided in Table 4-9.

Sediment cores collected for USACE–WES were shipped directly to USACE–WES via overnight delivery.

4.12.2 Reach Composites

After a subsample of sediment from each station was removed for analytical testing, 20-gallon composite samples from each reach were created for ecotoxicological testing using an equal volume of sediment from each station within the channel reach. Twenty-gallon composite samples for ecotoxicological testing were also created for reaches where surficial sediments were collected using an equal volume of sediment from each station within the reach. The composites for each reach were individually homogenized in 55-gallon fiberglass holding containers using large stainless-steel spoons. Sample processing equipment that came into direct contact with the sediment was decontaminated according to the protocols specified in the Section 4.10. The reach sediment composites were placed in pre-cleaned, decontaminated, 5-gallon polypropylene buckets and submitted to EA's Ecotoxicology Laboratory for toxicity testing and bioaccumulation studies. Toxicological holding times for the sediment composites began when the sediment was composited. A list of the composite samples for ecotoxicological testing is provided in Chapter 8. Recommended holding times for the ecotoxicological samples are provided in Table 4-10.

4.13 SAMPLE LABELING, CHAIN-OF-CUSTODY, AND DOCUMENTATION

4.13.1 Field Logbook

A log of coring activities, station locations, water depths, weather conditions, and core recoveries was recorded in permanently bound logbooks or datasheets. In addition to sampling information, personnel names, local weather conditions, and other information that impacted the field sampling program was recorded. Each page of the logbook (field and sample processing) was numbered, dated, and signed by the personnel entering information. Full copies of the project logbooks are contained in Attachment I.

4.13.2 Numbering System

For the coring program, two separate, but related sample numbering systems were used. One applied to the cores, the other to the sediment samples. The core numbering system was used to communicate between the field crew and the sampling processing crew, and indicated which cores were collected from each station. The sample numbering system provided communication between the sample processing operation and the laboratories performing the desired analyses.

<u>**Core Numbering**</u>
Cores were numbered as follows:

Example: CRE01-CORE1
CRE01-CORE2

where the first 2-3 letters denote the site designation and the following numbers denote the station number. CORE1, CORE2, etc., represented the multiple cores collected from each site.

<u>**Sample Numbering**</u>
Sample IDs for sediment, site water, and elutriate samples followed the numbering system similar to the system utilized in the FY95 and FY98 sampling programs. A breakdown of each sample type and the corresponding sample ID is provided in Table 4-11 (approach channels) and Table 4-12 (Inside Site 104, Outside Site 104, and Ocean Reference). Sediment samples from the homogenized and composited sediment cores were designated with a "VC" as the last 2 characters of the sample ID.

Blank Numbering System
Equipment blanks were labeled, respectively, as follows:

EQBCORE-*mmddyy* (rinsate from coring equipment)
EQBGRAB-*mmddyy* (rinsate from grab sampling equipment)
EQBWAT-*mmddyy* (rinsate from water collection equipment)
TB-*mmddyy* (trip blanks)

where the 2-digit month, day, and year of collection were designated within each sample ID.

4.13.3 Sample Labeling

Both cores and processed sediment were labeled. Sediment cores collected in the field were labeled with the site location, station number, core orientation (top and bottom), and date of collection. Sample containers for the surficial grabs, processed sediment, and water samples were labeled with the following information:

- Client name
- Project number
- Sample ID
- Station location
- Date and time of collection
- Sampler's initials
- Type of analyses required

4.13.4 Chain–of-Custody Records

Sediment cores collected in the field were documented on a core-specific chain-of-custody form. This chain-of-custody accompanied the cores to the sample processing facility at EA's facility in Sparks, Maryland. Sample processing personnel prepared a separate chain-of-custody for sample submittal to EA's Ecotoxicology Laboratory, STL–Baltimore, and USACE–WES. Copies of the chain-of-custody forms for the cores and WES samples are provided in Attachment I. Copies of the chain-of-custody forms for bulk sediment, water and elutriates, and ecotoxicological testing are provided in Attachments II, III, and V, respectively.

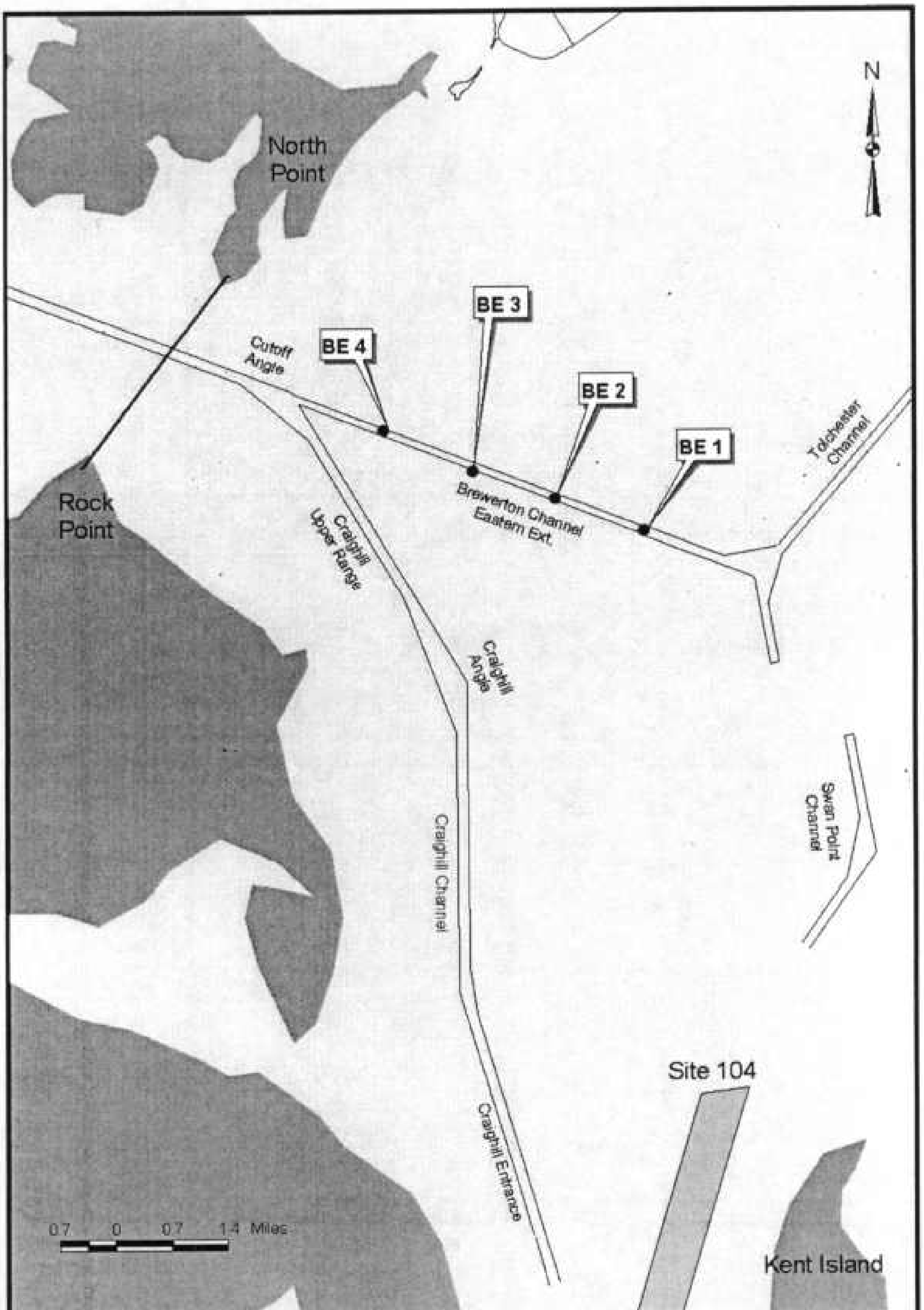

Figure 4-1. Grab sampling locations in the Brewerton Channel Eastern Extension.

DRAFT

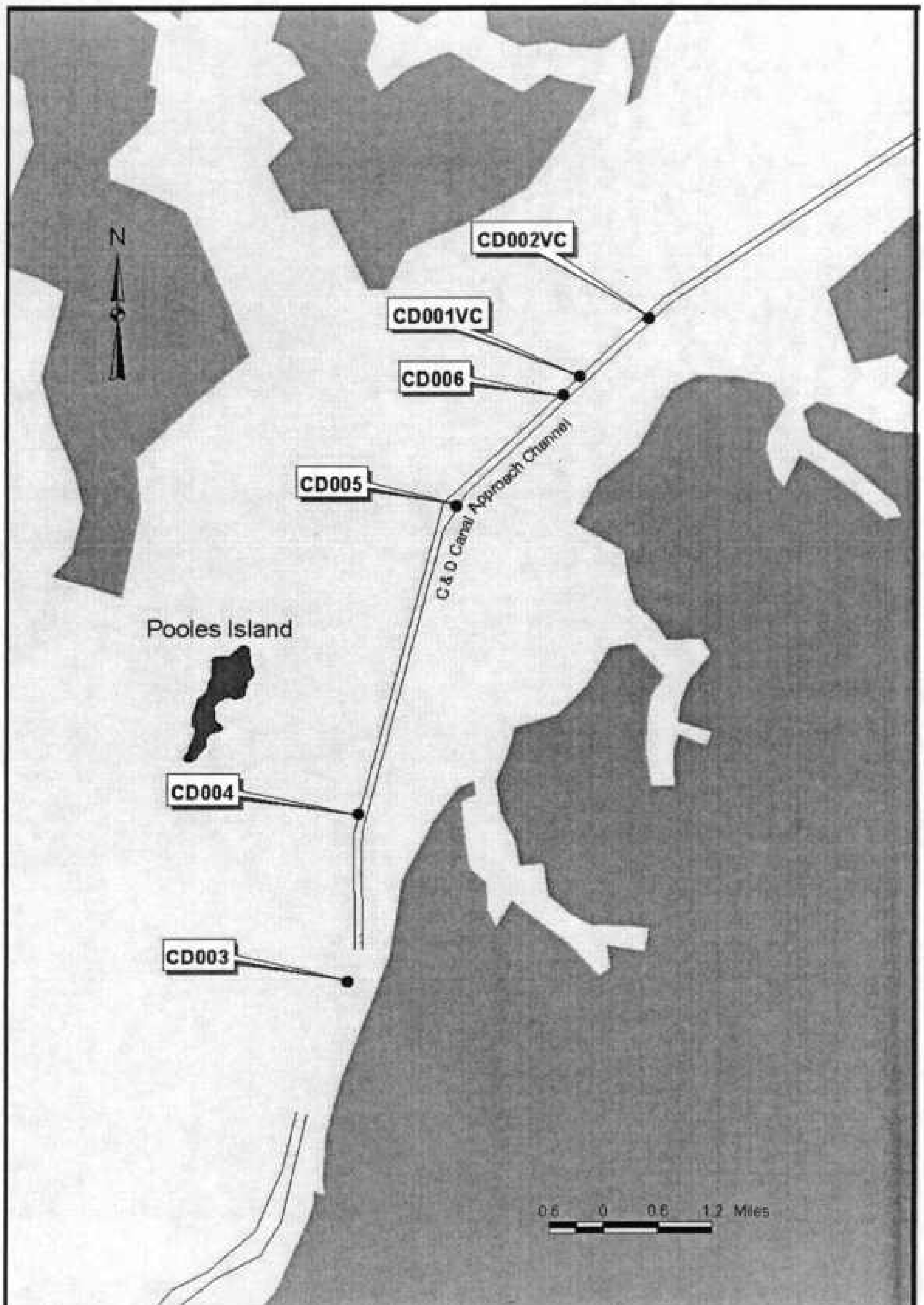

Figure 4-2. Vibracoring (VC) and grab sampling locations in the C&D Canal Approach Channel.

DRAFT

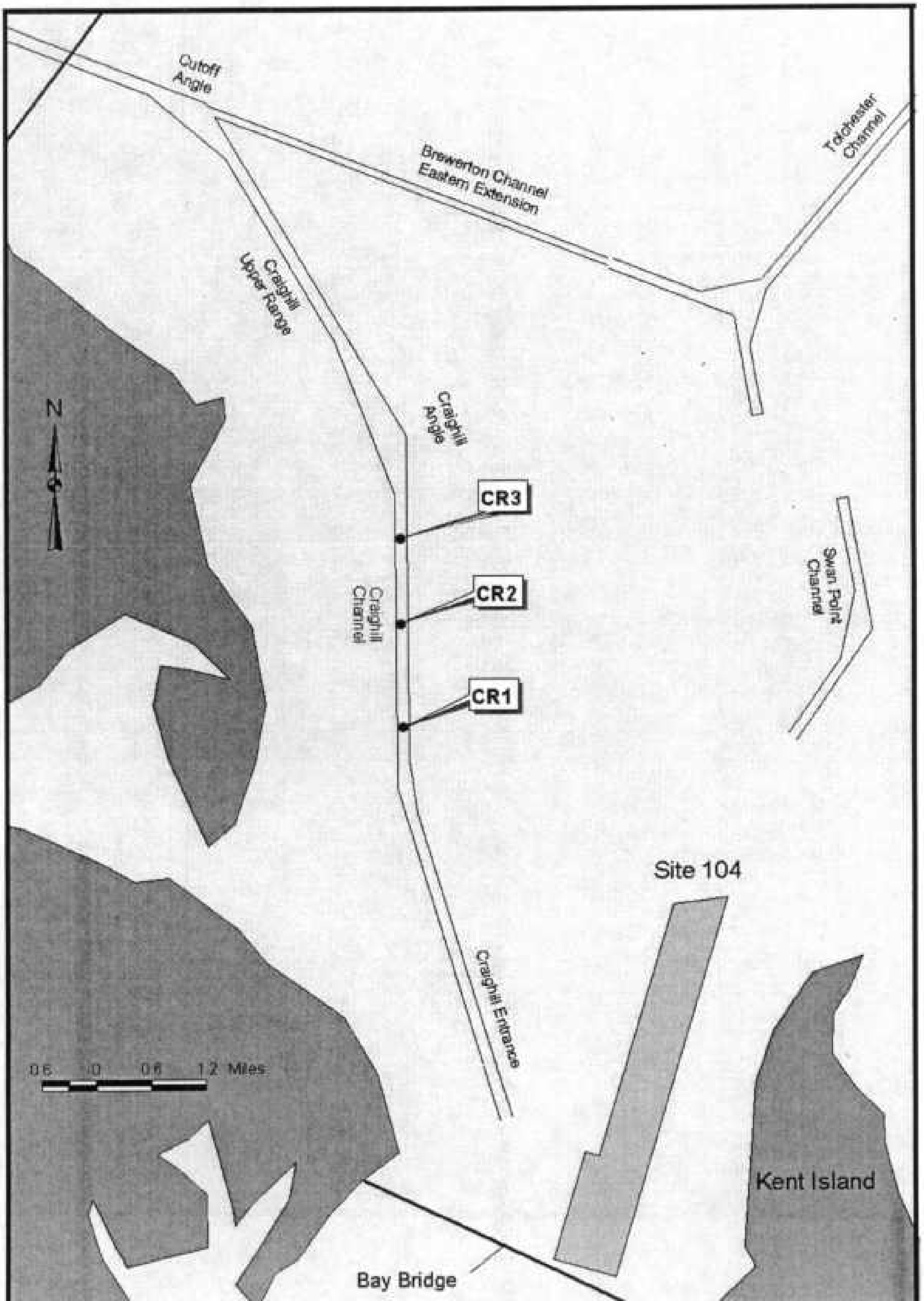

Figure 4-3. Grab sampling locations in the Craighill Channel.

DRAFT

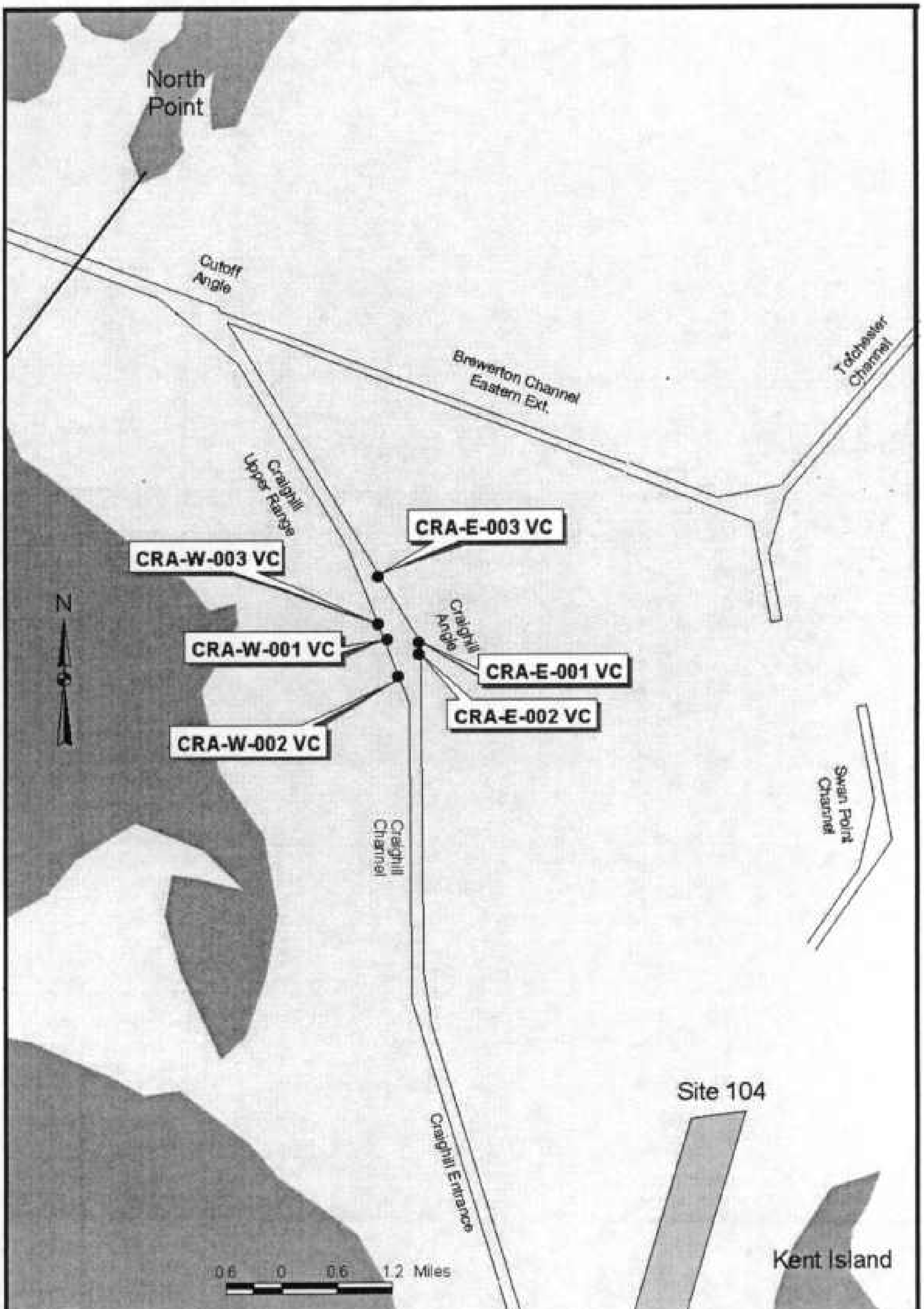

Figure 4-4. Vibracoring locations in the Craighill Angle (East and West).

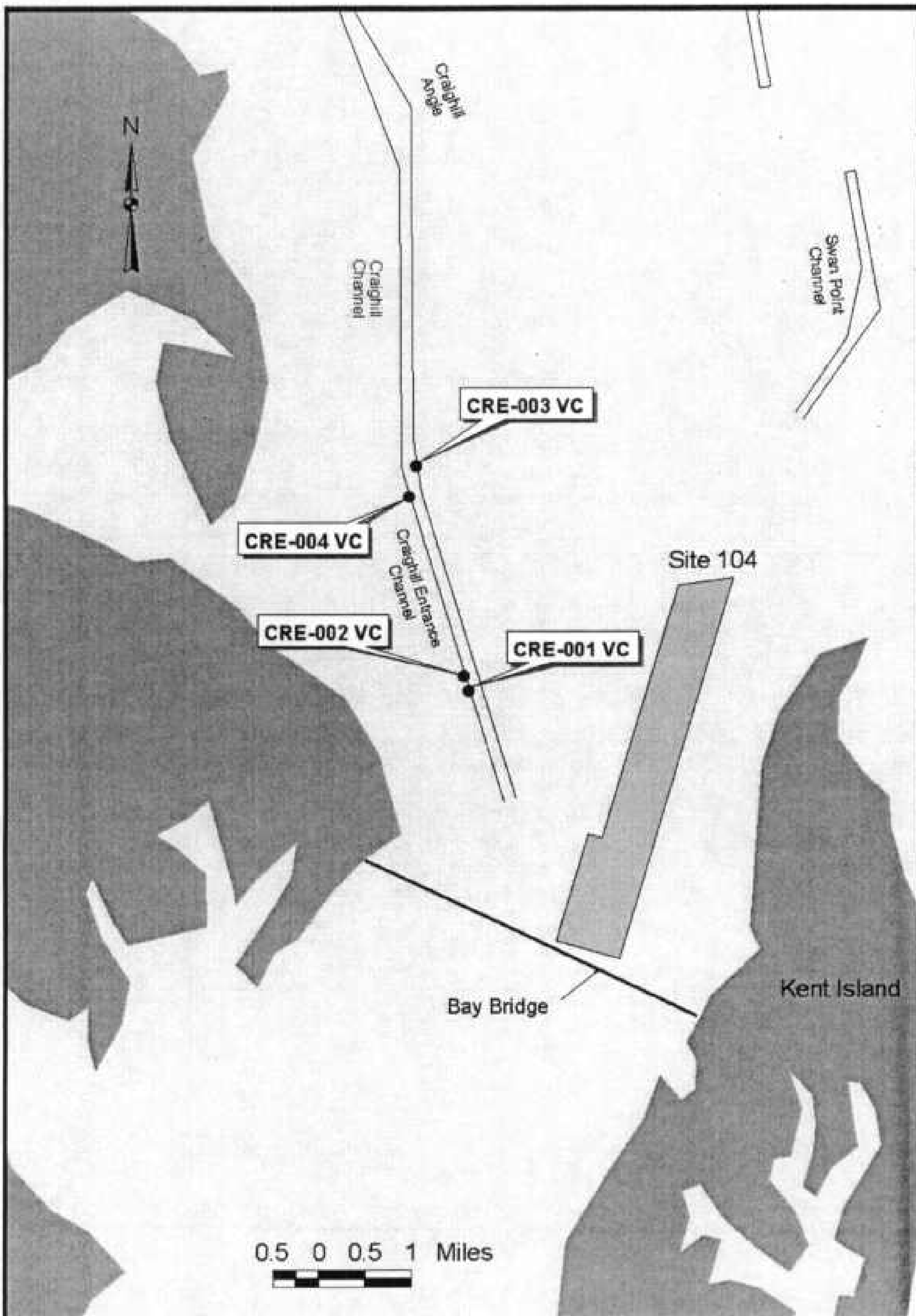

Figure 4-5. Vibracoring locations in the Craighill Entrance.

DRAFT

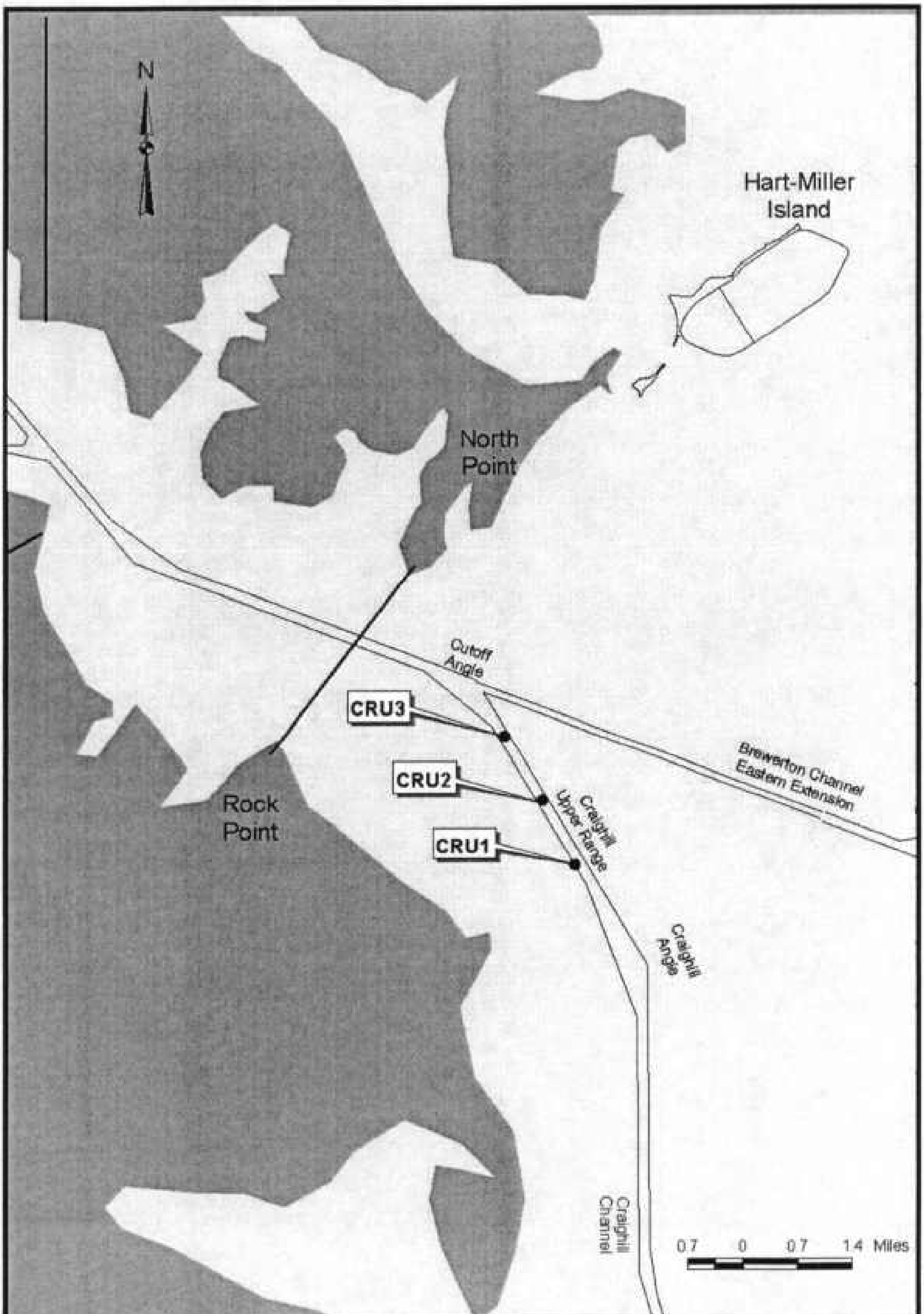

Figure 4-6. Grab sampling locations in the Craighill Upper Range.

DRAFT

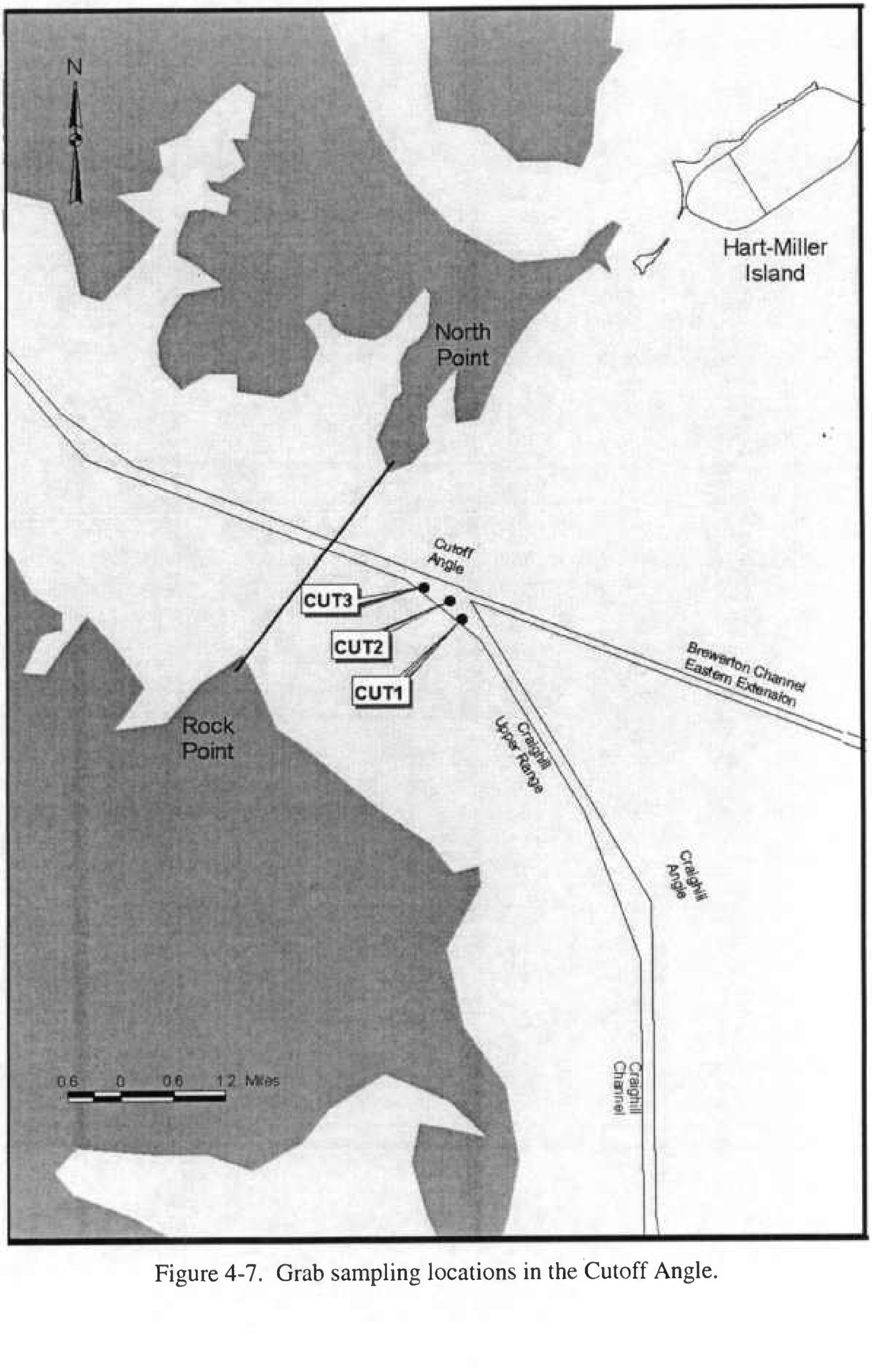

Figure 4-7. Grab sampling locations in the Cutoff Angle.

DRAFT

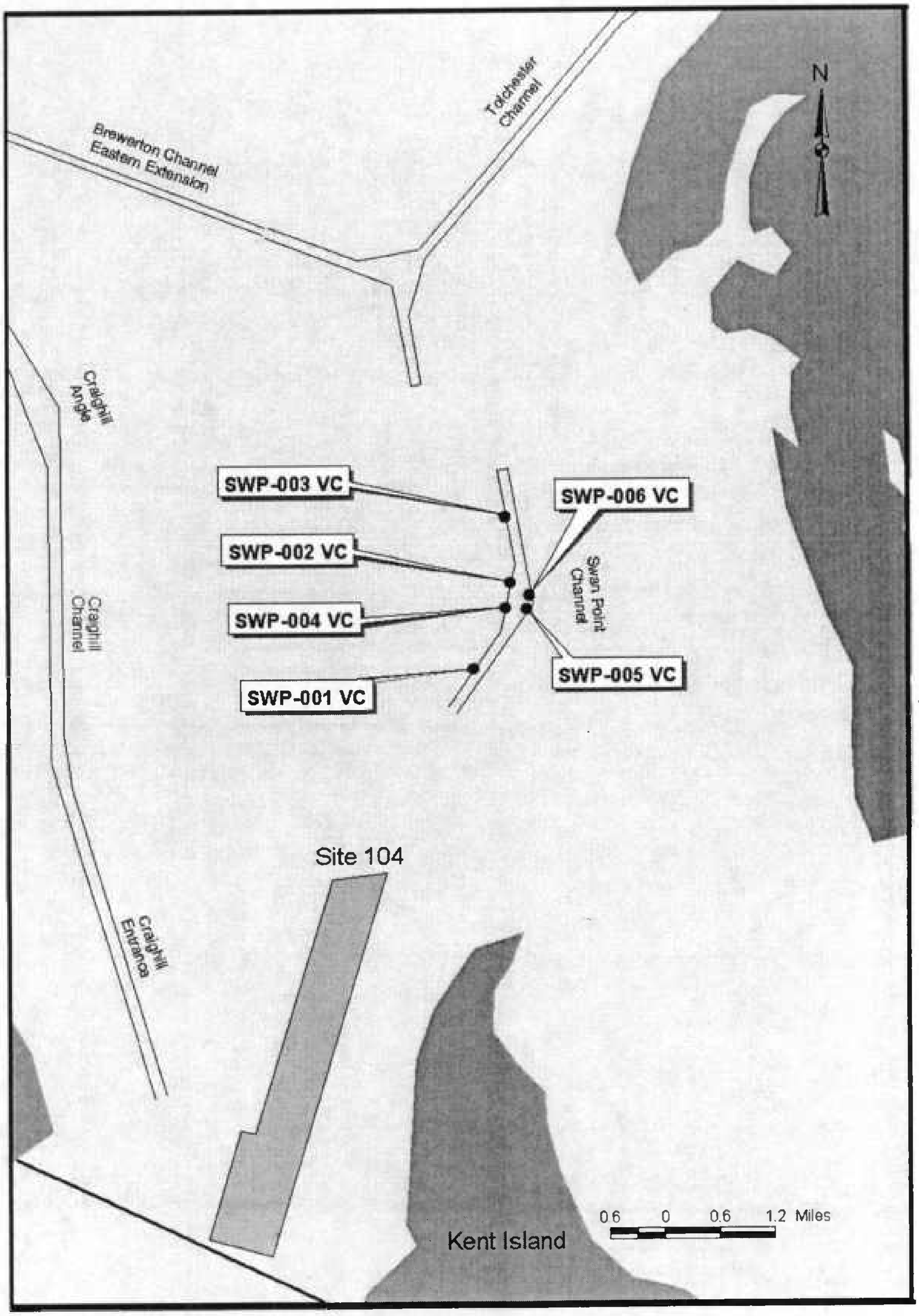

Figure 4-8. Vibracoring locations in the Swan Point Channel.

DRAFT

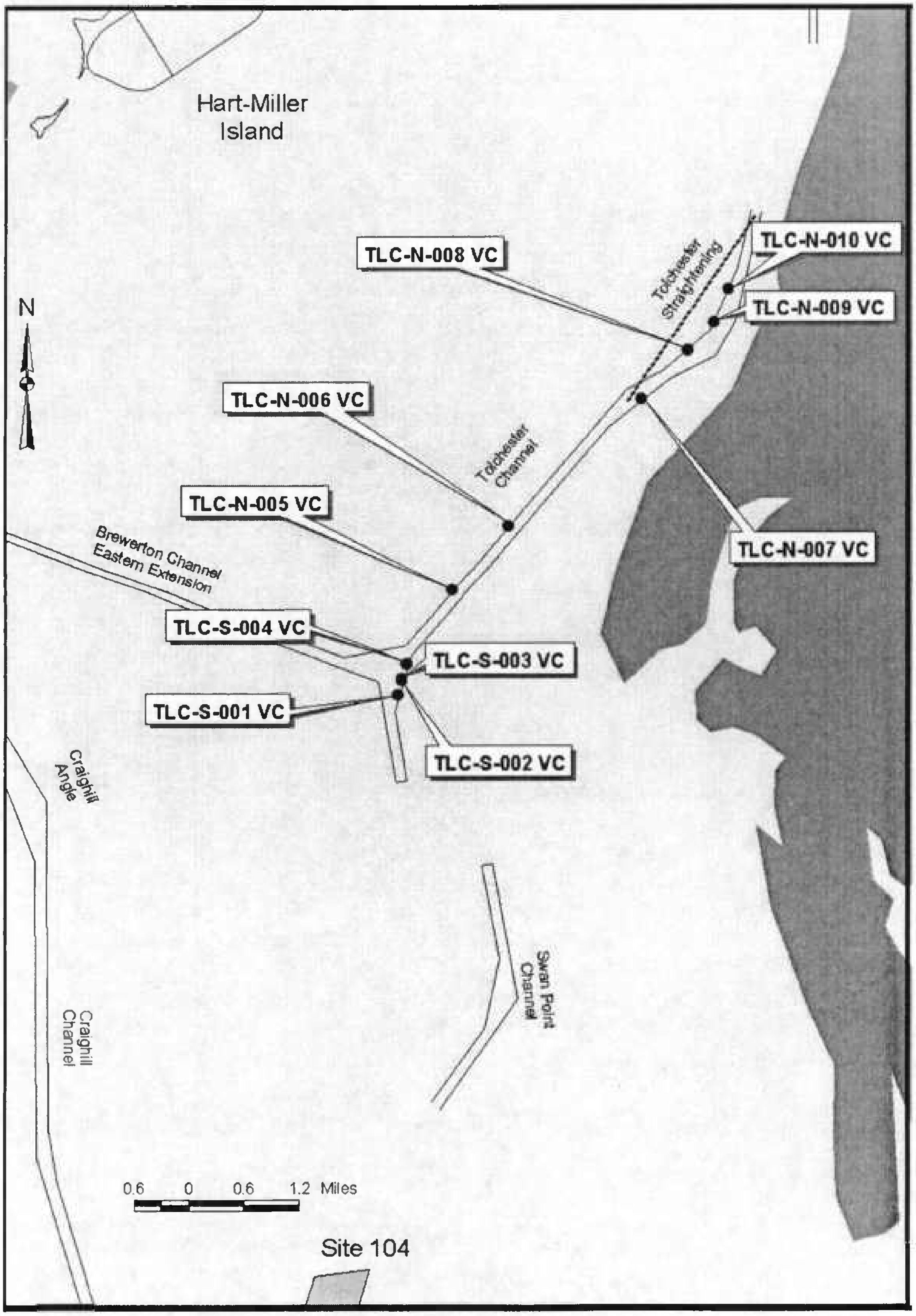

Figure 4-9. Vibracoring locations in the Tolchester Channel (North and South).

DRAFT

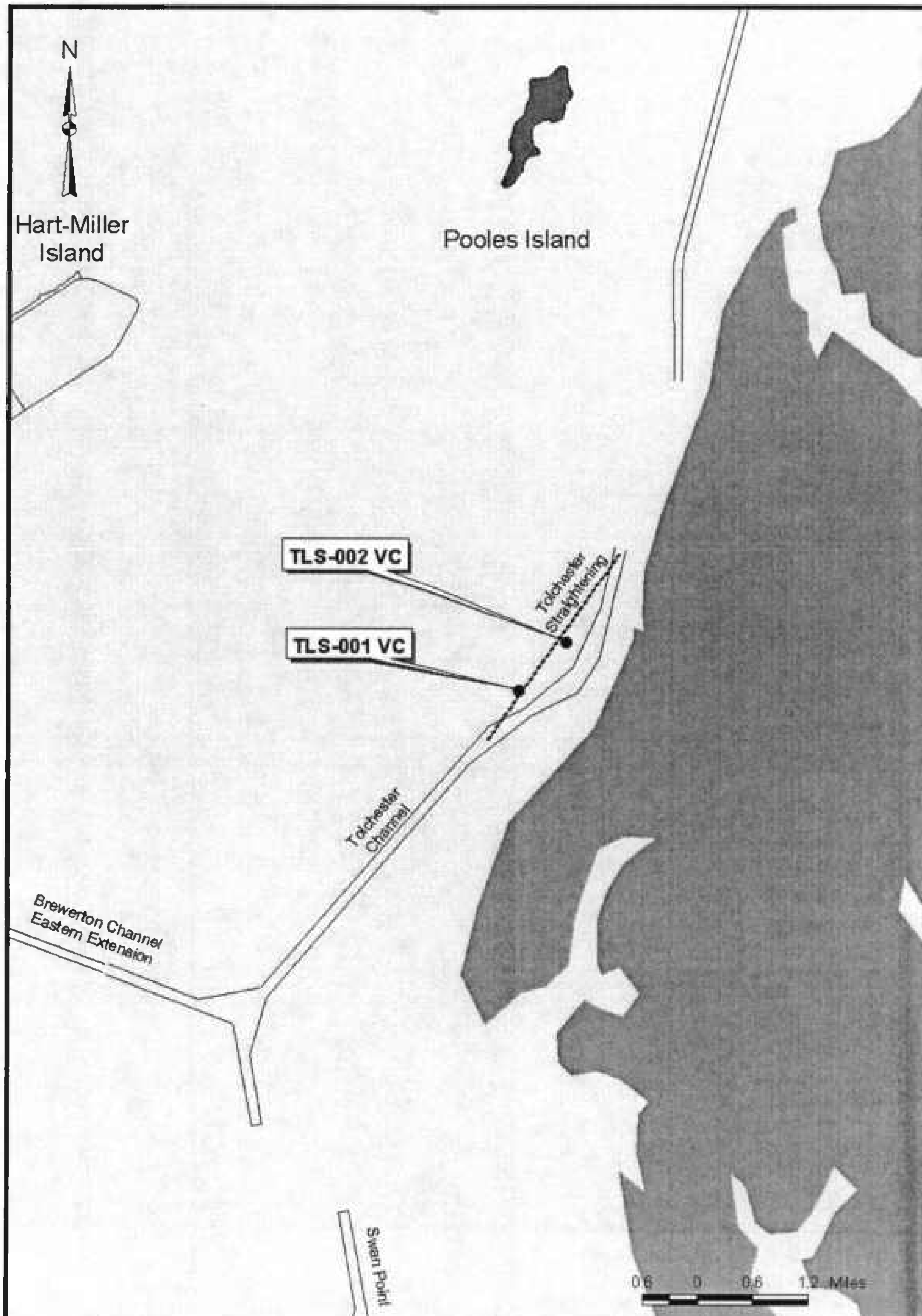

Figure 4-10. Vibracoring locations in the Tolchester S-Turn Channel Straightening.

DRAFT

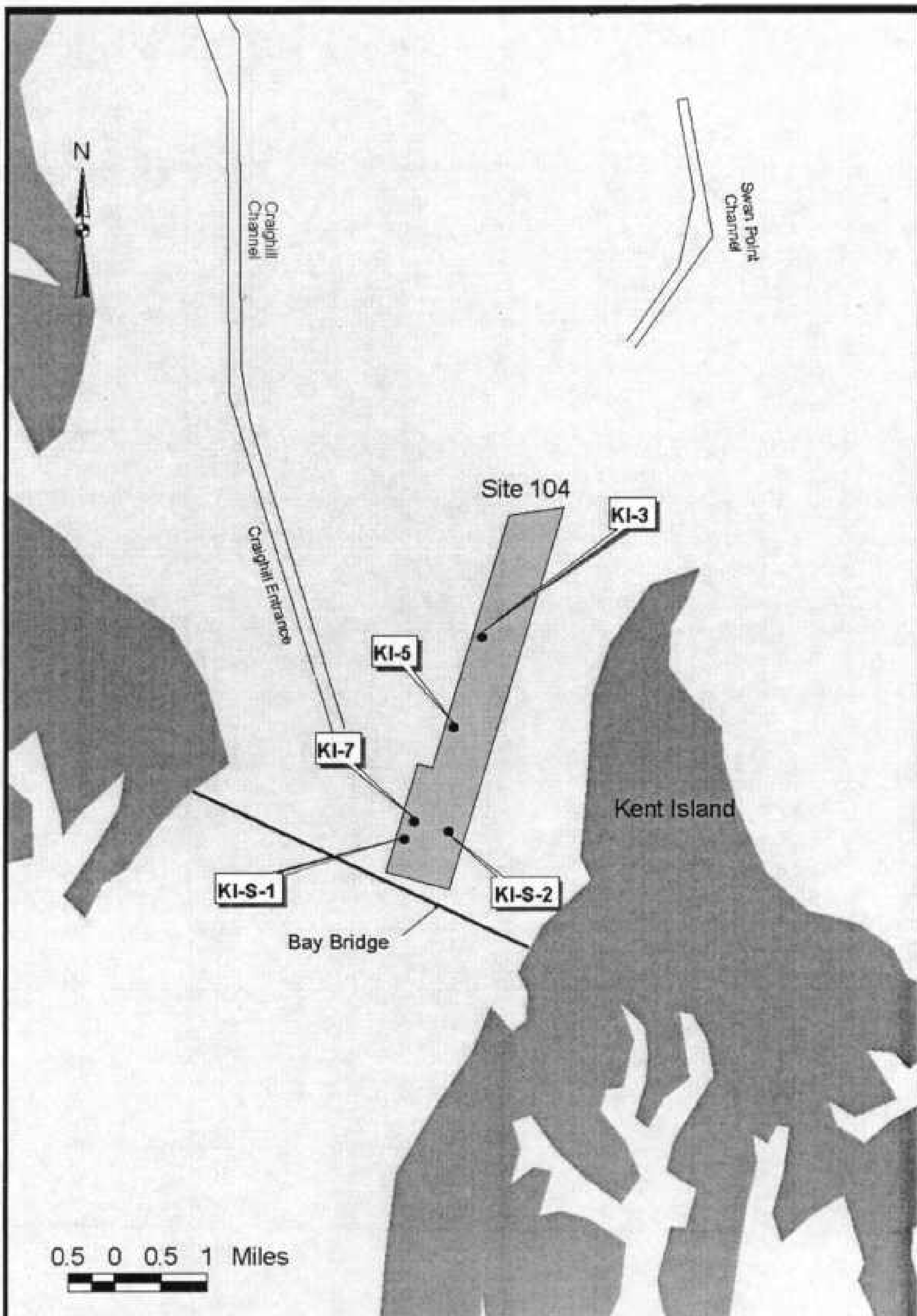

Figure 4-11. Grab sampling locations Inside Site 104.

DRAFT

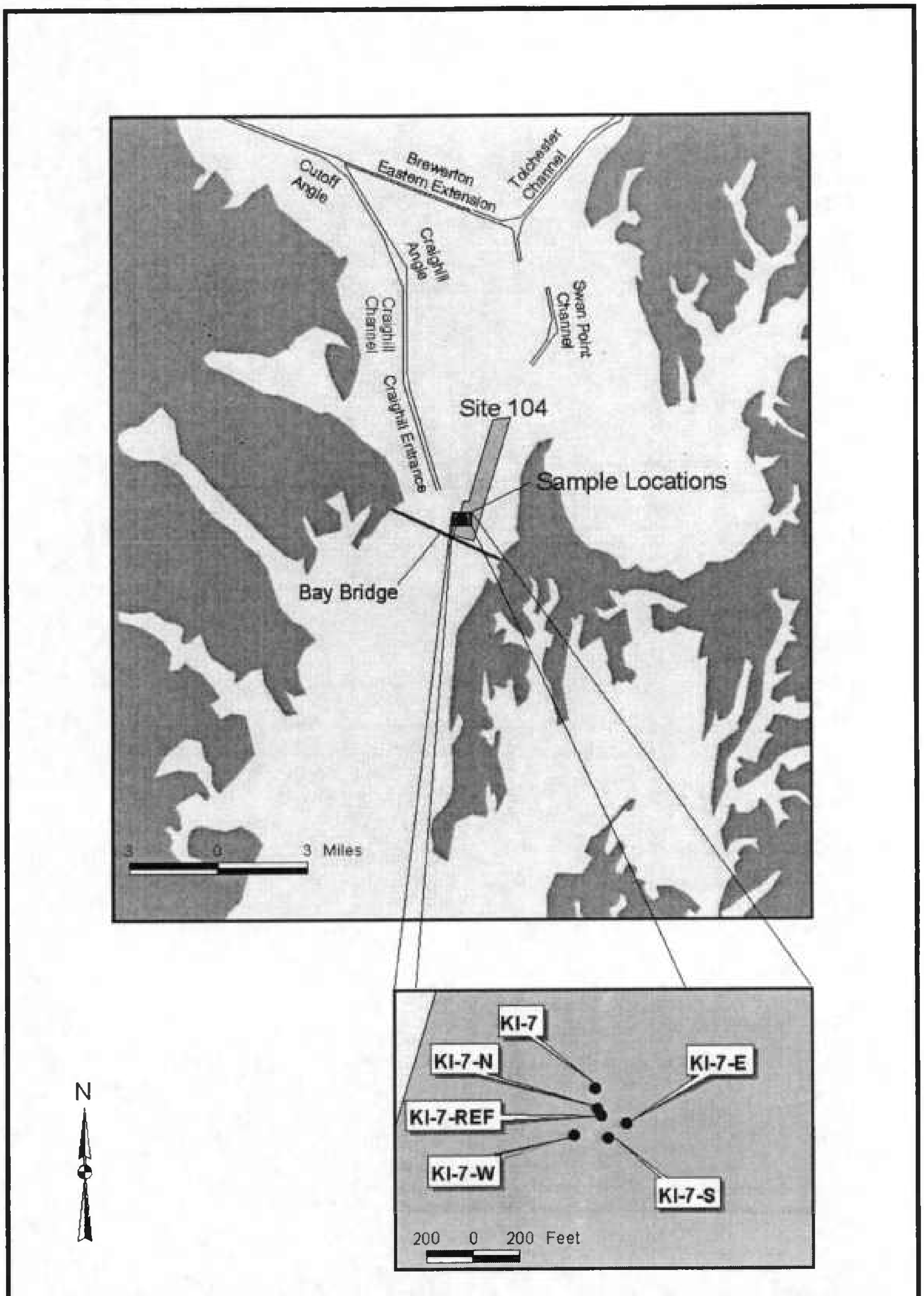

Figure 4-12. Grab sampling locations in the vicinity of KI-7 (Inside Site 104 boundaries).).

DRAFT

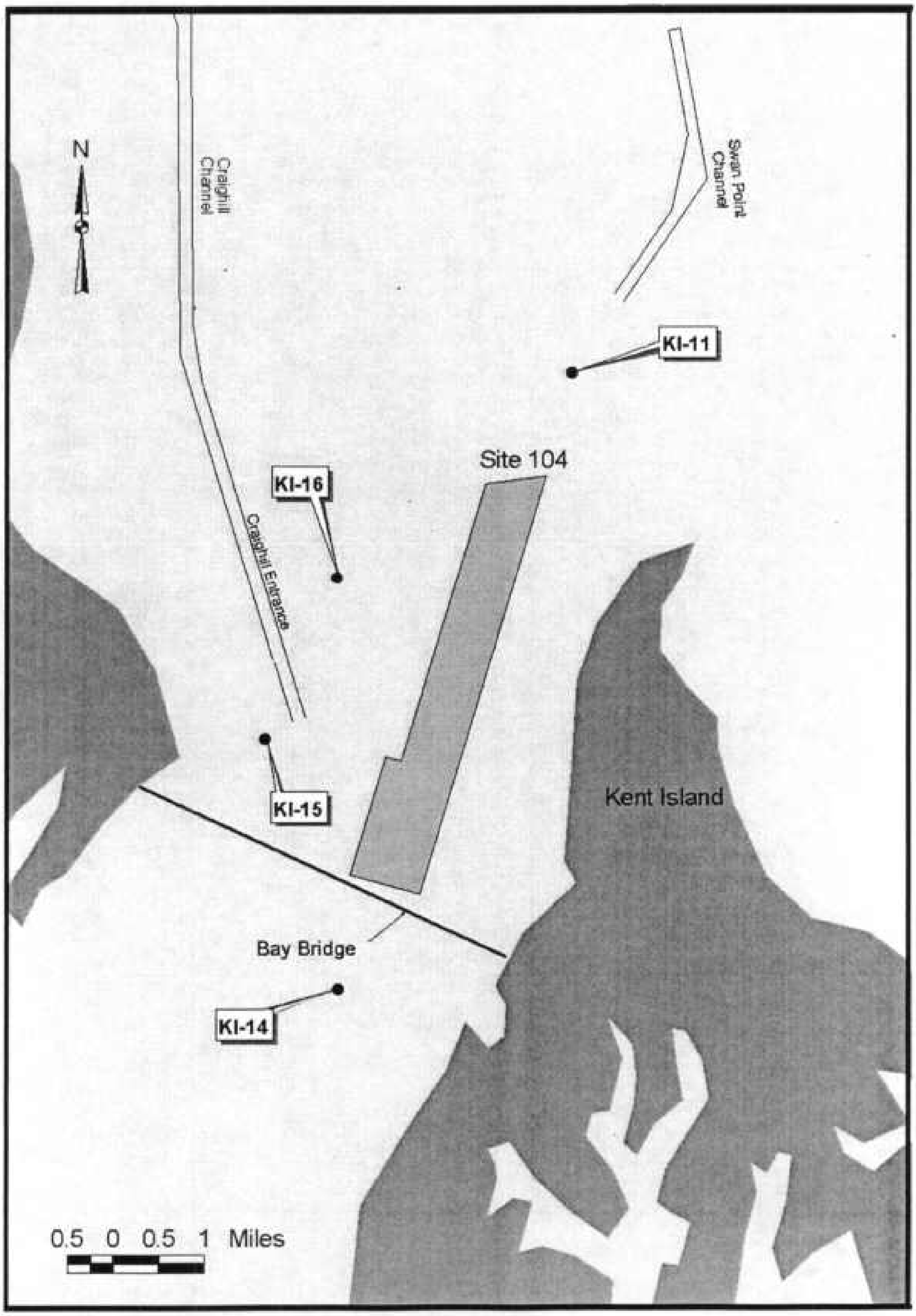

Figure 4-13. Grab sampling locations Outside Site 104.

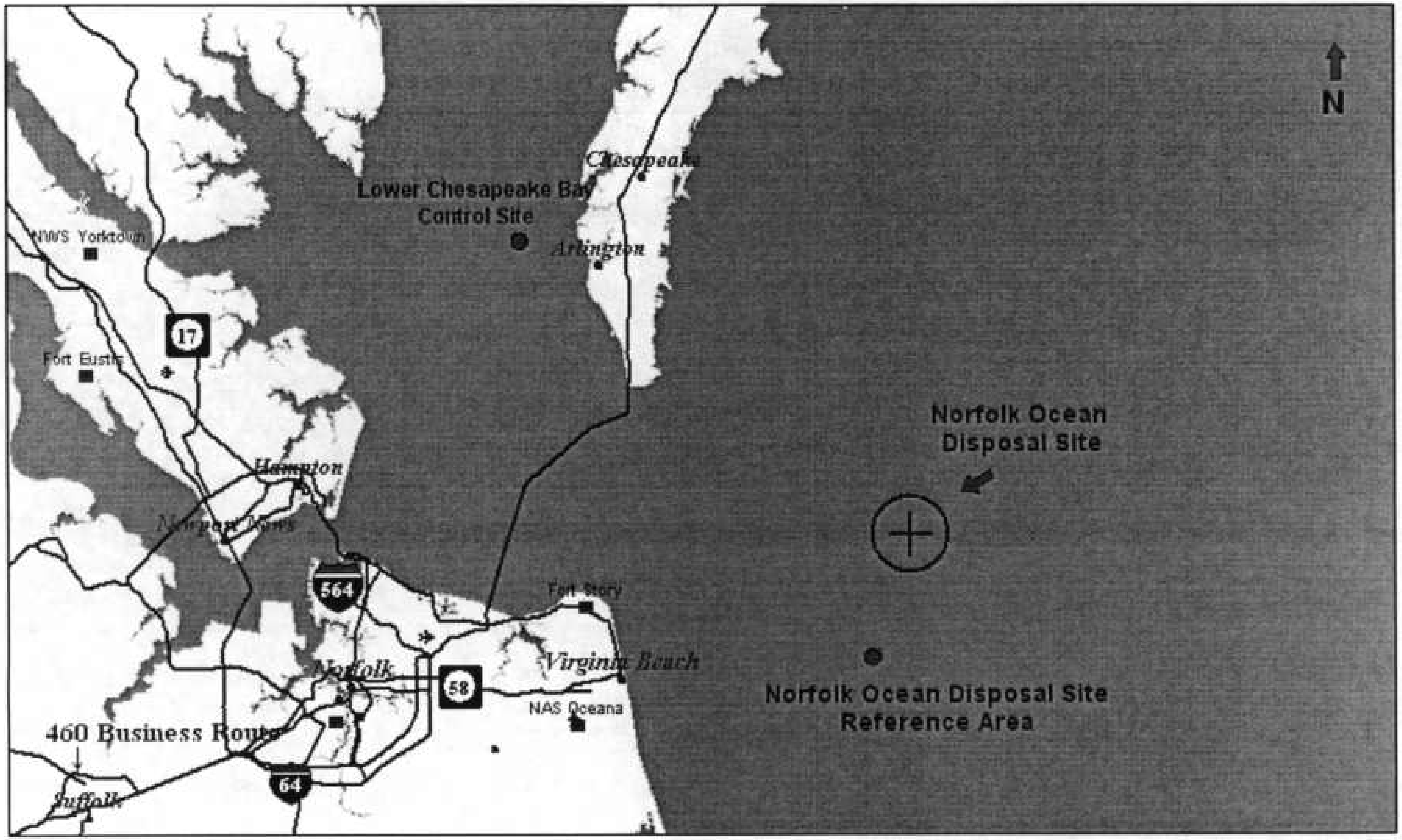

Figure 4-14. Grab sampling locations at the Norfolk Ocean Disposal Reference Area and lower Chesapeake Bay control site

TABLE 4-1 CHANNELS PROPOSED FOR DREDGING IN FY00 AND FY01, VOLUME OF MATERIAL TO BE REMOVED, AND NUMBER OF SAMPLING STATIONS

Channel	Required Depth (ft)	Volume (cubic yards)	No. of Sampling Stations
Craighill Entrance	51	172,000	2
		170,000	2
Craighill Angle	51	290,000	3
		285,000	3
Tolchester Channel	37	360,000	4
		170,000	2
		75,000	1
		250,000	3
Swan Point Channel	37	725,000*	6

* Assumes whole channel will be dredged. Only 6 stations chosen for sampling because actual sediment volume removed will probably be less than 700,000 cy.

TABLE 4-2 SAMPLING STATION COORDINATES

Sampling Reach	Station	(NAD 83) Northing	Easting	Sampling Method
Brewerton Channel Eastern Extension	BE1	546054.6	1484173.9	Grab
	BE2	544207.3	1490512.6	Grab
	BE3	545890.3	1485066.2	Grab
	BE4	548684.8	1479219.6	Grab
C&D Approach Channels	CD-001VC	608800	1541400	Core
	CD-002VC	612175	1545400	Core
	CD003	573600	1528000	Grab
	CD004	581300	1528650	Grab
	CD005	601300	1534250	Grab
	CD006	607525	1540450	Grab
Craighill Channel	CR1	515128.6	1484264.4	Grab
	CR2	521097.4	1484206.8	Grab
	CR3	526054.6	1484173.9	Grab
Craighill Angle-East	CRA-E-001VC	532042.07	1484445.93	Core
	CRA-E-002VC	531405.32	1484484.88	Core
	CRA-E-003VC	535877.91	1482174.72	Core
Craighill Angle-West	CRA-W-001VC	532237.22	1482683.56	Core
	CRA-W-002VC	530098.27	1483263.04	Core
	CRA-W-003VC	533112.97	1482200.47	Core
Craighill Entrance	CRE-001VC	498692.06	1487831.57	Core
	CRE-002VC	499552.33	1487570.33	Core
	CRE-003VC	511593.04	1484861.36	Core
	CRE-004VC	509853.57	1484454.57	Core
Craighill Upper Range	CRU1	538976.2	1479833.7	Grab
	CRU2	543109.9	1477601.3	Grab
	CRU3	547444.2	1475053.4	Grab
Cutoff Angle	CUT1	549257.3	1473781.9	Grab
	CUT2	550463	1472435.6	Grab
	CUT3	551262.7	1470855.7	Grab
Inside Site 104	KI-3	497783.9	1498316.6	Grab
	KI-5	492612.6	1496696.3	Grab
	KI-7	487234.6	1494445.2	Grab
	KI-S-1	486219.1	1493899.7	Grab
	KI-S-2	486641.5	1496423	Grab
Outside Site 104	KI-11	510575.7	1504376.8	Grab
	KI-14	478014.2	1492456.7	Grab
	KI-15	491442.1	1488417.1	Grab
	KI-16	499865	1492147.3	Grab
Swan Point Channel	SWP-001VC	516863.07	1508075.38	Core
	SWP-002VC	521804.29	1510170.87	Core
	SWP-003VC	525645.48	1509913.08	Core
	SWP-004VC	520350	1509900	Core
	SWP-005VC	520325	1511100	Core
	SWP-006VC	521075	1511275	Core
Tolchester Channel – North	TLC-005VC	544160.25	1507775.94	Core
	TLC-006VC	547953.08	1511035.91	Core
	TLC-007VC	555257.61	1518689.51	Core
	TLC-008VC	558006.26	1521327.61	Core
	TLC-009VC	559660.52	1522835.33	Core
	TLC-010VC	561572.83	1523670.53	Core
Tolchester Channel – South	TLC-001VC	538147.01	1504656.41	Core
	TLC-002VC	539002.82	1504887.52	Core
	TLC-003VC	539111.86	1504895.93	Core
	TLC-004VC	539958.37	1505138.26	Core
Tolchester Straightening	TLS-001VC	557840.5	1519614.6	Core
	TLS-002VC	560593.6	1522269	Core

TABLE 4-3 DEPTH OF CORES AND NUMBER OF CORES REQUIRED PER STATION

Sampling Reach	Station	Core Depth	Number of Cores Required*
C&D Approach Channels	CD-001VC	3	9
	CD-002VC	3	9
Craighill Angle-East	CRA-E-001VC	4.5	4
	CRA-E-002VC	2.5	7
	CRA-E-003VC	2.7	6
Craighill Angle-West	CRA-W-001VC	4	4
	CRA-W-002VC	4	4
	CRA-W-003VC	4	4
Craighill Entrance	CRE-001VC	5	3
	CRE-002VC	5	3
	CRE-003VC	4	4
	CRE-004VC	2.5	5
Swan Point Channel	SWP-001VC	4	4
	SWP-002VC	5	3
	SWP-003VC	4	4
	SWP-004VC	4	3
	SWP-005VC	3	5
	SWP-006VC	3	5
Tolchester Channel – North	TLC-005VC	4.7	2
	TLC-006VC	4.8	2
	TLC-007VC	4.5	2
	TLC-008VC	5	2
	TLC-009VC	5	2
	TLC-010VC	4.5	2
Tolchester Channel – South	TLC-001VC	6	2
	TLC-002VC	7	2
	TLC-003VC	7	2
	TLC-004VC	7.5	2
Tolchester Straightening	TLS-001VC	15	2
	TLS-002VC	15	2

* Pre-sampling estimate based on 100% recovery.

TABLE 4-4A SUMMARY OF VIBRACORING ACTIVITIES (SEPTEMBER 1999)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EDT)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
C&D Approach Channels	CD-001VC	CD-001VCSED	10	1	09/21/1999	1219	6	3.8	09/30/1999
				2	09/21/1999	1227	6	4.4	
				3	09/21/1999	1235	6	3*	
				4	09/21/1999	1244	6	5.25	
				5	09/21/1999	1252	6	3.4	
				6	09/21/1999	1300	6	5.25	
				7	09/21/1999	1307	6	4.1	
				8	09/21/1999	1315	6	3.8	
				9	09/21/1999	1324	6	3	
				10	09/21/1999	1333	6	4.5	
	CD-002VC	CD-002VCSED	9	1	09/21/1999	1104	6	5.2	09/30/1999
				2	09/21/1999	1111	6	3.6	
				3	09/21/1999	1119	6	5.2	
				4	09/21/1999	1126	6	4.1	
				5	09/21/1999	1134	6	4.3	
				6	09/21/1999	1143	6	3.4	
				7	09/21/1999	1153	6	5.2	
				8	09/21/1999	1200	6	4.6	
				9	09/21/1999	1207	6	5.3	
Craighill Angle-East	CRA-E-001VC	CRA-E-001VCSED	5	1	09/18/1999	1130	6	3.25	10/01/1999
				2	09/18/1999	1141	6	3.6	
				3	09/18/1999	1150	6	2.6	
				4	09/18/1999	1159	6	3.5	
				5	09/18/1999	1210	6	2.5	
	CRA-E-002VC	CRA-E-002VCSED	9	1	09/19/1999	1316	6	3	10/01/1999
				2	09/19/1999	1320	6	3	
				3	09/19/1999	1340	6	3.5	
				4	09/19/1999	1346	6	3	
				5	09/19/1999	1401	6	2	
				6	09/19/1999	1412	6	2.5	
				7	09/19/1999	1425	6	2.25	
				8	09/19/1999	1433	6	2.0	
				9	09/19/1999	1450	6	1.75*	
	CRA-E-003VC	CRA-E-003VCSED	6	1	09/15/1999	1120	10	3.25	10/01/1999
				2	09/15/1999	1155	10	5	
				3	09/15/1999	1220	10	5	
				4	09/15/1999	1240	10	5	
				5	09/18/1999	1010	10	5	
				6	09/18/1999	1030	10	5	

TABLE 4-4A (CONTINUED)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EDT)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
Craighill Angle-West	CRA-W-001VC	CRA-W-001VCSED	7	1	09/18/1999	1520	6	2.6	09/30/1999
				2	09/18/1999	1532	6	2.7	
				3	09/18/1999	1545	6	2.4	
				4	09/18/1999	1556	6	2.8	
				5	09/18/1999	1603	6	1.9	
				6	09/18/1999	1612	6	2.6*	
				7	09/18/1999	1623	6	2	
	CRA-W-002VC	CRA-W-002VCSED	7	1	09/18/1999	1640	6	2.4	09/30/1999
				2	09/18/1999	1648	6	1.8	
				3	09/18/1999	1656	6	2.3	
				4	09/18/1999	1706	6	1.8	
				5	09/18/1999	1717	6	2.7	
				6	09/18/1999	1726	6	2	
				7	09/18/1999	1747	6	1.9	
	CRA-W-003VC	CRA-W-003VCSED	5	1	09/19/1999	840	6	3	09/30/1999
				2	09/19/1999	845	6	2.7	
				3	09/19/1999	852	6	3.5	
				4	09/19/1999	902	6	3.7	
				5	09/19/1999	911	6	3.4	
Craighill Entrance	CRE-001VC	CRE-001VCSED	5	1	09/19/1999	955	6	2.7	09/30/1999
				2	09/19/1999	1003	6	3.2	
				3	09/19/1999	1014	6	3.4	
				4	09/19/1999	1025	6	2.8	
				5	09/19/1999	1036	6	1.3	
	CRE-002VC	CRE-002VCSED	6	1	09/19/1999	1053	6	3.3	09/30/1999
				2	09/19/1999	1059	6	2.4	
				3	09/19/1999	1109	6	3.7	
				4	09/19/1999	1116	6	3.8	
				5	09/19/1999	1125	6	3.5*	
				6	09/19/1999	1134	6	3.1	
	CRE-003VC	CRE-003VCSED	5	1	09/19/1999	1337	6	3.8	09/30/1999
				2	09/19/1999	1342	6	5	
				3	09/19/1999	1350	6	4.8	
				4	09/19/1999	1358	6	4.8	
				5	09/19/1999	1406	6	5.2	
	CRE-004VC	CRE-004VCSED	5	1	09/19/1999	1157	6	2.5	09/30/1999
				2	09/19/1999	1215	6	3	
				3	09/19/1999	1222	6	2.8	
				4	09/19/1999	1229	6	4.2	
				5	09/19/1999	1236	6	3.8	

TABLE 4-4A (CONTINUED)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EDT)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
Swan Point Channel	SWP-001VC	SWP-001VCSED	4	1	09/19/1999	1605	6	5.1	09/30/1999
				2	09/19/1999	1612	6	3.7	
				3	09/19/1999	1623	6	4.2	
				4	09/19/1999	1630	6	4.0	
	SWP-002VC	SWP-002VCSED	4	1	09/19/1999	1525	6	3.5	09/30/1999
				2	09/19/1999	1533	6	3.7	
				3	09/19/1999	1544	6	5.2	
				4	09/19/1999	1553	6	4.5*	
	SWP-003VC	SWP-003VCSED	4	1	09/19/1999	1446	6	4.6	09/30/1999
				2	09/19/1999	1456	6	3.3	
				3	09/19/1999	1505	6	5.3	
				4	09/19/1999	1512	6	4.5	
	SWP-004VC	SWP-004VCSED	5	1	09/23/1999	1529	6	3.2	09/30/1999
				2	09/23/1999	1538	6	2.8	
				3	09/23/1999	1549	6	4.0	
				4	09/23/1999	1601	6	3.0	
				5	09/23/1999	1611	6	3.8	
	SWP-005VC	SWP-005VCSED	5	1	09/23/1999	1411	6	3.1	09/30/1999
				2	09/23/1999	1435	6	3.9	
				3	09/23/1999	1447	6	3.8	
				4	09/23/1999	1458	6	2.5	
	SWP-006VC	SWP-006VCSED	5	1	09/23/1999	1308	6	4.7	09/30/1999
				2	09/23/1999	1319	6	3.2	
				3	09/23/1999	1332	6	2.3	
				4	09/23/1999	1341	6	3.4	
				5	09/23/1999	1354	6	3.8	

TABLE 4-4A (CONTINUED)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EDT)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
Tolchester Channel - North	TLC-N-005VC	TLC-N-005VCSED	2	1	09/20/1999	1022	6	5.2	10/01/1999
				2	09/20/1999	1031	6	4.7	
	TLC-N-006VC	TLC-N-006VCSED	3	1	09/20/1999	1046	6	4.3	10/01/1999
				2	09/20/1999	1054	6	4.2	
				3	09/20/1999	1107	6	5.2	
	TLC-N-007VC	TLC-N-007VCSED	4	1	09/20/1999	1129	6	4.2	10/01/1999
				2	09/20/1999	1138	6	3.5	
				3	09/20/1999	1149	6	3.3*	
				4	09/20/1999	1158	6	5.2	
	TLC-N-008VC	TLC-N-008VCSED	2	1	09/20/1999	1307	6	4.6	10/01/1999
				2	09/20/1999	1316	6	5.1	
	TLC-N-009VC	TLC-N-009VCSED	3	1	09/20/1999	1329	6	3.2	10/01/1999
				2	09/20/1999	1338	6	5.5	
				3	09/20/1999	1347	6	4.9	
	TLC-N-010VC	TLC-N-010VCSED	3	1	09/20/1999	1404	6	3.1	10/01/1999
				2	09/20/1999	1412	6	5.0	
				3	09/20/1999	1424	6	5.1	
Tolchester Channel - South	TLC-S-001VC	TLC-S-001VCSED	3	1	09/19/1999	1708	6	4.8	09/30/1999
				2	09/19/1999	1717	6	5.3	
				3	09/19/1999	1725	6	4.8	
	TLC-S-002VC	TLC-S-002VCSED	3	1	09/20/1999	855	10	6.9	09/30/1999
				2	09/20/1999	910	10	6.1	
				3	09/20/1999	928	6	2.7*	
	TLC-S-003VC	TLC-S-003VCSED	3	1	09/23/1999	1109	12	8.1	09/30/1999
				2	09/23/1999	1126	12	4.7	
				3	09/23/1999	1138	12	2.3	
	TLC-S-004VC	TLC-S-004VCSED	2	1	09/20/1999	941	10	7.8	09/30/1999
				2	09/20/1999	949	10	7.2	
Tolchester Straightening	TLS-001VC	TLS-001VCSED	4	1	09/23/1999	906	12	4.5*	09/30/1999
				2	09/23/1999	922	12	9.3	
				3	09/23/1999	936	12	9.4	
				4	09/23/1999	1022	12	8.1	
	TLS-002VC	TLS-002VCSED	3	1	09/20/1999	1519	16	12	09/30/1999
				2	09/20/1999	1636	12	7.8	
				3	09/20/1999	1651	12	9.5	

(a) = Core from individual stations composited first; sub-sample removed for analyical testing; then reach composite created for ecotoxicological testing.

* = Core submitted to WES for particle settling tests.

TABLE 4-4B SUMMARY OF VIBRACORING ACTIVITIES (DECEMBER 1999)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EST)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
C&D Approach Channels	CD-001VC	CD-001VCSED	4	1	12/08/1999	935	10.5	5.83	12/17/1999
				2	12/08/1999	950	10	7.08	12/17/1999
				3	12/08/1999	1004	10	6.5	12/17/1999
				4	12/09/1999	1518	10	4	12/17/1999
	CD-002VC	CD-002VCSED	4	1	12/08/1999	829	8	4.67	12/17/1999
				2	12/08/1999	841	8	4.625	12/17/1999
				3	12/08/1999	855	8	4.5	12/17/1999
				4	12/09/1999	1540	10	4	12/17/1999
Craighill Angle-East	CRA-E-001VC	CRA-E-001VCSED	4	1	12/15/1999	1105	10	4	12/17/1999
				2	12/15/1999	1120	10	3.17	12/17/1999
				3	12/15/1999	1135	10	3.5	12/17/1999
				4	12/15/1999	1150	10	4	12/17/1999
	CRA-E-002VC	CRA-E-002VCSED	7	1	12/15/1999	918	10	4.75	12/17/1999
				2	12/15/1999	930	10	2.08	12/17/1999
				3	12/15/1999	950	10	4.25	12/17/1999
				4	12/15/1999	1005	10	3.92	12/17/1999
				5	12/15/1999	1020	10	6.17	12/17/1999
				6	12/15/1999	1028	10	4.33	12/17/1999
				7	12/15/1999	1045	10	2.67	12/17/1999
	CRA-E-003VC	CRA-E-003VCSED	7	1	12/15/1999	743	8	4.67	12/17/1999
				2	12/15/1999	755	8	4.5	12/17/1999
				3	12/15/1999	810	8	4.67	12/17/1999
				4	12/15/1999	820	8	3	12/17/1999
				5	12/15/1999	830	8	4.5	12/17/1999
				6	12/15/1999	845	8	4.92	12/17/1999
				7	12/15/1999	856	8	3.58	12/17/1999
Craighill Angle-West	CRA-W-001VC	CRA-W-001VCSED	4	1	12/14/1999	755	8	3.5	12/17/1999
				2	12/14/1999	816	10	4.83	12/17/1999
				3	12/14/1999	842	10	4.5	12/17/1999
				4	12/14/1999	908	10	3.67	12/17/1999
	CRA-W-002VC	CRA-W-002VCSED	5	1	12/14/1999	945	10	4.5	12/17/1999
				2	12/14/1999	1035	10	3.83	12/17/1999
				3	12/14/1999	1115	10	3.42	12/17/1999
				4	12/14/1999	1125	10	3	12/17/1999
				5	12/14/1999	1145	10	4.33	12/17/1999
	CRA-W-003VC	CRA-W-003VCSED	4	1	12/14/1999	1250	10	4	12/17/1999
				2	12/14/1999	1315	10	2.17	12/17/1999
				3	12/14/1999	1345	10	2.5	12/17/1999
				4	12/14/1999	1420	10	2.58	12/17/1999

TABLE 4-4B (CONTINUED)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EST)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
Craighill Entrance	CRE-001VC	CRE-001VCSED	5	1	12/15/1999	1334	10	3.75	12/17/1999
				2	12/15/1999	1345	10	3.67	12/17/1999
				3	12/15/1999	1412	10	3.5	12/17/1999
				4	12/15/1999	1426	10	3.08	12/17/1999
				5	12/15/1999	1440	10	3.25	12/17/1999
	CRE-002VC	CRE-002VCSED	3	1	12/15/1999	1245	7	3	12/17/1999
				2	12/15/1999	1305	9	2.25	12/17/1999
				3	12/15/1999	1315	10	3	12/17/1999
	CRE-003VC	CRE-003VCSED	2	1	12/14/1999	1623	10	2.67	12/17/1999
				2	12/14/1999	1640	10	3.33	12/17/1999
	CRE-004VC	CRE-004VCSED	4	1	12/14/1999	1500	10	1.92	12/17/1999
				2	12/14/1999	1535	10	5.17	12/17/1999
				3	12/14/1999	1550	10	5.58	12/17/1999
				4	12/14/1999	1603	10	5.58	12/17/1999
Swan Point Channel	SWP-001VC	SWP-001VCSED	2	1	12/10/1999	718	10	4	12/17/1999
				2	12/10/1999	736	10	4	12/17/1999
	SWP-002VC	SWP-002VCSED	2	1	12/09/1999	1129	10	5	12/17/1999
				2	12/09/1999	1140	10	6.58	12/17/1999
	SWP-003VC	SWP-003VCSED	2	1	12/09/1999	1056	10	5.75	12/17/1999
				2	12/09/1999	1109	10	6.75	12/17/1999
	SWP-004VC	SWP-004VCSED	2	1	12/10/1999	802	10	4.83	12/17/1999
				2	12/10/1999	815	10	4	12/17/1999
	SWP-005VC	SWP-005VCSED	3	1	12/10/1999	850	10	4.67	12/17/1999
				2	12/10/1999	900	10	4.42	12/17/1999
				3	12/10/1999	934	10	4.25	12/17/1999
	SWP-006VC	SWP-006VCSED	3	1	12/10/1999	1014	10	5	12/17/1999
				2	12/10/1999	1026	10	4.25	12/17/1999
				3	12/10/1999	1037	10	4.67	12/17/1999
Tolchester Channel - North	TLC-N-005VC	TLC-N-005VCSED	2	1	12/08/1999	1435	10	6.42	12/17/1999
				2	12/08/1999	1450	10	6.67	12/17/1999
	TLC-N-006VC	TLC-N-006VCSED	2	1	12/08/1999	1358	10	4.67	12/17/1999
				2	12/08/1999	1414	10	7	12/17/1999
	TLC-N-007VC	TLC-N-007VCSED	2	1	12/08/1999	1307	10	5.58	12/17/1999
				2	12/08/1999	1320	10	5.83	12/17/1999
	TLC-N-008VC	TLC-N-008VCSED	2	1	12/08/1999	1157	10	5.04	12/17/1999
				2	12/08/1999	1211	10	5.67	12/17/1999
	TLC-N-009VC	TLC-N-009VCSED	2	1	12/08/1999	1126	10	6.42	12/17/1999
				2	12/08/1999	1140	10	5.83	12/17/1999
	TLC-N-010VC	TLC-N-010VCSED	2	1	12/08/1999	1056	10	5.83	12/17/1999
				2	12/08/1999	1109	10	5.625	12/17/1999

TABLE 4-4B (CONTINUED)

Sampling Reach	Station ID	Sediment Sample ID	Total # Cores Collected	Core No.	Collection Date	Collection Time (EST)	Penetration Depth (ft)	Recovery (ft)	Processing / Compositing Date
Tolchester Channel - South	TLC-S-001VC	TLC-S-001VCSED	2	1	12/09/1999	1015	10	7.67	12/17/1999
				2	12/09/1999	1025	10	7.42	12/17/1999
	TLC-S-002VC	TLC-S-002VCSED	2	1	12/09/1999	940	10	6.5	12/17/1999
				2	12/09/1999	952	10	7.17	12/17/1999
	TLC-S-003VC	TLC-S-003VCSED	2	1	12/09/1999	910	10	5	12/17/1999
				2	12/09/1999	920	10	5.71	12/17/1999
	TLC-S-004VC	TLC-S-004VCSED	3	1	12/08/1999	1523	10	5.67	12/17/1999
				2	12/08/1999	1553	10	5.67	12/17/1999
				3	12/08/1999	1605	10	6.33	12/17/1999
Tolchester Straightening	TLS-001VC	TLS-001VCSED	2	1	12/09/1999	820	18	12.08	12/17/1999
				2	12/09/1999	1420	18	13	12/17/1999
	TLS-002VC	TLS-002VCSED	2	1	12/09/1999	744	18	12.42	12/17/1999
				2	12/09/1999	1340	18	12.875	12/17/1999

TABLE 4-5A SUMMARY OF GRAB SAMPLING ACTIVITIES SEPTEMBER 1999

Sampling Reach	Station ID	Sediment Sample ID	Sample Date	Time (EDT)	Compositing Date[a]
Brewerton Channel Eastern Extension	BE1	BE1SED	09/27/1999	1615	10/01/1999
	BE2	BE2SED	09/27/1999	1443	
	BE3	BE3SED	09/27/1999	1715	
	BE3	BE3SEDFD	09/27/1999	1720	
	BE4	BE4SED	09/27/1999	1745	
C&D Approach Channels	CD003	CD003SED	09/27/1999	1455	10/01/1999
	CD004	CD004SED	09/27/1999	1410	
	CD005	CD005SED	09/27/1999	1340	
	CD006	CD006SED	09/27/1999	1300	
Craighill Channel	CR1	CR1SED	09/28/1999	1246	10/01/1999
	CR2	CR2SED	09/28/1999	1209	
	CR3	CR3SED	09/28/1999	1140	
Craighill Upper Range	CRU1	CRU1SED	09/28/1999	1057	10/01/1999
	CRU2	CRU2SED	09/28/1999	1025	
	CRU2	CRU2SEDFD	09/28/1999	1035	
	CRU3	CRU3SED	09/28/1999	0955	
Cutoff Angle	CUT1	CUT1SED	09/28/1999	0925	10/01/1999
	CUT2	CUT2SED	09/28/1999	0840	
	CUT3	CUT3SED	09/28/1999	0810	
Inside Site 104	KI-7N	KI-7N-SED	09/29/1999	0818	NC
	KI-7S	KI-7S-SED	09/29/1999	1124	
	KI-7E	KI-7E-SED	09/29/1999	1323	
	KI-7W	KI-7W-SED	09/29/1999	1412	
	KI-7	KI-7-SED	09/28/1999	1510	
	KI-3	KI-3-SED	09/28/1999	1410	10/01/1999
	KI-5	KI-5-SED	09/28/1999	1448	
	KI-7-REF	KI-7-REFSED	09/29/1999	0934	
	KI-7-REFFD	KI-7-REFSEDFD	09/29/1999	1100	
	KI-S-1	KI-S-1-SED	09/28/1999	1700	
	KI-S-2	KI-S-2-SED	09/28/1999	1725	

(a) = Date that reach composite was created for ecotoxicological testing.

NC = Not composited for ecotoxicological testing; chemical analysis of individual samples only.

TABLE 4-5B SUMMARY OF GRAB SAMPLING ACTIVITIES DECEMBER 1999

Sampling Reach	Station ID	Sediment Sample ID	Collection Date	Collection Time (EST)	Compositing Date[(a)]
Brewerton Channel Eastern Extension	BE1	BE1SED	12/14/1999	1540	12/17/1999
	BE2	BE2SED	12/14/1999	1415	
	BE3	BE3SED	12/14/1999	1500	
	BE3	BE3SEDFD	12/14/1999	1500	
	BE4	BE4SED	12/14/1999	1555	
C&D Approach Channels	CD003	CD003SED	12/14/1999	1235	12/17/1999
	CD004	CD004SED	12/14/1999	1155	
	CD005	CD005SED	12/14/1999	1115	
	CD006	CD006SED	12/14/1999	1055	
Craighill Channel	CR1	CR1SED	12/13/1999	1535	12/17/1999
	CR2	CR2SED	12/13/1999	1555	
	CR3	CR3SED	12/13/1999	1630	
Craighill Upper Range	CRU1	CRU1SED	12/15/1999	835	12/17/1999
	CRU2	CRU2SED	12/15/1999	915	
	CRU2	CRU2SEDFD	12/15/1999	915	
	CRU3	CRU3SED	12/15/1999	940	
Cutoff Angle	CUT1	CUT1SED	12/15/1999	1005	12/17/1999
	CUT2	CUT2SED	12/15/1999	1030	
	CUT3	CUT3SED	12/15/1999	1105	
Inside Site 104	KI-3	KI-3-SED	12/13/1999	1340	12/17/1999
	KI-5	KI-5-SED	12/13/1999	1350	
	KI-7-REF	KI-7-REF-SED	12/13/1999	1425	
	KI-S-1	KI-S-1-SED	12/13/1999	1405	
	KI-S-2	KI-S-2-SED	12/13/1999	1505	
Outside Site 104	KI-11	KI-11-SED	12/13/1999	1115	12/17/1999
	KI-14	KI-14-SED	12/13/1999	1225	
	KI-15	KI-15-SED	12/13/1999	1155	
	KI-16	KI-16-SED	12/13/1999	1130	

(a) = Date that reach composite was created for ecotoxicological testing.

TABLE 4-6 SAMPLING LOCATION COORDINATES FOR NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA AND LOWER CHESAPEAKE BAY CONTROL SITE

Station	Collection Date	Latitude	Longitude	Station Depth (ft)
Ocean Reference	Feb. 1, 2000	36° 52.6' N	75° 41.5' W	71
Control	Jan. 12, 2000	37° 15.0' N	76° 5.7' W	51

4-7A SUMMARY OF WATER SAMPLES COLLECTED IN SEPTEMBER 1999

Sampling Reach	Station ID	Water Sample ID	Sample Date	Sample Time	Sample Type
Brewerton Channel Eastern Extension	BE2	BE-SW	09/27/1999	1645	Elutriate Preparation Water
C&D Approach Channels	CD-002VC	CD-VC-SW	09/21/1999	1230	Elutriate Preparation Water
	CD004	CD-SW	09/27/1999	1420	Elutriate Preparation Water
Craighill Channel	CR2	CR-SW	09/28/1999	1205	Elutriate Preparation Water
Craighill Angle-East	CRA-E-002VC	CRA-E-SW	09/18/1999	1315	Elutriate Preparation Water
Craighill Angle-West	CRA-W-002VC	CRA-W-SW	09/18/1999	1645	Elutriate Preparation Water
Craighill Entrance	CRE-002VC	CRE-SW	09/19/1999	1052	Elutriate Preparation Water
Craighill Upper Range	CRU2	CRU-SW	09/28/1999	1020	Elutriate Preparation Water
Cutoff Angle	CUT2	CUT-SW	09/28/1999	835	Elutriate Preparation Water
Inside Site 104	KI-3	KI-3WAT	09/28/1999	1415	Receiving Water
	KI-7-REF	KI-SW	09/28/1999	1540	Elutriate Preparation Water
	KI-7-REF	KI-7WAT	09/28/1999	1600	Receiving Water
	KI-7-REF	KI-7WATFD	09/28/1999	1615	Receiving Water
	KI-7-REF	KI-7WATMS	09/28/1999	1630	Receiving Water
	KI-7-REF	KI-7WATMSD	09/28/1999	1645	Receiving Water
Swan Point Channel	SWP-002VC	SWP-SW	09/19/1999	1530	Elutriate Preparation Water
Tolchester Channel - North	TLC-N-007VC	TLC-N-SW	09/20/1999	1130	Elutriate Preparation Water
Tolchester Channel - South	TLC-S-002VC	TLC-S-SW	09/20/1999	850	Elutriate Preparation Water
Tolchester Straightening	TLS-001VC	TLS-SW	09/27/1999	1520	Elutriate Preparation Water

TABLE 4-7B SUMMARY OF WATER SAMPLES COLLECTED IN DECEMBER 1999

Sampling Reach	Station ID	Water Sample ID	Sample Date	Sample Time	Sample Type
Brewerton Channel Eastern Extension	BE2	BE-SW	12/14/1999	1420	Elutriate Preparation Water
C&D Approach Channels	CD-002VC	CD-VC-SW	12/08/1999	845	Elutriate Preparation Water
	CD004	CD-SW	12/14/1999	1210	Elutriate Preparation Water
Craighill Channel	CR2	CR-SW	12/13/1999	1600	Elutriate Preparation Water
Craighill Angle-East	CRA-E-002VC	CRA-E-SW	12/15/1999	930	Elutriate Preparation Water
Craighill Angle-West	CRA-W-002VC	CRA-W-SW	12/14/1999	950	Elutriate Preparation Water
Craighill Entrance	CRE-002VC	CRE-SW	12/15/1999	1300	Elutriate Preparation Water
Craighill Upper Range	CRU2	CRU-SW	12/15/1999	915	Elutriate Preparation Water
Cutoff Angle	CUT2	CUT-SW	12/15/1999	1035	Elutriate Preparation Water
Inside Site 104	KI-7-REF	KI-SW	12/13/1999	1430	Elutriate Preparation Water
	KI-7-REF	KI-7WAT	12/13/1999	1430	Receiving Water
	KI-7-REF	KI-7WATMS	12/13/1999	1430	Receiving Water
	KI-7-REF	KI-7WATMSD	12/13/1999	1430	Receiving Water
Outside Site 104	KI-14	KI-OUT-SW	12/13/1999	1235	Elutriate Preparation Water
	KI-14	KI-14WAT	12/13/1999	1235	Receiving Water
Swan Point Channel	SWP-002VC	SWP-SW	12/09/1999	1145	Elutriate Preparation Water
Tolchester Channel - North	TLC-N-007VC	TLC-N-SW	12/08/1999	1315	Elutriate Preparation Water
Tolchester Channel - South	TLC-S-002VC	TLC-S-SW	12/09/1999	950	Elutriate Preparation Water
Tolchester Straightening	TLS-001VC	TLS-SW	12/09/1999	830	Elutriate Preparation Water

TABLE 4-8 REQUIRED CONTAINERS, PRESERVATION TECHNIQUE, AND HOLDING TIMES FOR AQUEOUS SAMPLES

Parameter	Volume Required (mL)	Container[b]	Preservative	Holding Time[a]
Inorganics				
Mercury	100	P	pH <2 with HNO_3 Cool, 4°C	28 days
Other Metals	100	P	pH <2 with HNO_3 Cool, 4°C	6 months
Cyanide	500	P,G	NaOH to pH >12 Ascorbic Acid Cool, 4°C	14 days
Sulfide	500	P,G	NaOH to pH >9 Zinc Acetate Cool, 4°C	7 days
Ammonia	500	P,G	H_2SO_4 to pH <2 Cool, 4°C	28 days
Biological Oxygen Demand	1000	P,G	Cool, 4°C	48 hours
Chemical Oxygen Demand	50	P,G	H_2SO_4 to pH <2 Cool, 4°C	28 days
Nitrogen (Ammonia, Total Kjeldahl, Nitrate+Nitrite), Total Phosphorus	1050	P,G	H_2SO_4 to pH <2 Cool, 4°C	28 days
Organics				
Total Organic Carbon	50	P,G	H_2SO_4 or HCl to PH <2 Cool, 4°C	28 days
Organotins	1000	G, teflon-lined cap	Cool, 4°C	7 days until extraction, 7 days from extraction to derivatization, 40 days after extraction
Volatile Organic Compounds	80	G, teflon-lined septum	Cool, 4°C	14 days
Dioxins/Furans	1,000	G, teflon-lined cap	Cool, 4°C	30 days until extraction, 40 days after extraction

(a) From time of sample collection.
(b) P = plastic; G = glass.

TABLE 4-9 REQUIRED CONTAINERS, PRESERVATION TECHNIQUE, AND HOLDING TIMES FOR SEDIMENT SAMPLES

Parameter	Mass Required (g)	Container[b]	Preservative	Holding Time[a]
Inorganics				
Mercury	5	P	4°C	28 days
Other Metals	5	P	4°C	6 months
Cyanide	50	P,G	4°C	14 days
Sulfide	10	P,G	4°C	7 days
Acid Volatile Sulfides (AVS)	25	P, G	4°C	14 days
Ammonia	10	G	4°C	28 days
Biological Oxygen Demand	10	G	4°C	48 hours
Chemical Oxygen Demand	50	P,G	4°C	28 days
Nitrogen (Ammonia, Total Kjeldahl, Nitrate+Nitrite), Total Phosphorus	150	P,G	4°C	28 days
Physical Parameters				
Elutriate Preparation	1500	G	4°C	14 days until elutriate prep. Follow aqueous hold times after prep.
Total Moisture, Grain Size, Atterberg Limits, Specific Gravity	1000	P,G	4°C	6 months
Organics				
Total Organic Carbon	5	Heat treated glass vial with Teflon-lined lid[b]	4°C	14 days
Organotins	100	G	4°C	14 days until extraction, 7 days from extraction to derivatization, 40 days after extraction
Pesticides (Organochlorine and Organophosphate),PCB Congeners, Semivolatile Organics, Polynuclear Aromatic Hydrocarbons	400	G	4°C	14 days until extraction, 40 days after extraction
Volatile Organic Compounds	50	Heat-heated glass vial with Teflon-lined lid	4°C	14 days
Dioxins/Furans	40	G	4°C	30 days until extraction, 40 days after extraction

(a) From time of sample collection for grab samples; from the time of removal from the core liner for core samples.
(b) P = plastic; G = glass.

TABLE 4-10 RECOMMENDED CONTAINERS, PRESERVATION TECHNIQUE, AND HOLDING TIMES FOR TOXICITY AND BIOACCUMULATION TESTING

Parameter	Mass Required (g)	Container[b]	Preservative	Holding Time[a]
Toxicity and Bioaccumulation Testing				
Whole Sediment	30 L	P	≤ 4°C/dark	Optimum 14 days, maximum 6 weeks
Water Column	10 L	P	≤ 4°C/dark	Elutriate from sediment prepared within 24 hours of test initiation

(a) From time of sample collection per USEPA/USACE (1991), *The Green Book*, and USEPA/USACE (1995), *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations.*

(b) Polyethylene (P) or glass (G).

TABLE 4-11 BALTIMORE HARBOR APPROACH CHANNELS: SUMMARY OF SAMPLE IDs AND SAMPLE TYPES

Sampling Reach	Station ID	Sediment Sample ID	Ecotox Sample ID	Elutriate Site Water ID	Elutriate Sample ID
Brewerton Channel Eastern Extension	BE1	BE1SED	BE-TOX	BE-SW	BE-EL
	BE2	BE2SED			
	BE3	BE3SED			
	BE4	BE4SED			
C&D Approach Channels	CD-001VC	CD-001VCSED	CD-VC-TOX	CD-VC-SW	CD-VC-EL
	CD-002VC	CD-002VCSED			
	CD003	CD003SED	CD-TOX	CD-SW	CD-EL
	CD004	CD004SED			
	CD005	CD005SED			
	CD006	CD006SED			
Craighill Channel	CR1	CR1SED	CR-TOX	CR-SW	CR-EL
	CR2	CR2SED			
	CR3	CR3SED			
Craighill Angle-East	CRA-E-001VC	CRA-E-001VCSED	CRA-E-TOX	CRA-E-SW	CRA-E-VC-EL
	CRA-E-002VC	CRA-E-002VCSED			
	CRA-E-003VC	CRA-E-003VCSED			
Craighill Angle-West	CRA-W-001VC	CRA-W-001VCSED	CRA-W-TOX	CRA-W-SW	CRA-W-VC-EL
	CRA-W-002VC	CRA-W-002VCSED			
	CRA-W-003VC	CRA-W-003VCSED			
Craighill Entrance	CRE-001VC	CRE-001VCSED	CRE-TOX	CRE-SW	CRE-VC-EL
	CRE-002VC	CRE-002VCSED			
	CRE-003VC	CRE-003VCSED			
	CRE-004VC	CRE-004VCSED			
Craighill Upper Range	CRU1	CRU1SED	CRU-TOX	CRU-SW	CRU-EL
	CRU2	CRU2SED			
	CRU3	CRU3SED			
Cutoff Angle	CUT1	CUT1SED	CUT-TOX	CUT-SW	CUT-EL
	CUT2	CUT2SED			
	CUT3	CUT3SED			
Swan Point Channel	SWP-001VC	SWP-001VCSED	SWP-TOX	SWP-SW	SWP-VC-EL
	SWP-002VC	SWP-002VCSED			
	SWP-003VC	SWP-003VCSED			
	SWP-004VC	SWP-004VCSED			
	SWP-005VC	SWP-005VCSED			
	SWP-006VC	SWP-006VCSED			
Tolchester Channel - North	TLC-N-005VC	TLC-N-005VCSED	TLC-N-TOX	TLC-N-SW	TLC-N-VC-EL
	TLC-N-006VC	TLC-N-006VCSED			
	TLC-N-007VC	TLC-N-007VCSED			
	TLC-N-008VC	TLC-N-008VCSED			
	TLC-N-009VC	TLC-N-009VCSED			
	TLC-N-010VC	TLC-N-010VCSED			
Tolchester Channel - South	TLC-S-001VC	TLC-S-001VCSED	TLC-S-TOX	TLC-S-SW	TLC-S-VC-EL
	TLC-S-002VC	TLC-S-002VCSED			
	TLC-S-003VC	TLC-S-003VCSED			
	TLC-S-004VC	TLC-S-004VCSED			
Tolchester Straightening	TLS-001VC	TLS-001VCSED	TLS-TOX	TLS-SW	TLS-VC-EL
	TLS-002VC	TLS-002VCSED			

TABLE 4-12 PLACEMENT SITE 104: SUMMARY OF SAMPLE IDs AND SAMPLE TYPES

Sampling Reach	Station ID	Sediment Sample ID	Water Sample ID	Ecotox Sample ID	Elutriate Site Water ID	Elutriate Sample ID
Inside Site 104	KI-3	KI-3SED	KI-3WAT	KI-TOX	KI-SW	KI-EL
	KI-5	KI-5SED	-			
	KI-7	KI-7REFSED	KI-7WAT KI-7WATFD			
	KI-S-1	KI-S-1SED	-			
	KI-S-2	KI-S-2SED	-			
	KI-7	KI-7REFSED	-	-	KI-SW	KI-7-EL
	KI-7	KI-7-REFSEDFD	-			
	KI-7	KI-7SED*	-			
		KI-7SEDFD*	-			
		KI-7N**	-			
		KI-7S**	-			
		KI-7E**	-			
		KI-7W*	-			
Outside Site 104	KI-11	KI-11SED	-	KI-OUT-TOX	KI-OUT-SW	KI-OUT-EL
	KI-14	KI-14SED	KI-14WAT			
	KI-15	KI-15SED	-			
	KI-16	KI-16SED	-			
Ocean Reference	Ocean	Ocean Reference	Ocean Reference-SW	Ocean Reference-TOX	Reference-SW	Reference-EL
	Lower Chesapeake Bay	Control	-			

* not included in tox or elutriate composite.

** for delineation of KI-7.

CHAPTER 5 -
ANALYTICAL TESTING METHODS

5. ANALYTICAL TESTING OF BULK SEDIMENT, WATER, AND TISSUE

Analytical testing of sediment, water, elutriates, and tissue was conducted by STL–Baltimore (formerly EA Laboratories) located in Sparks, Maryland. Additional analytical support was provided by EBA Engineering (grain size and Atterberg Limits); EA's Ecotoxicology Laboratory (moisture content in tissue); STL–Burlington, Vermont (butyltins); and Paradiagm Analytical Laboratory (PAL) (dioxin and furan congeners).

Sediments, receiving water, and elutriates were tested for the following chemical fractions:

- volatile organic compounds (VOCs),
- semivolatile organic compounds (SVOCs),
- chlorinated and organophosphorus pesticides,
- polychlorinated biphenyl (PCB) congeners,
- polynuclear aromatic hydrocarbons (PAHs),
- metals,
- butyltins,
- dioxin and furan congeners, and
- cyanide.

In addition, sediments, receiving water, and elutriates were tested for the following nutrient and general chemistry parameters:

- ammonia,
- nitrate+nitrite,
- total Kjeldahl nitrogen (TKN),
- total phosphorus (TP),
- total organic carbon (TOC),
- total sulfide,
- chemical oxygen demand (COD), and
- biological oxygen demand (BOD).

The following physical and general chemistry analyses were conducted for bulk sediments:

- grain size,
- Atterberg Limits,
- specific gravity,
- moisture content, and
- simultaneously extracted metals (SEM) / acid volatile sulfides (AVS).

In the first round of sampling (September 1999), bulk sediments collected from each station were tested for all of the above referenced fractions with the exception of VOCs and dioxin and furan congeners. In the second round of sampling (December 1999), VOCs were tested in sediment collected from each station; and dioxin and furan congeners, TOC, moisture content, and grain size determinations were conducted for reach composites. A sample-by-sample breakdown of the analytical testing components for sediment is provided in Table 5-1A.

Elutriates were tested from each reach in both rounds of sampling. Elutriates were tested for all chemical parameters in both rounds of sampling with the exception of dioxin and furan congeners, which were tested only in the second round. Receiving waters from both Inside Site 104 and Outside Site 104 were also collected and tested for chemical constituents. A sample-by-sample breakdown of analytical testing for receiving water and elutriate samples is provided in Table 5-1B.

Target fractions for tissue analysis were determined in conjunction with USEPA Region III and USACE–Baltimore District following review of bulk sediment data and are discussed in detail in Chapter 9.

Target chemical analytes, target detection limits (TDLs), analytical methods, elutriate preparation procedures, and sample holding times were derived from the following guidance documents:

- USEPA/USACE, 1998 (EPA-823-B-98-004). *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.–Testing Manual (Inland Testing Manual–ITM).*

- USEPA/USACE, 1995 (EPA-823-B-95-001). *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations.*

- USEPA/USACE, 1991 (EPA-503/8-91/001). *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual (The Green Book).*

The analytical program for this project is described in detail in the Analytical Quality Assurance Project Plan (QAPP) (EA and STL 2000) (Appendix B). The QAPP was reviewed and approved by USACE–Baltimore District prior to initiation of the analytical testing program. A sample-by-sample breakdown of analytical testing is provided in Tables 5-1A and 5-1B. Required sample containers, preservation techniques, and holding time requirements are provided in Chapter 4 (Tables 4-8 and 4-9 for aqueous and sediment samples, respectively) and Chapter 9 (Table 9-7 for tissues). Key components of the testing program are outlined in the following sections.

5.1 ANALYTICAL METHODS

Inorganic and organic compounds for this project were determined using the methods listed in Table 5-2. To meet program-specific regulatory requirements for chemicals of concern, methods are followed as stated with exceptions noted below:

5.1.1 PCB Congeners

PCBs for this project were analyzed and quantified as individual congeners by SW846 Method 8082. Tables 5-3 (sediment), 5-4 (aqueous/elutriate), and 5-5 (tissue) provide a list of the 26 congeners that were tested for in the various matrices. These 26 congeners include all of the "summation" and "highest priority" congeners, plus several of the "secondary priority" congeners, specified in Table 9-3 of the ITM (USEPA/USACE 1998).

5.1.2 Semivolatile Organics and PAHs

In order to achieve the Target Detection Limits (TDL) referenced in *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations–Chemical Evaluations* [EPA 823-B-95-001, April 1995] (USEPA/USACE 1995) for sediment samples, PAHs in sediments were determined utilizing the SW846 Methods 3540C/8310 High Pressure Liquid Chromatography (HPLC).

5.1.3 Metals

Metals were determined utilizing Inductively Coupled Plasma (ICP) according to the methodology specified, including the use of TRACE ICP, with the following exceptions:

- For thallium, samples were analyzed by Graphite Furnace Atomic Absorption (GFAA) method (SW846 7841)
- For mercury, samples were analyzed by Cold Vapor Atomic Absorption (CVAA) method (SW846 7470A (aqueous) or 7471A (soil)). Preparation of samples for mercury analyses was modified to use autoclave digestion procedures in place of water bath according to STL-M-7470/1.

5.1.4 Dioxin and Furan Congeners

Dioxin and furan congeners were determined using method SW8290 for sediment, water, and elutriate matrices. USEPA method 1613 was used for dioxin and furan congener determination in the tissue samples. USEPA method 1613 requires more internal standards than SW8290 and is the recommended method in the ITM for dioxin and furan analysis in tissues. In general, tissue matrices are difficult to analyze due to lipid interferences and other complexities associated with the tissue media.

5.2 DETECTION LIMITS

The detection limit is a statistical concept that corresponds to the minimum concentration of an analyte above which the net analyte signal can be distinguished with a specified probability from the signal due to the noise inherent in the analytical system. The method detection limit (MDL) was developed by the USEPA, and is defined as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero" (40 CFR 136, Appendix B). Detection limits applicable to this project are listed in Tables 5-3, 5-4, and 5-5 for sediment samples, aqueous/elutriate samples, and tissue samples, respectively. These tables include the TDLs referenced in the ITM, and the laboratory MDLs for each parameter by matrix.

The sample quantitation limit (SQL), as specified by USACE, is the analyte MDL adjusted for any method modifications which will allow the laboratory to effectively achieve the TDLs, dilutions, and percent moisture. Analytical results for this project are reported to the SQL.

Chemical concentrations in sediments are reported on a dry weight basis. In order to achieve the lowest possible reporting limit (RL) for sediment samples, which characteristically have moisture contents in excess of 20%, the sample weight taken for analysis was adjusted for the percent moisture in the sample (up to 50% moisture), prior to analysis.

5.3 LABORATORY QUALITY CONTROL SAMPLES

Quality control samples specified in the ITM were analyzed at the frequency stated below for each matrix. Standard Reference Materials (SRMs) were obtained from National Institute of Standards and Technology (NIST) or a comparable source, if available. Acceptance criteria for laboratory quality control samples are listed in Appendix A of the Analytical QAPP (EA and STL 2000) (Appendix B).

QC Sample	Frequency
Standard Reference Material	1 per analytical batch of 1-20 samples, where available
Method Blanks	1 per analytical batch of 1-20 samples
Laboratory Control Sample	1 per analytical batch of 1-20 samples
Surrogates	Spiked into all field and QC samples (Organic Analyses)
Sample Duplicates	1 per analytical batch of 1-20 samples (Inorganic Analyses)
Matrix Spike/Matrix Spike Duplicate	1 per analytical batch of 1-20 samples

5.3.1 Standard Reference Material

Standard Reference Materials (SRM) represent performance-based QA/QC. A standard reference material is a soil/solution with a certified concentration that is analyzed as a sample and is used to monitor analytical accuracy. SRMs (if available) were analyzed for the following matrix/fractions:

- Sediment: Pesticides, PCB Congeners, Metals, PAHs, and Dioxin/Furan Congeners
- Water: Pesticides, PCB Congeners, and PAHs
- Tissue: Metals and Dioxin/Furan Congeners

Control criteria applied only to those analytes having SRM true values $\geq$ 10 times the MDL established for the method.

5.3.2 Method Blanks

The method (reagent) blank (MB) is used to monitor laboratory contamination. This is usually a sample of laboratory reagent water processed through the same analytical procedure as the sample (i.e., digested, extracted, distilled). Method blanks were analyzed at a frequency of one every analytical preparation batch of twenty (20) or fewer samples.

5.3.3 Laboratory Control Sample

The Laboratory Control Sample (LCS) is a fortified method blank consisting of reagent water or solid fortified with the analytes of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. LCS were prepared and analyzed with each analytical batch, and analyte recoveries were used to monitor analytical accuracy and precision.

5.3.4 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

A fortified sample (matrix spike) is an aliquot of a field sample that is fortified with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular sample. Samples to be spiked were chosen at random. The final spiked concentration of each analyte in the sample was at least ten times the calculated MDL. A matrix spike and a duplicate-fortified sample (matrix spike duplicate) was performed for every batch of twenty (20) or fewer samples.

5.3.5 Laboratory Duplicates

A laboratory duplicate is a second aliquot of a field sample that is analyzed to monitor analytical precision associated with that particular sample. Laboratory duplicates were performed for only analytes for which MS/MSD analyses were not appropriate (i.e., nutrients and physical chemistry). One sample was analyzed in duplicate for every batch of twenty (20) or fewer samples.

5.3.6 Surrogates

Surrogates are organic compounds that are similar to, but not the same as, analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. These compounds were spiked into all blank, standards, samples, and spiked samples prior to analysis for organic parameters. Generally, surrogates are not used for inorganic analyses. Percent recoveries were calculated for each surrogate. Surrogates were spiked into samples according to the requirements of the reference analytical method (Section 7 of the Analytical QAPP, EA and STL 2000). Surrogate spike recoveries were evaluated against the limits provided in Appendix A of Analytical QAPP, (EA and STL 2000), and were used to assess method performance and sample measurement bias. If sample dilution caused the surrogate concentration to fall below the quantitation limit, surrogate recoveries were not calculated.

5.3.7 Trip Blanks

Trip blanks (also called transport blanks) were analyzed to evaluate the effect of ambient site conditions and sample transport on sample integrity and to ensure proper container preparation and handling techniques. Trip blanks are samples that originate as analyte-free water placed in organic vials (preserved with HCl) in the laboratory and analyzed for VOCs. One trip blank was analyzed per sampling day or sample processing day. All volatiles samples were stored in the same cooler as the trip blank. Analytical results for trip blanks are provided in Attachment III.

5.4 ANALYTICAL DATA VALIDATION

Data validation was conducted for dioxin and furan congeners in sediment, water, elutriate, and tissue matrices. Metals, pesticides, PCB congeners, and sulfide fractions were validated in the receiving site water and elutriate samples (for both 1998 and 1999 data). Organic chemical fractions (SVOCs, pesticides, PCB congeners, and PAHs) were validated in the tissue samples.

Validation of the analytical data was conducted by Environmental Data Services, Inc. (EDS) located in Concord, New Hampshire. The data validation protocols were derived from the following USEPA guidelines allowing for the quality control requirements specific to the methods used for this project:

- USEPA, Region III. 1999. *Standard operating procedure for dioxin/furan data validation*. Region III Central Regional Laboratory, QA Branch. Annapolis, MD.

- USEPA, Region III. 1995. *Innovative approaches to data validation*. Region III Central Regional Laboratory, QA Branch. Annapolis, MD.

- USEPA, Region III. 1994. *Region III modifications to national functional guidelines for organic data review: multi-media, multi-concentration (OLM01.0-OLMO1.9).* Region III Central Regional Laboratory, QA Branch. Annapolis, MD.

- USEPA, Region III. 1993. *Region III modifications to the laboratory data validation functional guidelines for evaluating inorganics analysis.* Region III Central Regional Laboratory, QA Branch. Annapolis, MD.

Analytical data were reported at a Level IV data validation which requires checking 10% of the raw data (i.e., calculations, concentrations of analytes, detection limits, % Relative Standard Deviation (% RSD), % difference (% D), % recovery (% R) values, etc).

The Data Validation Reports (DVRs) for each Sample Delivery Group (SDG) are provided in Attachment IV. Each report contains the following information:

- An overview and summary of the DVR that includes findings by analyses type and a report content statement;

- Copies of US EPA Form I's (standard forms that present raw data) and/or equivalents;

- A report for each parameter group for the SDG including an introduction, full sample IDs, and technical review comments for each required performance criterion with the actions taken; and

- Data limitations including data usability statements.

TABLE 5-1A SAMPLE-BY-SAMPLE SUMMARY OF ANALYTICAL TESTING FOR SEDIMENT

Sampling Reach	Sediment Sample ID	VOCs[a]	SVOCs	Chlorinated & Organophosphorus Pesticides	PCB Congeners	PAHs	Metals	Butyltins	Dioxins & Furans[a,b]	Ammonia	Nitrate + Nitrite	Cyanide	Total Sulfide	TKN	TOC	TP	SEM / AVS	COD	BOD	Grain Size	Atterberg Limits	Specific Gravity	Moisture Content
Brewerton Channel Eastern Extension	BE1SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	BE2SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	BE3SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	BE3SEDFD	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	BE4SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	BE-COMP[a]								X						X					X			X
C&D Approach Channels	CD003SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD004SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD005SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD006SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD-COMP[a]								X						X					X			X
Craighill Channel	CR1SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CR2SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CR3SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CR-COMP[a]								X						X					X			X
Craighill Angle-East	CRA-E-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRA-E-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRA-E-003VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRA-E-COMP[a]								X						X					X			X
Craighill Angle-West	CRA-W-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRA-W-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRA-W-003VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRA-W-COMP[a]								X						X					X			X
Craighill Entrance	CRE-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRE-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRE-003VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRE-004VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRE-COMP[a]								X						X					X			X
Craighill Upper Range	CRU1SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRU2SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRU2SEDFD	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRU3SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CRU-COMP[a]								X						X					X			X
Cutoff Angle	CUT1SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CUT2SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CUT3SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CUT-COMP[a]								X						X					X			X
Inside Site 104	KI-7N-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7S-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7E-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7W-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-3-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-5-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7-REFSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7-REFSEDFD	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-S-1-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-S-2-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-COMP[a]								X						X					X			X

TABLE 5-1A (CONTINUED)

Sampling Reach	Sediment Sample ID	VOCs[a]	SVOCs	Chlorinated & Organophosphorus Pesticides	PCB Congeners	PAHs	Metals	Butyltins	Dioxins & Furans[a,b]	Ammonia	Nitrate + Nitrite	Cyanide	Total Sulfide	TKN	TOC	TP	SEM / AVS	COD	BOD	Grain Size	Atterberg Limits	Specific Gravity	Moisture Content
Outside Site 104	KI-11-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-14-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-15-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-16-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-3-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-5-SED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-OUT-COMP[a]								X						X					X			X
Swan Point Channel	SWP-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SWP-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SWP-003VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SWP-004VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SWP-005VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SWP-006VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SWP-COMP[a]								X						X					X			X
Tolchester Channel - North	TLC-N-005VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-N-006VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-N-007VCSEO	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-N-008VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-N-009VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-N-010VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-N-COMP[a]								X						X					X	X	X	X
Tolchester Channel - South	TLC-S-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-S-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-S-003VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-S-004VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLC-S-COMP[a]								X						X					X			X
Tolchester Straightening	TLS-001VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLS-002VCSED	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TLS-COMP[a]								X						X					X			X

(a) = December 1999 sampling only
(b) = Composite samples only.

TABLE 5-1B SAMPLE-BY-SAMPLE SUMMARY OF ANALYTICAL TESTING FOR RECEIVING WATER AND ELUTRIATES

Sampling Reach	Receiving Water / Elutriate Sample ID	VOCs[a]	SVOCs	Chlorinated & Organophosphorus Pesticides	PCB Congeners	PAHs	Metals	Butyltins	Dioxins & Furans[a]	Ammonia	Nitrate + Nitrite	Cyanide	Total Sulfide	TKN	TOC	TP	COD	BOD
Brewerton Channel Eastern Extension	BE-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C&D Approach Channels	CD-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	CD-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Craighill Channel	CR-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Craighill Angle-East	CRA-E-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Craighill Angle-West	CRA-W-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Craighill Entrance	CRE-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Craighill Upper Range	CRU-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cutoff Angle	CUT-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Inside Site 104	KI-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-3WAT[b]		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7-EL[b]		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7WAT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-7-WATFD	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Outside Site 104	KI-14WAT[c]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	KI-OUT-EL[c]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Swan Point Channel	SWP-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tolchester Channel - North	TLC-N-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tolchester Channel - South	TLC-S-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tolchester Straightening	TLS-VC-EL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(a) = fractions tested for December 1999 sampling only.
(b) = sampled and tested in September 1999 only.
(c) = sampled and tested in December 1999 only.

TABLE 5-2 BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104: ANALYTICAL METHODS

Parameter	Method	Method #	Matrix	Reference
SAMPLE PREPARATION				
Semivolatile (PAHs, Pest, PCBs, SVOA)	Continuous Extraction	3502C	W, E	EPA, 1997
Semivolatile (PAHs, Pest, PCBs, SVOA)	Soxhlet Extraction	3540C	S, T	EPA, 1997
Semivolatile (Dioxins/Furans)	Pressurized Fluid Extraction	3545	S, T	EPA, 1997
Volatiles	Purge and Trap (40°C)	5030A	S	EPA, 1997
Volatiles	Purge and Trap	5030B	W, E	EPA, 1997
Soluble Salts Extractions	Aqueous Extraction	10-2	S	ASA, 1992
Total Metals Digestion (ICP)	Nitric Acid - Hydrochloric Acid	3010A	W, E	EPA, 1997
Total Metals Digestion (GFAA)	Nitric Acid	3020A	W, E	EPA, 1997
Total Metals Digestion	Nitric Acid - Hydrogen Peroxide	3050B	S, T	EPA, 1997
ORGANIC - EXTRACTION CLEANUP	Liquid-liquid Partitioning	3665A	W, E, S, T	EPA, 1997
Sulfuric Acid Cleanup	Treatment with Cu, Hg, or TBA-sulfite	3660A/B	S	EPA, 1997
Sulfuric Cleanup	Molecular Size Exclusion Chromatography	3640A	T	EPA, 1997
Gel Permeation Chromatography (GPC) Cleanup	Adsorption Column Chromatography	3620B	W, E, S, T	EPA, 1997
Florisil Cleanup				
ORGANICS				
Semivolatile Organic Compounds	Gas Chromatography/Mass Spectrometry	8270C	W, E, S, T	EPA, 1997
Volatile Organic Compounds	Gas Chromatography/Mass Spectrometry	8260B	W, E, S	EPA, 1997
Polynuclear Aromatic Hydrocarbons (PAH)	HPLC - UV, fluorescence	8310	W, E, S, T	EPA, 1997
Halogenated Hydrocarbon Pesticides	Gas Chromatography - ECD	8081A	W, E, S, T	EPA, 1997
Organophosphorus Pesticides	Gas Chromatography - NPD/FPD	8141A	W, E, S, T	EPA, 1997
PCB Aroclors	Gas Chromatography - ECD	8082	W, E, S, T	EPA, 1997
PCB Congeners	Gas Chromatography - ECD	8082	W, E, S, T	EPA, 1997
Dioxins/Furans	HRGC/HRMS	8290	W, E, S	EPA, 1997
Dioxins/Furans	HRGC/HRMS	1613	T	EPA, 1990
Organotins	Gas Chromatography - FPD	STL-SOP	W, E, S, T	------------
METALS				
Aluminum	Atomic Emission - ICP	6010B	W, E, S, T	EPA, 1997
Antimony	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Arsenic	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Beryllium	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Cadmium	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Chromium	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997

TABLE 5-2 (CONTINUED)

Parameter	Method	Method #	Matrix	Reference
Copper	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Iron	Atomic Emission - ICP	6010B	W, E, S, T	EPA, 1997
Lead	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Manganese	Atomic Emission - ICP	6010B	W, E, S, T	EPA, 1997
Mercury	Atomic Absorption - Cold Vapor	7470A	W, E	EPA, 1997
Mercury	Atomic Absorption - Cold Vapor	7471A	S, T	EPA, 1997
Nickel	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Selenium	Atomic Emission - Trace ICP	6010B	W, E, S	EPA, 1997
Silver	Atomic Emission - Trace ICP	6010B	W, E, S, T	EPA, 1997
Thallium	Atomic Absorption - Furnace	7841	W, E, S, T	EPA, 1997
Zinc	Atomic Emission - ICP	6010B	W, E, S, T	EPA, 1997
INORGANIC NONMETALS				
Cyanide, Total	Colorimetric - Automated UV	9012A	W, E, S	EPA, 1997
Sulfide, Total	Titrimetric	9034	W, E	EPA, 1997
Sulfide, Total	Distillation/Titrimetric	9030B/9034	S	EPA, 1997
Total Organic Carbon	Oxidation - Infrared	9060	W, E, S	EPA, 1997
Biochemical Oxygen Demand	BOD (% day, 20°C)	405.1	W, E, S	EPA, 1979
Chemical Oxygen Demand	Colorimetric - Manual	410.4	W, E, S	EPA, 1979
Nitrogen, Ammonia	Colorimetric - Automated Phenate	350.1	W, E, S	EPA, 1979
Nitrogen, Total Kjeldhal	Colorimetric - Autoanalyzer II	351.2	W, E, S	EPA, 1979
Nitrogen, Nitrate + Nitrite	Colorimetric - Cadmium Reduction	353.2	W, E, S	EPA, 1979
AVS/SEM	-----------------	-------	S	EPA, 1991
Total Phosphorus	Colorimetric	365.3	W, E, S	EPA, 1979
PHYSICAL PARAMETERS				
Grain Size	Sieve Analysis	D422	S	ASTM, 1995
Atterberg Limits	Physical Measurement	D4318	S	ASTM, 1995
Moisture Content	Gravimetric	D4959	S	ASTM, 1995
Moisture Content	Gravimetric	EA-SOP	T	------------
Specific Gravity	Hydrometer	-------	S	Plumb, 1981
Percent Lipids	Extraction/Gravimetric	STL-SOP	T	------------

TABLE 5-2 (CONTINUED)

Matrix codes:

W - Water
E - Elutriate
S - Sediment
T - Tissue

References:

ASA, 1982	Page, A.L., R.H. Miller, and D.R. Keeney, eds. 1982. Methods of Soil Analysis, Part 2: Chemical and Microbiological Properties, 2nd edition. American Society of Agronomy, Madision, Wis.
ASTM, 1995	American Society for Testing and Materials. 1995. Annual Book of ASTM Standards. Volume 4.08. ASTM, Philadelphia, PA.
EPA, 1979	United States Environmental Protection Agency. 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. U.S. EPA, Cincinnati, Ohio.
EPA, 1990	United States Environmental Protection Agency. 1990. Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS. Method 1613 Revision A. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.
EPA, 1991	Allen, H.E. and F. Gongmin et al. 1991. Determination of Acid Voilatile Sulfide and Simultaneously Extractable Metals in Sediment, April 1991. (Draft Analytical Method for the Determination of Acid Volatile Sulfide in Sediment, U.S. EPA Office of Water and Office of Science and Technology, Health and Ecological Criteria Division, Washinto, D.C., August 1991).
EPA, 1997	United States Environmental Protection Agency. 1997. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. EPA SW-846, 3rd edition, including Final Update III. U.S. EPA, Washington, D.C.
Plumb, 1981	Plumb, R.H. Jr. 1981. Procedures for handling and Chemical Analysis of Sediment and Water Samples. Technical Report EPA/CE-81-1. U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

TABLE 5-3 METHOD DETECTION LIMITS (MDLs) FOR SEDIMENT SAMPLES

Parameter	Units	Laboratory MDL [(a)]	Recommended TDL[(b)]
Organochlorine Pesticides - GC/ECD - (SW846 3540C/8081A)			
Aldrin	ug/kg	0.52	10
α-BHC	ug/kg	0.38	-
β-BHC	ug/kg	0.49	-
δ-BHC	ug/kg	0.49	-
λ-BHC (Lindane)	ug/kg	0.45	10
Chlorbenzide	ug/kg	3.3 [(c)]	2
Chlordane (Technical)	ug/kg	1.6	10
Dacthal	ug/kg	10 [(c)]	2
4,4'-DDD	ug/kg	0.42	10
4,4'-DDE	ug/kg	0.40	10
4,4'-DDT	ug/kg	0.66	10
Dieldrin	ug/kg	0.43	10
Endosulfan I	ug/kg	0.72	10
Endosulfan II	ug/kg	0.36	10
Endosulfan sulfate	ug/kg	0.84	10
Endrin	ug/kg	1.5	5
Endrin aldehyde	ug/kg	0.94	5
Heptachlor	ug/kg	0.60	10
Heptachlor epoxide	ug/kg	0.81	10
Mirex	ug/kg	3.3 [(c)]	--
Methoxychlor	ug/kg	2.6	10
Toxaphene	ug/kg	14	50
PCB Aroclors – GC/ECD – (SW846 3540C/8082)			
Aroclor 1016	ug/kg	5.4	--
Aroclor 1221	ug/kg	6.8	--
Aroclor 1232	ug/kg	12	--
Aroclor 1242	ug/kg	8.8	--
Aroclor 1248	ug/kg	2.6	--
Aroclor 1254	ug/kg	7.8	--
Aroclor 1260	ug/kg	4.9	--
PCB Congeners - GC/ECD - (SW846 3540C/8082)			
2,4'-Dichlorobiphenyl (BZ # 8)	ug/kg	0.10	1
2,2',5-Trichlorobiphenyl (BZ # 18)	ug/kg	0.10	1
2,4,4'-Trichlorobiphenyl (BZ # 28)	ug/kg	0.037	1
2,2',3,5'-Tetrachlorobiphenyl (BZ # 44)	ug/kg	0.11	1
2,2',4,5'-Tetrachlorobiphenyl (BZ # 49)	ug/kg	0.17	1
2,2',5,5'-Tetrachlorobiphenyl (BZ # 52)	ug/kg	0.10	1
2,3',4,4'-Tetrachlorobiphenyl (BZ # 66)	ug/kg	0.056	1
3,3',4,4'-Tetrachlorobiphenyl (BZ # 77)	ug/kg	0.082	1
2,2',3,4,5'-Pentachlorobiphenyl (BZ # 87)	ug/kg	0.042	1
2,2',4,5,5'-Pentachlorobiphenyl (BZ # 101)	ug/kg	0.058	1
2,3,3',4,4'-Pentachlorobiphenyl (BZ # 105)	ug/kg	0.18	1
2,3',4,4',5-Pentachlorobiphenyl (BZ # 118)	ug/kg	0.069	1
3,3',4,4',5-Pentahlorobiphenyl (BZ # 126)	ug/kg	0.049	1
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ # 128)	ug/kg	0.048	1
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ # 138)	ug/kg	0.043	1
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ # 153)	ug/kg	0.037	1
2,3,3',4,4',5-Hexachlorobiphenyl (BZ # 156)	ug/kg	0.080	1
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ # 169)	ug/kg	0.095	1
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ # 170)	ug/kg	0.071	1
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ # 180)	ug/kg	0.087	1
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ # 183)	ug/kg	0.051	1
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ # 184)	ug/kg	0.056	1
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ # 187)	ug/kg	0.060	1

(a) Method Detection Limit (MDL) STL-Baltimore for standard solid matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-3 (CONTINUED)

Parameter	Units	Laboratory MDL [(a)]	Recommended TDL[(b)]
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ # 195)	ug/kg	0.087	1
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ # 206)	ug/kg	0.13	1
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ # 209)	ug/kg	0.16	1
Organophosphorus Pesticides GC/NPD - (SW 3540C/8141A)			
Demeton	ug/kg	21	--
Ethyl parathion (Parathion)	ug/kg	33 [(c)]	6
Guthion (Azinphos methyl)	ug/kg	22	--
Malathion	ug.kg	16	5
Methyl parathion	ug/kg	17	6
Volatile organics - GC/MS (SW846 5030A/ 8260B)			
Acrolein	ug/kg	20	-
Acrylonitrile	ug/kg	8	-
Benzene	ug/kg	0.6	10
Bromodichloromethane	ug/kg	0.7	-
Bromoform	ug/kg	0.9	-
Bromomethane	ug/kg	0.6	-
Carbon disulfide	ug/kg	0.4	-
Carbon tetrachloride	ug/kg	0.5	-
Chlorobenzene	ug/kg	0.9	-
Chloroethane	ug/kg	1	-
2-Chloroethyl vinyl ether	ug/kg	2	-
Chloroform	ug/kg	0.6	10
Chloromethane	ug/kg	0.6	-
Dibromochloromethane	ug/kg	1	-
1,2-Dichlorobenzene	ug/kg	1	20
1,3-Dichlorobenzene	ug/kg	0.6	20
1,4-Dichlorobenzene	ug/kg	0.8	20
trans-1,2-Dichloroethene	ug/kg	0.6	-
Dichlorodifluoromethane	ug/kg	0.5	-
1,1-Dichloroethane	ug/kg	0.4	-
1,2-Dichloroethane	ug/kg	0.6	-
1,1-Dichloroethene	ug/kg	0.5	-
1,2-Dichloropropane	ug/kg	0.6	-
cis-1,3-Dichloropropene	ug/kg	0.6	-
trans-1,3-Dichloropropene	ug/kg	0.9	-
Ethylbenzene	ug/kg	0.5	10
Methylene chloride	ug/kg	0.9	-
1,1,2,2-Tetrachloroethane	ug/kg	0.6	-
Tetrachloroethene	ug/kg	0.6	10
Toluene	ug/kg	0.7	10
1,1,1-Trichloroethane	ug/kg	0.5	-
1,1,2-Trichloroethane	ug/kg	0.6	-
Trichloroethene	ug/kg	0.7	10
Trichlorofluoromethane	ug/kg	0.4	-
Vinyl chloride	ug/kg	0.5	-
Semivolatile organics GC/MS - (SW846 3540C/8270C)			
Benzoic acid	ug/kg	1600	100
Benzyl alcohol	ug/kg	58	50
Bis(2-chloroethyl) ether	ug/kg	63	-
Bis(2-chloroethoxy)methane	ug/kg	69	-
Bis(2-ethylhexyl) phthalate	ug/kg	53	50
4-Bromophenyl phenyl ether	ug/kg	61	-
Butylbenzylphthalate	ug/kg	56	50

(a) Method Detection Limit (MDL) STL-Baltimore for standard solid matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-3 (CONTINUED)

Parameter	Units	Laboratory MDL [(a)]	Recommended TDL[(b)]
4-Chloro-3-methylphenol	ug/kg	70	-
2-Chloronaphthalene	ug/kg	74	-
2-Chlorophenol	ug/kg	64	-
4-Chlorophenyl phenyl ether	ug/kg	71	-
Dibenzofuran	ug/kg	73	50
Di-n-butyl phthalate	ug/kg	46	50
1,2-Dichlorobenzene	ug/kg	54	20
1,3-Dichlorobenzene	ug/kg	72	20
1,4-Dichlorobenzene	ug/kg	73	20
3,3'-Dichlorobenzidine	ug/kg	47	-
2,4-Dichlorophenol	ug/kg	68	-
Diethyl phthalate	ug/kg	47	50
4,6-Dinitro-2-Methylphenol	ug/kg	64	-
2,4-Dimethylphenol	ug/kg	130	20
Dimethyl phthalate	ug/kg	55	50
2,4-Dinitrophenol	ug/kg	630	-
2,4-Dinitrotoluene	ug/kg	51	-
2,6-Dinitrotoluene	ug/kg	58	-
1,2-Diphenylhydrazine	ug/kg	55	-
Di-n-octyl phthalate	ug/kg	64	50
Hexachlorobenzene	ug/kg	59	10
Hexachlorobutadiene	ug/kg	67	20
Hexachloroethane	ug/kg	130	100
Hexachlorocyclopentadiene	ug/kg	61	--
Isophorone	ug/kg	81	--
2-Methylphenol	ug/kg	77	50
4-Methylphenol	ug/kg	160	100
Nitrobenzene	ug/kg	72	-
2-Nitrophenol	ug/kg	55	-
4-Nitrophenol	ug/kg	52	-
N-Nitrosodiphenylamine	ug/kg	57	20
N-Nitrosodimethylamine	ug/kg	57	-
N-Nitroso-di-n-propylamine	ug/kg	86	-
2,2'-Oxybis(1-chloropropane)	ug/kg	83	-
Pentachlorophenol	ug/kg	310	100
Phenol	ug/kg	66	100
1,2,4-Trichlorobenzene	ug/kg	75	10
2,4,6-Trichlorophenol	ug/kg	77	-
Polynuclear Aromatic Hydrocarbons (PAHs) - HPLC (SW846 3540C/8310)			
Acenaphthene	ug/kg	9.6	20
Acenaphthylene	ug/kg	20	20
Anthracene	ug/kg	0.73	20
Benzo[a]anthracene	ug/kg	0.85	20
Benzo[b]fluoranthene	ug/kg	1.8	20
Benzo[k]fluoranthene	ug/kg	2.1	20
Benzo[a]pyrene	ug/kg	1.1	20
Benzo[ghi]perylene	ug/kg	2.1	20
Chrysene	ug/kg	1.3	20

(a) Method Detection Limit (MDL) STL-Baltimore for standard solid matrix determined according to the procedure in 40 CFR 136 Appendix B.
(b) Target Detection Limit (USEPA/USACE 1995).
(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-3 (CONTINUED)

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
Dibenzo[a,h]anthracene	ug/kg	3.4	20
Fluoranthene	ug/kg	2.6	20
Fluorene	ug/kg	1.3	20
Indeno[1,2,3-cd]pyrene	ug/kg	1.1	20
1-Methylnaphthalene	ug/kg	12	20
2-Methylnaphthalene	ug/kg	7.8	20
Naphthalene	ug/kg	7.4	20
Phenanthrene	ug/kg	1.3	20
Pyrene	ug/kg	0.63	20
Organotins by GC/FPD (STL-Burlington SOP)			
Monobutyltins	ug/kg	1.0 (c)	10
Dibutyltins	ug/kg	1.3 (c)	10
Tributyltins	ug/kg	1.5 (c)	10
Dioxins/Furans-HRGC/HRMS (SW846 3545/8290)			
2,3,7,8-TCDF	ng/kg	0.36	1
2,3,7,8-TCDD	ng/kg	0.29	1
1,2,3,7,8-PeCDF	ng/kg	0.52	2.5
2,3,4,7,8-PeCDF	ng/kg	0.78	2.5
1,2,3,7,8-PeCDD	ng/kg	0.87	2.5
1,2,3,4,7,8-HxCDF	ng/kg	0.90	5
1,2,3,6,7,8-HxCDF	ng/kg	1.19	5
2,3,4,6,7,8-HxCDF	ng/kg	1.07	5
1,2,3,4,7,8-HxCDD	ng/kg	1.26	5
1,2,3,6,7,8-HxCDD	ng/kg	0.93	5
1,2,3,7,8,9-HxCDD	ng/kg	1.64	5
1,2,3,7,8,9-HxCDF	ng/kg	0.70	5
1,2,3,4,6,7,8-HpCDF	ng/kg	1.37	5
1,2,3,4,6,7,8-HpCDD	ng/kg	1.29	5
1,2,3,4,7,8,9-HpCDF	ng/kg	1.38	5
OCDD	ng/kg	10.48	10
OCDF	ng/kg	2.16	10
Inorganic Nonmetals /General Organics			
Cyanide (SW846 9012A)	mg/kg	0.065	2.0
Nitrogen, ammonia (EPA 350.1)	mg/kg	1.4	0.1
Nitrogen, nitrate + nitrite (EPA 353.2)	mg/kg	0.50 (c)	--
Nitrogen, total Kjeldahl (EPA 351.2)	mg/kg	43.2	--
Sulfide (SW846 9030B/9034)	mg/kg	30.7	0.1
TOC (SW846 9060)	mg/kg	547	1000
BOD (EPA 405.1)	mg/kg	60 (c)	--
COD (EPA 410.4)	mg/kg	1000 (c)	--
Total Phosphorus (EPA 365.3M)	mg/kg	2.1	--
Metals - Cold Vapor (SW846 7471A)			
Mercury	mg/kg	0.027	0.2
Metals - Furnace (SW846 3050B/7841)			
Thallium	mg/kg	0.15	0.2

(a) Method Detection Limit (MDL) for standard solid matrix determined according to the procedure in 40 CFR 136 Appendix B.
(b) Target Detection Limit .
(c) For these compounds, no laboratory MDL has been determined. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-3 (CONTINUED)

Parameter	Units	Laboratory MDL [(a)]	Recommended TDL[(b)]
Metals - ICP (SW846 3050B/6010B)			
Aluminum	mg/kg	3.7	50
Iron	mg/kg	3.1	50
Manganese	mg/kg	0.78	5.0
Zinc	mg/kg	0.79	15
Metals-TRACE ICP (SW846 3050B/6010B)			
Antimony	mg/kg	0.22	2.5
Arsenic	mg/kg	0.093	5.0
Beryllium	mg/kg	0.0080	2.5
Cadmium	mg/kg	0. 022	0.3
Chromium	mg/kg	0.091	5.0
Copper	mg/kg	0.17	5.0
Lead	mg/kg	0.093	5.0
Nickel	mg/kg	0.25	5.0
Selenium	mg/kg	0.13	1.0
Silver	mg/kg	0.28	0.2

(a) Method Detection Limit (MDL) for standard solid matrix determined according to the procedure in 40 CFR 136 Appendix B.
(b) Target Detection Limit .
(c) For these compounds, no laboratory MDL has been determined. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-4 METHOD DETECTION LIMITS FOR SITE WATER AND ELUTRIATE SAMPLES

Parameter	Units	Laboratory MDL [(a)]	Recommended TDL[(b)]
Pesticides and PCBs GC/ECD - organochlorine compounds (SW846 3520C/8081A)			
Aldrin	ug/L	0.023	0.04
α-BHC	ug/L	0.010	--
β-BHC	ug/L	0.011	--
δ-BHC	ug/L	0.012	--
γ-BHC (Lindane)	ug/L	0.0081	0.1
Chlorbenzide	ug/L	0.10 [(c)]	0.002
Chlordane (Technical)	ug/L	0.10	0.14
Dacthal	ug/L	0.30 [(c)]	0.01
4,4'-DDD	ug/L	0.018	0.1
4,4'-DDE	ug/L	0.024	0.1
4,4'-DDT	ug/L	0.020	0.1
Dieldrin	ug/L	0.010	0.02
Endosulfan I	ug/L	0.019	0.1
Endosulfan II	ug/L	0.024	0.1
Endosulfan sulfate	ug/L	0.029	0.1
Endrin	ug/L	0.033	0.1
Endrin aldehyde	ug/L	0.032	0.1
Heptachlor	ug/L	0.023	0.1
Heptachlor epoxide	ug/L	0.019	0.1
Methoxychlor	ug/L	0.085	0.5
Mirex	ug/L	0.10[(c)]	--
Toxaphene	ug/L	0.49	0.5
PCB Aroclors - GC/ECD - (SW846 3520C/8082)			
Aroclor 1016	ug/L	0.33	--
Aroclor 1221	ug/L	0.32	--
Aroclor 1232	ug/L	0.29	--
Aroclor 1242	ug/L	0.30	--
Aroclor 1248	ug/L	0.094	--
Aroclor 1254	ug/L	0.44	--
Aroclor 1260	ug/L	0.41	--
PCB Congeners - GC/ECD - (SW846 3520C/8082)			
2,4'-Dichlorobiphenyl (BZ # 8)	ug/L	0.0030	0.01
2,2',5-Trichlorobiphenyl (BZ # 18)	ug/L	0.0064	0.01
2,4,4'-Trichlorobiphenyl (BZ # 28)	ug/L	0.0065	0.01
2,2',3,5'-Tetrachlorobiphenyl (BZ # 44)	ug/L	0.0055	0.01
2,2',4,5'-Tetrachlorobiphenyl (BZ # 49)	ug/L	0.0030	0.01
2,2',5,5'-Tetrachlorobiphenyl (BZ # 52)	ug/L	0.0022	0.01
2,3',4,4'-Tetrachlorobiphenyl (BZ # 66)	ug/L	0.00045	0.01
3,3',4,4'-Tetrachlorobiphenyl (BZ # 77)	ug/L	0.0025	0.01
2,2',3,4,5'-Pentachlorobiphenyl (BZ # 87)	ug/L	0.0012	0.01
2,2',4,5,5'-Pentachlorobiphenyl (BZ # 101)	ug/L	0.0026	0.01
2,3,3',4,4'-Pentachlorobiphenyl (BZ # 105)	ug/L	0.0034	0.01
2,3',4,4',5-Pentachlorobiphenyl (BZ # 118)	ug/L	0.0018	0.01
3,3',4,4',5-Pentahlorobiphenyl (BZ # 126)	ug/L	0.0022	0.01
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ # 128)	ug/L	0.0013	0.01
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ # 138)	ug/L	0.0013	0.01
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ # 153)	ug/L	0.0030	0.01
2,3,3',4,4',5-Hexachlorobiphenyl (BZ # 156)	ug/L	0.0012	0.01
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ # 169)	ug/L	0.0022	0.01
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ # 170)	ug/L	0.0014	0.01
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ # 180)	ug/L	0.0015	0.01
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ # 183)	ug/L	0.0017	0.01
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ # 184)	ug/L	0.00099	0.01

(a) Method Detection Limit (MDL) STL-Baltimore for standard water matrix determined according to the procedure in 40 CFR 136 Appendix B.
(b) Target Detection Limit (USEPA/USACE 1995) .
(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins arc lab reporting limits).

Parameter	Units	Laboratory MDL [(a)]	Recommended TDL[(b)]
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ # 187)	ug/L	0.0053	0.01
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ # 195)	ug/L	0.0017	0.01
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ # 206)	ug/L	0.0024	0.01
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ # 209)	ug/L	0.0026	0.01
Organophosphorus Pesticides GC/NPD/FPD - (SW 3520C/8141A)			
Demeton	ug/L	2.0	--
Ethyl parathion (Parathion)	ug/L	1 [(c)]	0.8
Guthion (Azinphos methyl)	ug/L	0.58	--
Malathion	ug/L	0.22	0.8
Methyl parathion	ug/L	0.24	0.8
Volatile organics GC/MS - 5 mL purge (SW846 5030B/8260B)			
Acrolein	ug/L	6	--
Acrylonitrile	ug/L	6	--
Benzene	ug/L	0.6	--
Bromodichloromethane	ug/L	0.6	5
Bromoform	ug/L	1	--
Bromomethane	ug/L	1	--
Carbon disulfide	ug/L	0.7	--
Carbon tetrachloride	ug/L	1	--
Chlorobenzene	ug/L	0.8	--
Chloroethane	ug/L	0.8	--
2-Chloroethyl vinyl ether	ug/L	2	--
Chloroform	ug/L	0.6	5
Chloromethane	ug/L	0.5	--
Dibromochloromethane	ug/L	0.5	--
trans-1, 2-Dichloroethene	ug/L	1	--
Dichlorodifluoromethane	ug/L	2	--
1,1-Dichloroethane	ug/L	0.6	--
1,2-Dichloroethane	ug/L	0.8	--
1,1-Dichloroethene	ug/L	1	--
1,2-Dichloropropane	ug/L	0.7	--
cis-1,3-Dichloropropene	ug/L	0.7	--
trans-1,3-Dichloropropene	ug/L	0.7	--
Ethylbenzene	ug/L	0.7	5
Methylene chloride	ug/L	1	--
1,1,2,2-Tetrachloroethane	ug/L	1	--
Tetrachloroethene	ug/L	1	5
Toluene	ug/L	0.7	5
1,1,1-Trichloroethane	ug/L	1	--
1,1,2-Trichloroethane	ug/L	0.7	--
Trichloroethene	ug/L	1	5
Trichlorofluoromethane	ug/L	1	--
Vinyl chloride	ug/L	0.9	--
Semivolatile organics GC/MS - (SW846 3520C/8270C)			
Benzoic acid	ug/L	34	50
Benzyl alcohol	ug/L	2	50
Bis(2-chloroethyl) ether	ug/L	2	--
Bis(2-chloroethoxy)methane	ug/L	2	--
Bis(2-ethylhexyl) phthalate	ug/L	2	10
4-Bromophenyl phenyl ether	ug/L	3	--
Butylbenzylphthalate	ug/L	2	10
4-Chloro-3-methylphenol	ug/L	1	--
2-Chloronaphthalene	ug/L	2	--
2-Chlorophenol	ug/L	1	--

(a) Method Detection Limit (MDL) STL-Baltimore for standard water matrix determined according to thc procedurc in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
4-Chlorophenyl phenyl ether	ug/L	2	--
Dibenzofuran	ug/L	2	10
Di-n-butyl phthalate	ug/L	4	10
1,2-Dichlorobenzene	ug/L	2	10
1,3-Dichlorobenzene	ug/L	2	10
1,4-Dichlorobenzene	ug/L	2	10
3,3'-Dichlorobenzidine	ug/L	7	--
2,4-Dichlorophenol	ug/L	2	--
Diethyl phthalate	ug/L	3	10
4,6-Dinitro-2-Methylphenol	ug/L	5	--
2,4-Dimethylphenol	ug/L	4	10
Dimethyl phthalate	ug/L	3	10
2,4-Dinitrophenol	ug/L	23	--
2,4-Dinitrotoluene	ug/L	2	--
2,6-Dinitrotoluene	ug/L	2	--
1,2-Diphenylhydrazine	ug/L	3	--
Di-n-octyl phthalate	ug/L	3	10
Hexachlorobenzene	ug/L	3	10
Hexachlorobutadiene	ug/L	2	50
Hexachloroethane	ug/L	2	50
Hexachlorocyclopentadiene	ug/L	4	--
Isophorone	ug/L	2	--
2-Methylphenol	ug/L	2	--
4-Methylphenol	ug/L	2	--
Nitrobenzene	ug/L	3	--
2-Nitrophenol	ug/L	3	10
4-Nitrophenol	ug/L	4	10
N-Nitrosodiphenylamine	ug/L	4	50
N-Nitrosodimethylamine	ug/L	3	--
N-Nitroso-di-n-propylamine	ug/L	4	--
2,2'-Oxybis(1-chloropropane)	ug/L	1	--
Pentachlorophenol	ug/L	2	50
Phenol	ug/L	2	10
1,2,4-Trichlorobenzene	ug/L	2	10
2,4,6-Trichlorophenol	ug/L	2	--
Polynuclear Aromatic Hydrocarbons (PAHs) - HPLC (SW846 3520C/8310)			
Acenaphthene	ug/L	0.39	10
Acenaphthylene	ug/L	0.38	10
Anthracene	ug/L	0.034	10
Benzo[a]anthracene	ug/L	0.031	10
Benzo[b]fluoranthene	ug/L	0.034	10
Benzo[k]fluoranthene	ug/L	0.053	10
Benzo[a]pyrene	ug/L	0.047	10
Benzo[ghi]perylene	ug/L	0.066	10
Chrysene	ug/L	0.024	10
Dibenzo[a,h]anthracene	ug/L	0.065	10
Fluoranthene	ug/L	0.047	10
Fluorene	ug/L	0.064	10
Indeno[1,2,3-cd]pyrene	ug/L	0.035	10
1-Methylnaphthalene	ug/L	0.31	10
2-Methylnaphthalene	ug/L	0.21	10
Naphthalene	ug/L	0.32	10
Phenanthrene	ug/L	0.034	10
Pyrene	ug/L	0.063	10
Dioxins/Furans – HRGC/HRMS (SW846 3520C/8290)			

(a) Method Detection Limit (MDL) STL-Baltimore for standard water matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
2,3,7,8-TCDF	ng/L	0.0023	0.01
2,3,7,8-TCDD	ng/L	0.0038	0.01
1,2,3,7,8-PeCDF	ng/L	0.0080	0.025
2,3,4,7,8-PeCDF	ng/L	0.0122	0.025
1,2,3,7,8-PeCDD	ng/L	0.0064	0.025
1,2,3,4,7,8-HxCDF	ng/L	0.0095	0.05
1,2,3,6,7,8-HxCDF	ng/L	0.0043	0.05
2,3,4,6,7,8-HxCDF	ng/L	0.0085	0.05
1,2,3,4,7,8-HxCDD	ng/L	0.0096	0.05
1,2,3,6,7,8-HxCDD	ng/L	0.0083	0.05
1,2,3,7,8,9-HxCDD	ng/L	0.0093	0.05
1,2,3,7,8,9-HxCDF	ng/L	0.0135	0.05
1,2,3,4,6,7,8-HpCDF	ng/L	0.0102	0.05
1,2,3,4,6,7,8-HpCDD	ng/L	0.0108	0.05
1,2,3,4,7,8,9-HpCDF	ng/L	0.0124	0.05
OCDD	ng/L	0.0341	0.1
OCDF	ng/L	0.0383	0.1
Organotins by GC/FPD (STL-Burlington SOP)			
Monobutyltins	ug/L	0.031 (c)	0.01
Dibutyltins	ug/L	0.038 (c)	0.01
Tributyltins	ug/L	0.044 (c)	0.01
Inorganic nonmetals/general organics			
Cyanide (SW846 9012A)	mg/L	0.0050	5
Nitrogen, ammonia (EPA 350.1)	mg/L	0.028	0.03
Nitrogen, nitrate + nitrite (EPA 353.2)	mg/L	0.020	--
Nitrogen, total Kjeldahl (EPA 351.2)	mg/L	0.19	--
Sulfide (SW846 9034)	mg/L	0.35	0.1
TOC (SW846 9060)	mg/L	0.080	1000
BOD (EPA 405.1)	mg/L	0.37	--
COD (EPA 410.4)	mg/L	4.4	--
Total Phosphorus (EPA 365.3)	mg/L	0.0014	--
Metals - Autoclave Digestion - Cold Vapor (SW846 7470A)			
Mercury	ug/L	0.039	0.2
Metals - Furnace (SW846 3020A/7841)			
Thallium	ug/L	2.4	1.0
Metals - ICP (SW846 3010A/6010B)			
Aluminum	ug/L	57.6	40
Iron	ug/L	42.8	10
Manganese	ug/L	6.6	1.0
Zinc	ug/L	2.3	1.0
Metals-Trace ICP (SW846 3010A/6010B)			
Antimony	ug/L	3.0	3.0
Arsenic	ug/L	1.7	1.0
Beryllium	ug/L	0.083	0.2
Cadmium	ug/L	0.24	1.0
Chromium	ug/L	0.74	1.0
Copper	ug/L	1.9	1.0
Nickel	ug/L	2.4	1.0
Lead	ug/L	1.1	1.0
Selenium	ug/L	1.8	2.0
Silver	ug/L	3.2	1.0

(a) Method Detection Limit (MDL) STL-Baltimore for standard water matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995) .

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-5 METHOD DETECTION LIMITS FOR TISSUE SAMPLES

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
Organochlorine Pesticides - GC/ECD - (SW846 3540C/8081A)			
Aldrin	ug/kg	0.53	10
α-BHC	ug/kg	0.72	-
β-BHC	ug/kg	0.77	-
δ-BHC	ug/kg	0.69	-
λ-BHC (Lindane)	ug/kg	0.82	10
Chlorbenzide	ug/kg	3.3 [c]	2
Chlordane (Technical)	ug/kg	3.3	10
Dacthal	ug/kg	10 [c]	2
4,4'-DDD	ug/kg	1.5	10
4,4'-DDE	ug/kg	1.3	10
4,4'-DDT	ug/kg	1.2	10
Dieldrin	ug/kg	0.77	10
Endosulfan I	ug/kg	0.61	10
Endosulfan II	ug/kg	0.86	10
Endosulfan sulfate	ug/kg	0.95	10
Endrin	ug/kg	0.98	10
Endrin aldehyde	ug/kg	1.2	10
Heptachlor	ug/kg	0.68	10
Heptachlor epoxide	ug/kg	0.73	10
Mirex	ug/kg	3.3 [c]	--
Methoxychlor	ug/kg	3.0	10
Toxaphene	ug/kg	13	50
PCB Aroclors - GC/ECD - (SW846 3540C/8082)			
Aroclor 1016	ug/kg	15	--
Aroclor 1221	ug/kg	3.8	--
Aroclor 1232	ug/kg	10	--
Aroclor 1242	ug/kg	4.9	--
Aroclor 1248	ug/kg	8.7	--
Aroclor 1254	ug/kg	7.2	--
Aroclor 1260	ug/kg	14	--
PCB Congeners - GC/ECD - (SW846 3540C/8082)			
2,4'-Dichlorobiphenyl (BZ # 8)	ug/kg	0.24	2
2,2',5-Trichlorobiphenyl (BZ # 18)	ug/kg	0.12	2
2,4,4'-Trichlorobiphenyl (BZ # 28)	ug/kg	0.12	2
2,2',3,5'-Tetrachlorobiphenyl (BZ # 44)	ug/kg	0.11	2
2,2',4,5'-Tetrachlorobiphenyl (BZ # 49)	ug/kg	0.26	2
2,2',5,5'-Tetrachlorobiphenyl (BZ # 52)	ug/kg	0.14	2
2,3',4,4'-Tetrachlorobiphenyl (BZ # 66)	ug/kg	0.33	2
3,3',4,4'-Tetrachlorobiphenyl (BZ # 77)	ug/kg	0.21	2
2,2',3,4,5'-Pentachlorobiphenyl (BZ # 87)	ug/kg	0.13	2
2,2',4,5,5'-Pentachlorobiphenyl (BZ # 101)	ug/kg	0.18	2
2,3,3',4,4'-Pentachlorobiphenyl (BZ # 105)	ug/kg	0.16	2
2,3',4,4',5-Pentachlorobiphenyl (BZ # 118)	ug/kg	0.21	2
3,3',4,4',5-Pentahlorobiphenyl (BZ # 126)	ug/kg	0.20	2
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ # 128)	ug/kg	0.14	2
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ # 138)	ug/kg	0.20	2
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ # 153)	ug/kg	0.12	2
2,3,3',4,4',5-Hexachlorobiphenyl (BZ # 156)	ug/kg	0.088	2
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ # 169)	ug/kg	0.11	2
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ # 170)	ug/kg	0.075	2
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ # 180)	ug/kg	0.085	2
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ # 183)	ug/kg	0.076	2
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ # 184)	ug/kg	0.10	2

(a) Method Detection Limit (MDL) STL-Baltimore for standard tissue matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ # 187)	ug/kg	0.088	2
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ # 195)	ug/kg	0.13	2
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ # 206)	ug/kg	0.11	2
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ # 209)	ug/kg	0.15	2
Organophosphorus Pesticides GC/NPD – (SW 3540C/8141A)			
Dementon	ug/kg	33 [c]	--
Ethyl parathion (Parathion)	ug/kg	33 [c]	6
Guthion (Azinphos methyl)	ug/kg	33 [c]	--
Malathion	ug/kg	33 [c]	5
Methyl parathion	ug/kg	33 [c]	6
Semivolatile organics GC/MS - (SW846 3540C/8270C)			
Benzoic Acid	ug/kg	250	100
Benzyl alcohol	ug/kg	100	100
Bis(2-chloroethyl) ether	ug/kg	110	-
Bis(2-chloroethoxy)methane	ug/kg	130	-
Bis(2-ethylhexyl) phthalate	ug/kg	180	20
4-Bromophenyl phenyl ether	ug/kg	120	-
Butylbenzylphthalate	ug/kg	150	20
4-Chloro-3-methylphenol	ug/kg	77	-
2-Chloronaphthalene	ug/kg	100	-
2-Chlorophenol	ug/kg	91	-
4-Chlorophenyl phenyl ether	ug/kg	94	-
Dibenzofuran	ug/kg	100	20
Di-n-butyl phthalate	ug/kg	110	20
1,2-Dichlorobenzene	ug/kg	140	20
1,3-Dichlorobenzene	ug/kg	140	20
1,4-Dichlorobenzene	ug/kg	140	20
3,3'-Dichlorobenzidine	ug/kg	280	-
2,4-Dichlorophenol	ug/kg	100	-
Diethyl phthalate	ug/kg	110	20
4,6-Dinitro-2-Methylphenol	ug/kg	100	-
2,4-Dimethylphenol	ug/kg	84	20
Dimethyl phthalate	ug/kg	64	20
2,4-Dinitrophenol	ug/kg	190	-
2,4-Dinitrotoluene	ug/kg	57	-
2,6-Dinitrotoluene	ug/kg	67	-
1,2-Diphenylhydrazine	ug/kg	69	-
Di-n-octyl phthalate	ug/kg	370	20
Hexachlorobenzene	ug/kg	89	20
Hexachlorobutadiene	ug/kg	120	40
Hexachloroethane	ug/kg	110	40
Hexachlorocyclopentadiene	ug/kg	59	--
Isophorone	ug/kg	120	--
2-Methylphenol	ug/kg	87	20
4-Methylphenol	ug/kg	67	20
Nitrobenzene	ug/kg	110	-
2-Nitrophenol	ug/kg	120	-
4-Nitrophenol	ug/kg	140	-
N-Nitrosodiphenylamine	ug/kg	110	20
N-Nitrosodimethylamine	ug/kg	120	-
N-Nitroso-di-n-propylamine	ug/kg	120	-
2,2'-Oxybis(1-chloropropane)	ug/kg	150	-
Pentachlorophenol	ug/kg	210	100
Phenol	ug/kg	98	20
1,2,4-Trichlorobenzene	ug/kg	120	20

(a) Method Detection Limit (MDL) STL-Baltimore for standard tissue matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-5 (CONTINUED)

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
2,4,6-Trichlorophenol	ug/kg	83	-
Polynuclear Aromatic Hydrocarbons (PAHs) - HPLC (SW846 3540C/8310)			
Acenaphthene	ug/kg	2.8	20
Acenaphthylene	ug/kg	21	20
Anthracene	ug/kg	0.54	20
Benzo[a]anthracene	ug/kg	0.76	20
Benzo[b]fluoranthene	ug/kg	0.78	20
Benzo[k]fluoranthene	ug/kg	0.44	20
Benzo[a]pyrene	ug/kg	0.41	20
Benzo[ghi]perylene	ug/kg	0.92	20
Chrysene	ug/kg	0.24	20
Dibenzo[a,h]anthracene	ug/kg	0.91	20
Fluoranthene	ug/kg	0.78	20
Fluorene	ug/kg	1.0	20
Indeno[1,2,3-cd]pyrene	ug/kg	0.80	20
1-Methylnaphthalene	ug/kg	4.8	20
2-Methylnaphthalene	ug/kg	4.7	20
Naphthalene	ug/kg	3.6	20
Phenanthrene	ug/kg	1.0	20
Pyrene	ug/kg	0.44	20
Organotins – GC/FPD (STL Burlington SOP)			
Monobutyltins	ug/kg	1.0 [c]	10
Dibutyltins	ug/kg	1.3 [c]	10
Tributyltins	ug/kg	1.5 [c]	10
Dioxins/Furans – HRGC/HRMS (EPA 1613)			
2,3,7,8-TCDF	ng/kg	0.73	1
2,3,7,8-TCDD	ng/kg	0.19	1
1,2,3,7,8-PeCDF	ng/kg	0.52	2.5
2,3,4,7,8-PeCDF	ng/kg	0.67	2.5
1,2,3,7,8-PeCDD	ng/kg	1.20	2.5
1,2,3,4,7,8-HxCDF	ng/kg	0.50	5
1,2,3,6,7,8-HxCDF	ng/kg	0.35	5
2,3,4,6,7,8-HxCDF	ng/kg	0.39	5
1,2,3,4,7,8-HxCDD	ng/kg	0.32	5
1,2,3,6,7,8-HxCDD	ng/kg	0.74	5
1,2,3,7,8,9-HxCDD	ng/kg	0.36	5
1,2,3,7,8,9-HxCDF	ng/kg	0.84	5
1,2,3,4,6,7,8-HpCDF	ng/kg	1.63	5
1,2,3,4,6,7,8-HpCDD	ng/kg	2.06	5
1,2,3,4,7,8,9-HpCDF	ng/kg	0.66	5
OCDD	ng/kg	18.17	10
OCDF	ng/kg	2.20	10
Metals - Cold Vapor (SW846 7471A)			
Mercury	mg/kg	0.14	0.01
Metals - Furnace (SW846 3050B/7000 series)			
Thallium	mg/kg	0.30	0.1
Metals - ICP (SW846 3050B/6010B)			
Aluminum	mg/kg	11.0	1.0
Iron	mg/kg	16.0	10
Manganese	mg/kg	2.9	0.5
Zinc	mg/kg	9.1	2.0

(a) Method Detection Limit (MDL) STL-Baltimore for standard tissue matrix determined according to the procedure in 40 CFR 136 Appendix B.

(b) Target Detection Limit (USEPA/USACE 1995).

(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

TABLE 5-5 (CONTINUED)

Parameter	Units	Laboratory MDL [a]	Recommended TDL[b]
Metals-TRACE ICP (SW846 3050B/6010B)			
Antimony	mg/kg	0.90	0.1
Arsenic	mg/kg	0.42	0.1
Beryllium	mg/kg	0.30	0.1
Cadmium	mg/kg	0. 045	0.1
Chromium	mg/kg	0.27	0.1
Copper	mg/kg	0.42	0.1
Lead	mg/kg	0.23	0.1
Nickel	mg/kg	0.22	0.1
Silver	mg/kg	0.27	0.1
Selenium	mg/kg	0.16	0.2

(a) Method Detection Limit (MDL) STL-Baltimore for standard tissue matrix determined according to the procedure in 40 CFR 136 Appendix B.
(b) Target Detection Limit (USEPA/USACE 1995).
(c) For these compounds, no laboratory MDL has been determined by STL-Baltimore. A Reporting Limit is used based upon the low calibration standard concentration (Organotins are lab reporting limits).

CHAPTER 6 -
BULK SEDIMENT

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6. BULK SEDIMENT CHEMISTRY

This chapter presents a Tier II sediment chemistry evaluation for the approach channels, Inside Site 104, Outside Site 104, and the Ocean Reference area. The chapter presents data for sediments that were specifically collected in 1999 for Tier II and Tier III evaluations. The 1999 field program is described in Chapter 4. The following topics are presented and discussed: (1) constituents tested and detected within the sediments; (2) comparisons of detected constituents to sediment quality guidelines; (3) comparisons of detected constituents to background and reference concentrations; (4) comparisons of detected constituents to available Tier I information presented in Chapter 3; and (5) results of Theoretical Bioaccumulation Potential (TBP) calculations.

6.1.1 SAMPLE RECEIPT AND HOMOGENIZATION PROCEDURES

The sediment cores and grab samples were transported from the field staging areas (either Fort McHenry, Baltimore or Sandy Point State Park, Annapolis) to EA's laboratory facility in Sparks, Maryland at the end of each workday. The cores and grab samples were chilled with ice during transport. The sediment cores and the grab samples designated for ecotoxicological testing were stored in a walk-in refrigeration unit cooled to 4°C until all sampling was complete. Grab samples designated for chemical analysis were hand-delivered to the analytical laboratory on the day of collection. Upon completion of all sampling activities, the cores were sorted, visually inspected, and the labeled core sleeves were compared against the chain-of-custody record prior to processing. Grab samples that were received at the analytical laboratory were compared against the chain-of-custody upon receipt.

Core processing was conducted at EA's warehouse facility on 30 September to 01 October 1999 and 17 December 1999. Sediment samples for each station were processed for analytical testing and channel composites were created for ecotoxicological testing.

Sediments from each station were extracted from the core sleeves and were composited and homogenized in pre-cleaned, 5-gallon stainless steel bowls. Multiple cores for each station were extracted and homogenized with decontaminated stainless-steel mixing spoons until the sediment was thoroughly mixed and was of uniform consistency. When compositing and homogenization of sediment from each station was complete, subsamples were removed for bulk chemistry analysis. The sub-samples were placed into pre-cleaned glass jars using stainless steel spoons, and were labeled for analytical testing. The remainder of the sediment was placed in a 55-gallon decontaminated fiberglass holding container to create the channel composite for ecotoxicological testing. When not actively being processed, the core and grab samples were stored in a secured walk-in cooler, in the dark at 4°C. A second chain-of-custody form was completed for the homogenized core sediment that was designated for chemical analysis, and the sample homogenization time was recorded as the initiation of the sample holding time.

The bulk sediment samples were hand-delivered to STL–Baltimore, where the samples were compared against the chain-of-custody form. The samples were logged into the analytical laboratory and were assigned a unique accession number. Samples were stored in walk-in refrigeration units (cooled to 4°C) following receipt and prior to analysis. Copies of the bulk sediment chain–of-custody forms are provided in Attachment II. The compositing scheme for the ecotoxicological testing is discussed in Chapters 4 and 8.

6.2 ANALYTICAL METHODS AND DETECTION LIMITS

Bulk sediments were analyzed for target analytes identified in the approved Analytical Chemistry QAPP (EA and STL 2000) and outlined in Chapter 5. Project-specific analytical methods and detection limits for sediment samples are provided in Tables 5-2 and 5-3, respectively. A sample-by-sample breakdown of bulk sediment analyses is provided in Table 5-1A.

6.3 DATA ANALYSIS

For sediments, data were evaluated based on mean concentrations of constituents detected within each channel. The mean concentrations best represent the concentrations that would be expected when the material is dredged, mixed together, and placed in large volumes.

6.3.1 Mean Calculations

Mean concentrations of detected analytes were calculated for each sampling reach (channels, Inside Site 104, Outside Site 104, and Ocean Reference). The mean concentration for each reach is most representative of the concentration expected in the field during dredging and placement and is most representative of the expected concentration in the reach composite samples that were utilized in the elutriate, toxicity, and bioaccumulation testing. The detection limit (DL) was substituted for non-detected (ND) analytes in the calculations of the mean for each reach. Using the detection limit gives the highest possible mean value. If an analyte was not detected in any sample within a sampling reach, the mean detection limit is reported and qualified with a "U."

The mean analyte concentrations for Inside Site 104 were calculated with data from eight analyzed samples [the five targeted stations (Figure 4-11), one station located south of KI-7 (KI-7REF) (Figure 4-12) where visual signs of contamination were present, and two field duplicate samples (KI-7FD and KI-7REFFD)]. The mean calculations for Craighill Upper Range and Brewerton Channel Eastern Extension each included results from one field duplicate sample in addition to the results from the targeted locations. Analyte concentrations for the Ocean Reference sediment represent the actual detected concentrations in one composited sample. Dioxin and furan results for each channel, reference, or placement site reach represent the actual detected concentrations in one composited sample.

For individual samples, PCB concentrations were determined by summing the 18 summation congeners (as specified in Table 9-3 of the ITM). The total summed concentration was then multiplied by a factor of 2 following the NOAA (1993) standard approach for total PCB determinations. Total PAHs were determined by summing the concentrations of 16 PAHs in

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each sample. In the summation calculations for both total PCBs and total PAHs, three total values are presented in the data tables:

- Non-detects = zero (ND=0);
- Non-detects = ½ of the detection limit (ND=½ DL); and
- Non-detects = the detection limit (ND=DL).

The substitution of the detection limit (ND=DL) provides the most conservative approach to calculating and evaluating the data. However, in cases where few PCB congeners or PAHs are detected, the detection limit drives the total value and overestimates the actual expected concentration.

Mean total PCB and total PAH concentrations were determined by averaging the total that was calculated for each sample. In the PCB and PAH tables (Table 6-9 and 6-10, respectively), note that the average of the sums does not equal the sum of the average concentrations for each congener or analyte for calculations with ND=0 and ND=1/2.

The Toxicity Equivalency Quotients (TEQs) for dioxin were calculated following the approach in USEPA (1989). Each congener was multiplied by the Toxicity Equivalency Factor (TEF) and then the congener concentrations were summed (Table 6-13). Concentrations that were flagged with a "B" (detected in blank) or "EMPC" (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA Region III dioxin validation guidance (USEPA Region III 1999). The TEQs were calculated using ND=0, ND=1/2DL, and ND=DL.

6.3.2 Comparisons to Sediment Quality Guidelines (SQGs)

Mean concentrations of detected analytes in sediment samples were compared against Sediment Quality Guidelines (SQG) for marine sediments as discussed in Chapter 3. TEL and PEL screening values are provided in Table 3-1.

Because TELs/PELs have been widely used despite their recently demonstrated low reliability in predicting toxicity, the mean concentrations of contaminants in the sediments sampled in this project were compared to the TEL and PEL values for all analytes for which TEL/PEL values have been developed (Buchman 1999). Comparison of sediment chemistry to SQGs is not a part of the tiered testing evaluations in the ITM (USEPA/USACE 1998) or the Green Book (USEPA/USACE 1991). For dredged material evaluations, SQGs are used as a tool to assist with identification of COPCs and to provide additional weight of evidence in the evaluation (USACE–WES 1998b). Comparisons to TEL/PEL values were used only for these purposes in this evaluation of the sediments sampled in this project.

6.4 BULK SEDIMENT RESULTS

Results of the bulk sediment chemistry analyses are presented in the following sub-sections. Sample weights were adjusted for percent moisture (up to 50%) prior to analysis to achieve the lowest possible detection limits. Because sediments contain a large proportion of moisture, each analyte has a sample-specific detection limit. The detection limit range is provided in the analytical summary tables (Tables 6-3 through 6-13). Analytical results are reported on a dry weight basis. Definitions of organic and inorganic data qualifiers are provided in Tables 3-4 and 3-5, respectively. Qualifiers for dioxin and furan analysis are described in Table 6-1. Analytical narratives that include an evaluation of laboratory quality assurance/quality control results are provided in Attachment II. STL–Baltimore will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

Mean analyte concentrations are provided by analytical fraction in Tables 6-2 through 6-13. Results of TEL and PEL screening comparisons for mean concentrations are provided in Tables 6-14 and 6-15, respectively. Frequency of detection by analytical fraction for each channel is provided in Table 6-16. Frequency of detection by analytical fraction for Inside Site 104, Outside Site 104, and the Ocean Reference is provided in Table 6-17. Data for individual stations and summary statistics that include minimum and maximum concentrations for each reach are provided in Appendices D and E, respectively.

6.4.1 Physical Analyses

Results of physical analyses are provided in Table 6-2. Grain size determinations indicated that the channel sediments were primarily comprised of silt and clay (Figure 6-1). The Craighill Channel exhibited the highest proportion of sand (67%), followed by Craighill Upper Range (32%). Both Craighill Channel and Craighill Upper Range have been recently dredged; therefore, a greater proportion of sand would be expected at these locations due to minimal shoaling and deposition of fine materials since dredging occurred. Inside Site 104, Outside Site 104, and the Ocean Reference area contained higher proportions of sand than the channels, with the exception of the Craighill Channel and Craighill Upper Range (Figure 6-1). Percent moisture in the channel sediments ranged from 40.8% to 72%. The ocean sediment had the lowest moisture content (21.5%).

6.4.2 Inorganic Non-metals and Nutrients

Results of the inorganic non-metal analyses are provided in Table 6-3. Mean concentrations of TOC in the channels ranged from 2.7 to 13.4 percent (Figure 6-2). These concentrations are similar to those reported for the channels in the 1998 study (3.4 to 14.1 percent) (see Chapter 3). Surficial sediments from the channels that have been most recently dredged (Craighill Channel and Craighill Upper Range) contained the lowest mean concentrations of TOC. The highest mean TOC in the sediment was from the Tolchester Straightening, where the deepest cores were collected (approximately 10 ft in depth). Mean TOC concentrations in the Inside and Outside

Site 104 reference areas were 7.2% and 11.4%, respectively, and fell within the range of mean TOC reported for the channels. The Ocean Reference sediment contained the lowest percentage of TOC (0.5%).

Mean sulfide concentrations in the channels ranged from < 30.7 mg/kg (C&D Approach Channel cores) to 1,536 mg/kg (Swan Point Channel). Mean sulfide concentrations were generally higher in sediments from the eastern side of the upper Bay (Inside and Outside Site 104, Swan Point Channel, and Tolchester Straightening). These areas are more prone to low dissolved oxygen conditions and sulfide formation. The high sulfide concentrations reported for Inside and Outside Site 104 are consistent with results reported for surficial sediments in the 1997-1998 Site 104 and channel studies (see Chapter 3). Sulfides were not detected in the Ocean Reference grab sample or C&D Canal Approach core sample sediments.

Mean total phosphorus (TP) ranged from 198 mg/kg (Craighill Upper Range) to 632 mg/kg (Craighill Angle West). TP detected in the reference and placement areas fell within the range of concentrations reported for the channels, with the Ocean Reference sediment at the lower end.

Mean concentrations of ammonia-nitrogen (total ammonia) ranged from 12 mg/kg (Craighill Upper Range) to 223 mg/kg (Craighill Entrance). Mean ammonia-nitrogen concentrations in Inside and Outside Site 104 fell within the range for the channels. Mean ammonia-nitrogen concentrations Outside Site 104 (182.4 mg/kg) were nearly 5 times higher than Inside Site 104 (36.7 mg/kg). The 1997 Site 104 studies revealed a similar pattern, with ammonia-nitrogen concentrations Outside Site 104 (137.7 mg/kg) approximately 2.6 times higher than Inside Site 104 (51.2 mg/kg) (see Chapter 3). Ammonia-nitrogen was detected just above the detection limit in the Ocean Reference sediment (2 mg/kg).

Mean TKN (organic nitrogen + ammonia-nitrogen) concentrations ranged from 225.2 mg/kg (Craighill Channel) to 3,714 mg/kg (Brewerton Channel Eastern Extension). Mean TKN concentrations for both Inside and Outside Site 104 fell within the range reported for the channel sediments, and mean TKN concentration Outside Site 104 was more than 2 times higher than Inside Site 104. TKN concentration was lowest in the Ocean Reference sediment (180 mg/kg).

6.4.3 Volatile Organic Compounds (VOCs)

Results of the volatile organic compound analyses are presented in Table 6-4. VOCs were detected in 23 of 1,540 cases (1.5%) in the channel sediments. VOCs were detected in 8 of 175 cases (4.6%) Inside Site 104 and in 5 of 140 cases (3.6%) Outside Site 104 (see Table 6-17). Only 2 of the 35 tested VOCs, carbon disulfide and dichloromethane (methylene chloride), were detected, and they were detected within both the channel and Inside/Outside Site 104 samples. The highest mean concentration of carbon disulfide was detected Inside Site 104 (7.98 μg/kg) and the highest mean concentration of dichloromethane was detected for Brewerton Channel Eastern Extension (15.75 μg/kg). Although neither compound was detected in the laboratory method blanks, both analytes are common laboratory contaminants. Overall, VOCs were not detected in 4 of the 13 channel reaches (C&D Canal Approach, Craighill Angle West, Craighill

Entrance, and Tolchester North). No VOCs were detected in the Ocean Reference sediment. No TEL or PEL values exist for VOCs. A few scattered occurrences of carbon disulfide and dichloromethane were also detected in channel sediments tested in 1998 (EA 2000c) (see Chapter 3).

6.4.4 Semivolatile Organic Compounds (SVOCs)

Results of the semivolatile organic compound analyses are presented in Table 6-5. Seven of the 47 tested SVOCs were detected in the channel sediments. Overall, SVOCs were detected in 164 of 2,350 cases (7%) in the channel sediments. SVOCs were detected in 23 of 376 cases (6.1%) Inside Site 104 and in 18 of 188 cases (9.6%) Outside Site 104. At least one SVOC was detected within every tested channel reach. No SVOCs were detected in the Ocean Reference sediment. Six of seven SVOCs detected in the channel sediments were also detected Inside and Outside Site 104 [1-methylnaphthalene, 2-methylnaphalene, 3,4-methylphenol, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and phenol]. Four SVOCs were detected Outside Site 104, but not within the channel reaches [2,2'-oxybis(1-chloropropane), 4-nitrophenol, di-n-octyl phthalate, and diethyl phthalate]. Dibenzofuran was detected in the Tolchester Straightening area and Outside Site 104. Benzyl butyl phthalate was the only SVOC detected in the channels (Brewerton Channel Eastern Extension only) that was not detected Inside or Outside Site 104.

2-Methylnaphthalene and bis(2-ethylhexyl)phthalate are the only SVOCs that have TEL/PEL values (Tables 6-14 and 6-15). Mean concentrations of 2-methylnaphthalene exceeded the TEL in 11 of the 13 channel reaches and in both Inside and Outside Site 104. Mean concentrations of 2-methylnaphthalene exceeded the PEL only for the Tolchester Straightening area and Inside Site 104 sediments. Although bis-(2-ethylhexyl) phthalate was detected in 5 of the 13 channel reaches and in both Inside and Outside Site 104 sediments, none of the concentrations exceeded the TEL or PEL value.

Six of the seven SVOCs detected in the channel sediments in the 1999 testing program were also detected in the channel sediments in the 1998 testing program [1-methylnaphthalene, 2-methylnaphalene, 3,4-methylphenol, benzyl butyl phthalate, bis(2-ethylhexyl)phthalate, and phenol] (see Chapter 3).

6.4.5 Chlorinated Pesticides

Results of the chlorinated pesticides analyses are presented in Table 6-6. Approximately 98% of the channel pesticide analyses yielded no detectable concentrations of chlorinated pesticides. Chlorinated pesticides were detected in 16 of 1,100 cases (1.5%) in the channel sediments. Chlorinated pesticides were detected in 5 of the 13 channels reaches [C&D Canal Approach (cores), Craighill Angle West, Tolchester North, Tolchester South, and Tolchester Straightening]. Only 3 of the 22 tested chlorinated pesticides were detected in channel sediments (heptachlor epoxide, 4,4'-DDD and 4,4'-DDE). These three pesticides were also detected in the channel sediments tested in the 1998 program (EA 2000c) (see Chapter 3).

Chlorinated pesticides were detected in 8 of 176 cases (4.5%) Inside Site 104 and in 3 of 88 cases (3.4%) Outside Site 104. Five of the 22 tested chlorinated pesticides were detected Inside Site 104 (4,4'-DDE, aldrin, endosulfan II, endrin aldehyde, and heptachlor epoxide). Heptachlor epoxide was the only chlorinated pesticide detected Outside Site 104. None of the 22 targeted chlorinated pesticides was detected in the Ocean Reference sediment.

TEL and PEL values exist for 6 of the 22 tested chlorinated pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane, dieldrin, and gamma-BHC (Tables 6-14 and 6-15, respectively). None of the mean detected concentrations of DDD or DDE exceeded PEL or TEL values. The detection limits for several chlorinated pesticides exceeded the TEL value: gamma-BHC, dieldrin, chlordane, and 4,4-DDT. However, none of the mean detection limits exceeded the PEL values for these pesticides. In cases where the detection limit exceeded the TEL value, it is not possible to determine whether these pesticides were present at concentrations between the TEL and PEL.

6.4.6 Organophosphorus Pesticides

Results of the organophosphorus pesticide analyses are provided in Table 6-7. Organophosphorus pesticides were not detected in any of the channel sediments (0 of 250 cases), Inside Site 104 (0 of 40 cases), Outside Site 104 (0 of 20 cases), or in the Ocean Reference (0 of 5 cases). There are no TEL/PEL values for organophosphorus pesticides.

6.4.7 PCB Aroclors and Congeners

Results of the PCB aroclor analyses are provided in Table 6-8. PCB aroclors (commercially manufactured mixtures of congeners) were not detected in any of the channel sediments (0 of 350 cases), Outside Site 104 (0 of 28 cases), or in the Ocean Reference (0 of 7 cases). Two of the seven tested PCB aroclors (Aroclor 1248 and Aroclor 1254) were detected Inside Site 104 (2 of 56 cases or 3.6%). There are no TEL/PEL values for PCB aroclors. Aroclors 1254 and 1260 were also detected Inside Site 104, Outside Site 104, and in several channel reaches in the 1997 and 1998 testing programs (EA 1998a and 2000c) (see Chapter 3).

Results of the PCB congener analyses are provided in Table 6-9. There are a total of 209 PCB congeners, each having a different molecular configuration. Twenty-five of the 26 tested congeners were detected in the channel sediments. PCB congeners were detected in 654 of 1,350 cases (48.4%) in the channel sediments. PCB congeners were detected in 110 of 208 cases (53%) Inside Site 104 and in 33 of 104 cases (32%) Outside Site 104. One PCB congener (BZ#8) was detected in the Ocean Reference sediment (1 of 26 cases or 3.8%). Importantly, the majority of detected congeners were detected at concentrations that were below the recommended USEPA/USACE (1995) Target Detection Limit (TDL).

Mean total PCB concentrations for the channels and reference areas are depicted in Figure 6-3. Mean total PCB concentrations in the channels (ND=DL) ranged from 3.45 μg/kg (Craighill Channel) to 22.6 μg/kg [C&D Canal Approach (cores)]. The mean total PCB concentration

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Inside Site 104 was approximately 3.3 times higher than Outside Site 104. The total PCB values for both Inside and Outside Site 104 fell within the range for the channels. Only the mean total PCB concentration for the C&D Approach (cores) exceeded the TEL (21.55 µg/kg) and that by 1 µg/kg (Table 6-14).

The detection limits for PCB congeners in the 1997 and 1998 sampling programs (EA 1998a and 2000c) were 2 to 3 times higher than the detection limits in the 1999 sampling program. Therefore, total PCBs (ND=DL) for the 1997-1998 testing exceeded the TEL, even when no congeners were detected (see Chapter 3). It is important to note that, the TDL for each individual PCB congener is 1 µg/kg (USEPA/USACE 1995). If total PCBs are calculated using the TDL, the total exceeds the TEL value. In this investigation, the detection limits were substantially lower than the TDL, and only one channel reach exceeded the TEL.

6.4.8 Polynuclear Aromatic Hydrocarbons

Results of the PAH analyses are provided in Table 6-10. Each of the tested PAHs was detected in at least one of the channel reaches. PAHs were detected in 696 of 800 cases (87%) in the channel sediments. PAHs were detected in 116 of 128 cases (91%) Inside Site 104 and in 55 of 64 cases (86%) Outside Site 104. None of the sixteen tested PAHs was detected in the Ocean Reference sediment. Acenaphthylene and dibenz[a,h]anthracene were the only two PAHs that were not detected in all of the channel reaches. All of the tested PAHs were detected Inside Site 104, and dibenz[a,h]anthracene was the only PAH that was not detected Outside Site 104.

Mean total PAH concentrations (ND=DL) are depicted in Figure 6-4. The mean total PAH concentration in Tolchester Straightening was nearly 3 times higher than the next highest mean channel concentration (Tolchester North). Overall, the mean concentrations of total PAHs Inside and Outside Site 104 were nearly equivalent and were higher than each of the channels with the exception the Tolchester Straightening sediments. Mean total PAH concentrations reported for Inside Site 104, Outside Site 104, and Tolchester Straightening exceeded the TEL value of 1,684.06 µg/kg (Table 6-14), but concentrations were well below the PEL value of 16,770.4 µg/kg (Table 6-15). None of the mean total PAHs concentrations reported in the 1997 and 1998 testing programs exceeded the TEL value (EA 1998a and 2000c) (see Chapter 3).

Overall, of the channel reaches, Tolchester Straightening had the greatest number of PAH analytes with mean concentrations exceeding TELs (12 analytes) and PELs (4 analytes). Mean concentrations of four PAHs (anthracene, benz(a)anthracene, benzo(a)pyrene, and pyrene).

from the Tolchester Straightening area exceeded TELs only in that channel and in no other channel reach. Inside and Outside Site 104 had mean concentrations for 9 and 10 analytes, respectively, that exceeded TEL values. Both the Inside and Outside Site 104 reference areas had only one PAH analyte (acenaphthene) with a mean concentration that exceeded a PEL.

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6.4.9 Metals

Results of the metals analyses are provided in Table 6-11. Metals were detected in 731 of 800 cases (91%) in the channel sediments. Metals were detected in 118 of 128 cases (92%) Inside Site 104 and 58 of 64 cases (91%) Outside Site 104. Ten of the 16 tested metals (62.5%) were detected in the Ocean Reference sediment. Six metals (arsenic, copper, lead, mercury, nickel, and zinc) exceeded TEL values in 11 of the 13 channel reaches and in both Inside and Outside Site 104 (Table 6-14). Craighill Channel and Craighill Upper Range were the only channels that did not have any TEL or PEL exceedances for metals. Cadmium exceeded the TEL in three channel reaches [C&D Canal Approach (cores), Craighill Angle West, and Tolchester Channel North], and chromium exceeded the TEL in one channel reach (Cutoff Angle). Nickel and zinc were the only metals in the channel sediment that exceeded PEL values (7 and 2 channel reaches, respectively) (Table 6-15). Nickel and zinc were also the only two metals detected in the channel sediment in the 1998 testing program that exceeded the PELs (see Chapter 3).

In addition to arsenic, copper, lead, mercury, and zinc, mean silver concentrations also exceeded the TEL in both Inside and Outside Site 104 (Table 6-14). Mean cadmium and chromium concentrations also exceeded the TEL value Inside Site 104. Mean concentrations of lead, silver, and zinc concentrations exceeded the PEL value Inside Site 104. None of the metals detected Outside Site 104 exceeded PEL values (Table 6-15). None of the metals exceeded TELs at the Ocean Reference site.

The mean simultaneously extracted metals /acid volatile sulfide (SEM/AVS) ratio was less than 1 for all channel reaches, with the exception of Brewerton Eastern Extension and the C&D Canal Approach Channel (surficial sediments). Ratios that are less than 1 indicate that metals are bound to organic material and are not bioavailable. Ratios that are greater than 1 indicate that metals could be bioavailable to aquatic organisms.

6.4.10 Butyltins

Results of the butyltin analyses are provided in Table 6-12. Butyltins were detected in 4 of 200 cases (2%) in the channel sediments. Low concentrations of dibutyltin were detected in one sample each from Craighill Angle East (11 μg/kg) and Tolchester Straightening (4.9 μg/kg), and a low concentration of tributyltin was detected in Craighill Upper Range (4 μg/kg). Tributyltin was detected below the lowest method calibration limit in the Ocean Reference sediment (3 μg/kg). Butyltins were not detected either Inside Site 104 (0 of 32 cases) or Outside Site 104 (0 of 16 cases).

6.4.11 Dioxin and Furan Congeners

Results of the dioxin and furan analyses and associated Toxicity Equivalency Factors (TEFs) and Toxicity Equivalency Quotients (TEQs) are provided in Table 6-13. The TEFs represent the toxicity of each congener relative to 2,3,7,8 TCDD (the most toxic congener). TEQs represent a weighted summation of all dioxin and furan congeners based on the toxicity of each congener relative to 2,3,7,8, TCDD. All seven of the dioxin congeners and ten of the tested furan congeners were detected within channel sediments. In the 13 channel reaches, dioxin and furan congeners were detected in 106 of 221 cases (48%). All 17 of the dioxin and furan congeners were detected Inside Site 104, 4 of 17 (24%) were detected Outside Site 104, and 5 of 17 (29%) were detected in the Ocean Reference sediment.

The highest and most frequent concentrations were detected for the congeners with the lowest TEF potency (1,2,3,4,6,7,8-HpCDD, OCDD, 1,2,3,4,6,7,8-HPCDF, and OCDF). TEQs (ND=DL) ranged from 0.87 ng/kg to 6.65 ng/kg; TEQs (ND=1/2 DL) ranged from 0.50 ng/kg to 6.53 ng/kg; TEQs (ND=0) ranged from 0.12 ng/kg to 6.4 ng/kg). Craighill Entrance and Craighill Channel tended to have the highest detected congener concentrations, and the highest TEQ value (ND= DL) was reported for Craighill Channel (6.65 ng/kg) (Figure 6-5). Nine of the 13 channel reaches had a TEQ value (ND=DL) that was less than 3 ng/kg (parts per quadrillion). TEQs (ND=DL) for Inside Site 104, Outside Site 104, and the Ocean Reference site were 1.5 ng/kg, 1.4 ng/kg, and 0.27 ng/kg, respectively. There are no TEL/PEL values for dioxin.

6.5 THEORETICAL BIOACCUMULATION POTENTIAL (TBP)

Results of the bulk sediment analyses were used to calculate Theoretical Bioaccumulation Potential (TBP). TBP is a screening tool that provides a partial basis for selecting appropriate tissue analyses for quantification of bioaccumulation (Chapter 9). The TBP represents the approximate equilibrium tissue concentration that would be expected if the sediment or dredged material were the only source of contaminants. TBP estimates the potential concentration of a neutral organic substance that would accumulate in an organism from continuous exposure to the contaminated sediment (USACE–WES 1999). TBP is only determined for nonpolar organic compounds (pesticides, PAHs, PCBs, and dioxin and furan congeners) and is not calculated for metals, organic acids or salts, organotins, or methyl mercury.

According to the ITM, TBP is an environmentally conservative value (USEPA/USACE 1998) and a conservative predictor of bioaccumulation (USACE–WES 1999); that is, calculated TBP values tend to be higher than the actual bioaccumulation values measured in tissues of organisms exposed to the same sediment. Although a substance may have the potential to cause an adverse effect, the actual likelihood of an adverse effect is a function of : (1) physical and chemical properties of the constituent, (2) actual concentration in the tissue, and (3) the period of exposure (USACE–WES 1999).

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

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

Where TBP is expressed in the same concentration units as the C_s and

C_s = Concentration found in the sediment (expressed in any unit); these data are provided in Tables 6-6 (chlorinated pesticides), 6-7 (organophosphorus pesticides), 6-8 (PCB aroclors), 6-9 (PCB congeners), 6-10 (PAHs), and 6-13 (dioxin and furan congeners);

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

% TOC = Total organic carbon in the sediment (expressed as a decimal fraction); these data are provided in Table 6-3;

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

For screening purposes, TBP conservatively identifies contaminants in dredged material that may cause unacceptable bioaccumulation in aquatic organisms. TBP calculations have known limitations and uncertainty associated with estimating PAH bioaccumulation (MacFarland and Clarke 1999). A BSAF value of 4 (as recommended by the ITM) for all analytes has been referred to as "unreasonably conservative" for predicting bioaccumulation (USACE-WES 1996). Although a BSAF value of 1 has been justified for calculating dioxin TBP (USEPA 1993c; Pruell et al. 1993), a BSAF value of 4 was used for all analytical fractions in this project to identify a worst-case bioaccumulation potential.

TBP values were calculated using the mean sediment contaminant concentrations from each sampling reach. If a compound was not detected in the sediment within the channel reach, TBP was not calculated. Lipid concentrations for soft-bodied invertebrates vary depending upon the test organisms, but can range up to as high as 1-2 percent of total body wet weight (USEPA/USACE 1998). A 2 percent lipid value was used for the TBP calculations, assuming a worst-case bioaccumulation potential.

For each analytical fraction (chlorinated pesticides, organophosphorus pesticides, PCB aroclors, PCB congeners, PAHs, and dioxin/furan congeners), three sets of numerical comparisons were conducted: approach channels vs. Inside Site 104, approach channels vs. Outside Site 104, and approach channels vs. the Ocean Reference.

Chemical constituents with TBP values that exceed the placement site/reference site TBPs will be further evaluated in Tier III bioaccumulation studies.

6.5.1 Pesticides and PCB Aroclors

TBP results and comparisons for pesticides are provided in Table 6-18A (Inside Site 104), 6-18B (Outside Site 104), and 6-18C (Ocean Reference). In the 13 channel reaches, the TBP for pesticides (both chlorinated and organophosphorus) and PCB aroclors exceeded the Inside Site 104 TBP in only 4 of 286 cases (1.4%), the Outside Site 104 TBP in 8 of 286 cases (2.8%), and the Ocean Reference TBP in 9 of 286 cases (3.1%). 4,4'-DDD, 4,4'-DDE, and heptachlor epoxide were the only three pesticides that exceeded the placement site/reference site TBP values (Table 6-24). There were no TBP exceedances for either organophosphorus pesticides or PCB aroclors (see Tables 6-18A, 6-18B, and 6-18C). These results indicate only three pesticides (4,4'-DDD, 4,4'-DDE, and heptachlor epoxide) have *the potential to* bioaccumulate more in tissue exposed to channel sediments than to tissues exposed to the placement site/reference site sediments.

6.5.2 PCB Congeners

TBP results and comparisons for PCB congeners and total PCBs are provided in Tables 6-19A (Inside Site 104), 6-19B (Outside Site 104), and 6-19C (Ocean Reference). In the 13 channel reaches, the TBP for PCB congeners numerically exceeded the Inside Site 104 TBP in 46 of 338 cases (13.6%), the Outside Site 104 TBP in 210 of 338 cases (62%), and the Ocean Reference TBP in 253 of 338 cases (75%) (Table 6-24).

The C&D Approach (core) was the only channel reach where the TBP for total PCBs (ND=0) numerically exceeded the TBP for total PCBs Inside Site 104. The TBP for total PCBs (ND=DL and ND=1/2DL) in each of the 13 reaches numerically exceeded the TBP for total PCBs Outside Site 104. The TBP for total PCBs (ND=0) in 6 of the 13 reaches numerically exceeded the TBP for total PCBs in the Ocean Reference sediment. These results indicate that total PCBs in several channel reaches have *the potential* to bioaccumulate more in tissue exposed to channel sediments than to tissues exposed to placement site/reference site sediments.

6.5.3 Polynuclear Aromatic Hydrocarbons

TBP results and comparisons for PAHs are provided in Tables 6-20A (Inside Site 104), 6-20B (Outside Site 104), and 6-20C (Ocean Reference). In the 13 channel reaches, the TBP for PAHs numerically exceeded the Inside Site 104 TBP in 11 of 208 cases (5.3%), the Outside Site 104 TBP in 28 of 208 cases (13.5%), and the Ocean Reference TBP in 194 of 208 cases (93%) (Table 6-24).

TBP values for 7 of the 16 tested PAHs numerically exceeded the TBP for Inside Site 104. Tolchester Straightening had the highest number of PAHs that exceeded Inside Site 104 TBP values (6 PAHs) and had the highest TBP values. Tolchester Straightening was the only channel reach where the TBP for Total PAHs exceeded TBP value for Inside Site 104.

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TBP values for 10 of the 16 targeted PAHs exceeded the TBP for Outside Site 104. Dibenz[a,h]anthracene was the PAH with the most Outside Site 104 exceedances (7 of the 13 channel reaches). Tolchester Straightening had the highest number of PAHs that exceeded Outside Site 104 TBP values (10 PAHs), followed by Tolchester Channel North (7 PAH exceedances). Tolchester Straightening was the only channel reach where the TBP for Total PAHs exceeded the TBP value for Outside Site 104.

TBP values for all 16 of the tested PAHs exceeded the TBP for the Ocean Reference area. Fourteen of the 16 tested PAHs exceeded the Ocean Reference TBP for all 13 channel reaches. The TBP value for total PAHs (ND=0) in the every channel exceeded the Ocean Reference TBP value.

These results suggest that only PAHs have the potential to bioaccumulate more in tissue exposed to sediments from the Tolchester Straightening than from tissue exposed to sediments Inside and Outside Site 104. In addition, comparisons to the Ocean Reference data indicate that PAHs have the *potential* to bioaccumulate more in tissue exposed to all channels than to tissues exposed to the Ocean Reference sediment.

6.5.4 Dioxin and Furan Congeners

TBP results and comparisons for dioxin and furan congeners are provided in Tables 6-21A (Inside Site 104), 6-21B (Outside Site 104), and 6-21C (Ocean Reference). In the 13 channel reaches, the TBP for dioxin and furan congeners exceeded the Inside Site 104 TBP in 67 of 221 cases (30%), the Outside Site 104 TBP in 95 of 221 cases (43%), and the Ocean Reference TBP in 74 of 221 cases (34%). Overall, the Craighill Channel had the highest TBP values and the most TBP exceedances for all of the reference areas. Comparisons of TBP for TEQs indicated that dioxins and furans in several channel reaches have *the potential* to bioaccumulate more in tissue exposed to channel sediments than tissue exposed to placement site/reference area sediments.

6.6 DISCUSSION AND TIER II TBP EVALUATION

6.6.1 Frequency of Detection

Overall, of the three reference areas, the Ocean Reference sediment had the fewest detected organic constituents (Table 6-17). Metals, many of which naturally occur in sediments, were the constituents that were most frequently detected in the approach channels, Inside Site 104, Outside Site 104, and in the Ocean Reference area. PAHs were the most frequently detected organic constituents in the sediments from the approach channels, Inside Site 104, and Outside Site 104. Overall, few chlorinated VOCs, SVOCs, chlorinated pesticides, and PCB aroclors were detected in the channels and placement site/reference areas. No organophosphorus pesticides were detected in any of the sediments tested.

6.6.2 Comparisons to TELs and PELs

The number of TEL and PEL exceedances for mean concentrations in each channel reach are summarized in Tables 6-22 (TEL) and 6-23 (PEL). Inside Site 104 and Outside Site 104 had the highest number of TEL exceedances for mean concentrations, 21 and 22 respectively. Of the 13 channels, Tolchester Straightening had the highest number of TEL exceedances (20), followed by the Brewerton Channel Eastern Extension, C&D Approach (surficial), Cutoff Angle, and Tolchester North (15). Inside Site 104 and Tolchester Straightening had the highest number of PEL exceedances (5 and 6 exceedances, respectively).

Although the number of TEL or PEL exceedances within a given channel reach can not predict toxicity, none of the tested sediments may be ruled out as non-toxic without additional evaluation (O'Connor et al. 1998).

6.6.3 Chemical Concentrations

Sediments serve as a sink and a source for natural materials, as well as organic contaminants which bind to fine particulates that may be deposited and buried within sediments. Disturbance by dredging and placement can re-mobilize contaminants and particulates from the sediment into the water column. Areas proposed for dredging in urbanized watersheds can contain measurable quantities of contaminants. Contaminants originate from both point-sources (e.g., industrial and municipal effluents) and non-point sources (e.g., stormwater runoff, agricultural runoff, and atmospheric deposition). The sediments and sediment quality of the Upper Bay are primarily influenced by non-point sources within the Chesapeake Bay watershed.

According to the 1999 State of the Chesapeake Bay Report (USEPA–Chesapeake Bay Program 1999), there is no evidence of system-wide toxic problems within the sediments of the Chesapeake Bay. Currently, there are three Chesapeake Bay Regions of Concern: Baltimore Harbor/Patapsco River, the Anacostia River, and the Elizabeth River. Sediments in these systems are severely contaminated with anthropogenic constituents and are targeted for sediment clean-up and remediation. The mainstem navigation channels in the upper Chesapeake Bay are not within the immediate vicinity of these areas and are not considered areas of concern. Overall, in the Bay channels proposed for dredging and in sediments from Outside Site 104, there are only scattered hits of contaminants, as would be expected from sediments outside areas of concern. Sediment quality Inside Site 104 has been influenced by past placement activities (some from Baltimore Harbor) and some of the chemical concentrations reported in the sediments may have been influenced by these past placement of Baltimore Harbor sediments.

The major types of contaminants that potentially occur in sediments include bulk organics (hydrocarbons that include oil and grease), halogenated hydrocarbons (persistent organics that degrade slowly), polycyclic aromatic hydrocarbons (PAHs, organics that include petroleum products and petroleum by-products), metals and nutrients. The concentrations of metals and organic constituents detected in the channel sediments are discussed in the following sections and are compared to concentrations reported by Eskin et al. 1996 for Region 3 (Figure 6-6) of the upper Chesapeake Bay.

6.6.3.1 Metals

Metals were consistently detected in the approach channels, Inside Site 104, Outside Site 104, and in the Ocean Reference sediment, and metals tended to have the most TEL exceedances. Although not statistically compared, mean concentrations of metals in the channel sediments were generally less than or comparable to the concentrations reported for both Outside and Inside Site 104.

The majority of metals detected in the sediments are naturally occurring within the environment (e.g., arsenic, cadmium, copper, lead, manganese, nickel, and zinc), and small quantities of some of these metals are essential nutrients for aquatic organisms (USEPA-CBP 1995). Metals tend to be naturally elevated in the Upper Bay region, and Eskin et al. (1996) noted that, Bay-wide, the highest concentrations and greatest variability of trace metals occur in the Upper Bay region from Pooles Island to the Bay Bridge. Overall, the ranges of metals concentrations for all approach channels combined were generally comparable to ranges reported by Eskin et al. (1996) (Figure 6-7).

Arsenic may be naturally released to the environment through volcanic eruption or by the weathering of arsenic-containing rocks. Anthropogenic sources of arsenic include fossil fuel burning and manufacturing of pesticides, wood preservatives, and fertilizers. Elevated arsenic concentrations occur throughout the Upper Bay region (Eskin et al., 1996). With the exception of Craighill Channel, the grain size-normalized concentrations of arsenic reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-8; Eskin et al. 1996). It is important to note that the mean normalized arsenic concentration reported for Craighill Channel was skewed high because of the high sand concentration measured in one of the three channel samples. Although skewed higher than other channel sediments, the mean arsenic concentration (non-normalized value) did not exceed the TEL.

Cadmium and chromium are elements that occur naturally in soils, rocks, and sediments. Anthropogenic sources of cadmium include municipal and industrial effluents. The mean grain-size normalized concentrations of cadmium reported in the individual upper Chesapeake Bay approach channels were below the normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-9; Eskin et al. 1996). Anthropogenic sources of chromium include manufacturing and stainless steel and metal electroplating processes. With the exception of Craighill Channel, the grain-size-normalized concentrations of chromium in the individual upper Chesapeake Bay approach channels were within the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-10; Eskin et al. 1996). It is important to note that the mean normalized chromium concentration reported for Craighill Channel was skewed high because of the high sand concentration measured in one of the three channel samples.

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Copper may be naturally released through the weathering of rocks or release of copper sulfide. Man-made sources of copper include wood preservatives, anti-fouling paint, copper pipes and fungicides (MacDonald 1993). The grain size-normalized concentrations of copper reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-11; Eskin et al. 1996).

Lead primarily originates from industrial uses, including paints, batteries, leaded fuels, and metal manufacturing. With the exception of Craighill Channel and the Cutoff Angle, the grain size-normalized concentrations of lead reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-12; Eskin et al. 1996). It is important to note that the mean normalized concentration reported for Craighill Channel was skewed high because of the high sand concentration measured in one of the three channel samples. None of the lead concentrations in the channel sediments exceeded the PEL.

Mercury is released to aquatic environments from naturally occurring mercury in rocks and from anthropogenic sources such as paper mills and chemical facilities (USEPA 1999c). Incineration and fossil fuel combustion release mercury into the atmosphere and it is redeposited on land and surface waters, then adsorbed by soils and sediments. The grain size-normalized concentrations of mercury reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-13; Eskin et al. 1996).

Nickel and zinc are trace metals that are found in soils and sediments, but can also originate from industrial manufacturing of metals and metal alloys. Previous studies have indicated that nickel and zinc occur at naturally elevated levels in sediments of the Upper Chesapeake Bay (Eskin et al. 1996). The primary man-made source of nickel is combustion of fossil fuels, and refining and electroplating processes. Zinc is detected at high concentrations in urban stormwater, and stormwater runoff is considered to be a major source of zinc to the Upper Bay (Eskin et al. 1996). The mean grain size-normalized concentrations of nickel and zinc reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figures 6-14 (nickel) and 6-15 (zinc); Eskin et al. 1996).

Generally, metals accumulate in organism tissues, but most, with the exception of mercury, do not biomagnify in the food chain (Suedel et al. 1994). The bioavailability of divalent metals to aquatic organisms is influenced by the ratio of SEM/AVS. In low oxygenated environments, metals may precipitate with sulfides, making them unavailable for uptake by aquatic organisms. Brewerton Channel Eastern Extension and the C&D Canal Approach Channel (surficial sediments) were the only reaches where the SEM/AVS ratio was greater than 1, indicating that some metals (particularly cadmium, copper, lead, nickel, and zinc) may be bioavailable in these reaches, but are not in any other reaches.

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6.6.3.2 PAHs

PAHs are found throughout the environment (U.S. Department of Health and Human Services 1995; Menzie et al. 1992) and are widespread throughout the Chesapeake Bay sediments (Eskin et al., 1996; USEPA-CBP 1995). PAHs originate from both natural and anthropogenic sources. Forest fires and volcanic eruptions are the primary natural sources of PAHs while fuel combustion processes are the primary anthropogenic source. The majority of PAHs are distributed to aquatic environments via atmospheric deposition. PAHs are divided into two categories: high molecular weight (HMW) and low molecular weight (LMW) PAHs. The HMW PAHs originate from the combustion of fossil fuels and include fluoranthene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, dibenzo(a,h)anthracene, ideno(1,2,3,-cd)pyrene, and pyrene. The LMW PAHs originate from both natural sources and petroleum products and include acenaphthene, naphthalene, acenaphthylene, anthracene, fluorene, 1-methylnaphthalene, and 2-methylnaphthalene.

In the 13 channel reaches, the highest concentrations of PAHs were reported for the Tolchester Straightening. The sediments from this location represent the deepest material proposed for dredging (10-ft cores). All of the PAHs that exceeded PELs in the Tolchester Straightening were LMW PAHs. These concentrations, however, fall below the mean total PAH concentration of 4,766 ppb that Eskin et al. (1996) found in this region of the Bay. The elevated concentration of PAHs in this region of the Bay may be related to high TOC values, as PAHs have a high affinity for particulates. There are no significant point sources for PAHs in the near vicinity of the Tolchester Straightening. Eskin et al. (1996) found that PAH concentrations in Bay sediments peak in the upper Bay from Turkey Point to the Patapsco River. Overall, the ranges of PAHs for all approach channels combined were generally comparable to ranges reported by Eskin et al. (1996) (Figure 6-16).

The high PAHs Inside Site 104 (particularly throughout the southern end of the site) may have originated from historical dredged material placement activities that occurred at the site from 1924 through 1975. Sediments placed from 1924 to 1975 were placed prior to implementation of testing programs. These sediments may have originated from historic maintenance dredging of the approach channels and from within Baltimore Harbor. Sediments from Inside Site 104 contained elevated concentrations of LMW PAHs compared to the majority of the channel sediments. Observations of sediment collected from the vicinity of KI-7 indicated that a petroleum-like odor and oily sheen was present approximately 4-5 inches below the sediment surface.

Although there were signs of visual contamination Inside Site 104, the mean concentrations of PAHs in sediments were similar Inside Site 104 and Outside Site 104. Inside Site 104 tended to have higher concentrations of LMW PAHs, and Outside Site 104 tended to have higher concentrations of HMW PAHs. Although not statistically compared, concentrations of PAHs in the channels proposed for maintenance dredging are comparable to or lower than the mean concentrations for both Outside and Inside Site 104, with the exception of Tolchester Straightening.

There were no detectable concentrations of PAHs reported in sediments from the Ocean Reference area. The Ocean Reference area is located offshore in an area that is not impacted by watershed deposition of organic constituents and associated PAHs.

Comparisons of PAH concentrations in the individual upper Chesapeake Bay approach channels to studies conducted by Eskin et al. (1996) indicated that mean TOC-normalized concentrations of anthracene (Figure 6-17), benz(a)anthracene (Figure 6-18), benzo(g,i,h)perylene (Figure 6-19), benzo(a)pyrene (Figure 6-20), chrysene (Figure 6-21), fluoranthene (Figure 6-23), ideno(1,2,3-cd)pyrene (Figure 6-24), naphthalene (Figure 6-25), phenanthrene (Figure 6-26), pyrene (Figure 6-27), and Total PAHs (Figure 6-28) in the channel sediments were substantially below the mean-normalized concentrations reported by Eskin et al. (1996). It is likely that laboratory instrumentation has improved significantly within the past 10 years, and analytical instrumentation is able to detect much lower concentrations of PAHs. Dibenzo(a,h)anthracene (Figure 6-22) was the only constituent where two channels (Craighill Channel and Craighill Upper Range) exceeded the normalized concentration reported by Eskin et al. (1996). It is important to note, however, that dibenzo(a,h)anthracene was only tested in one sample in the Eskin et al. (1996) study.

6.6.3.3 PCBs

PCBs are man-made chemicals that were historically used in electrical transformers, are wide-spread in the mainstem Upper Bay, are persistent in the environment (USEPA 1999a), and are known to bioaccumulate in aquatic organisms (USEPA 1999a). The mean concentrations of PCBs throughout the channels proposed for dredging were substantially lower than the TEL values. Because they are present in such low concentrations, PCBs in the channel sediments are not expected to cause adverse effects to aquatic organisms. Studies by Eskin et al. (1996) also detected low concentrations of PCB congeners in the mainstem sediments. Overall, the range to total PCB concentrations for all approach channels combined was generally comparable to the range reported by Eskin et al. (1996) (Figure 6-29).

PCB concentrations Inside Site 104 were higher than those reported in the approach channels, Outside 104, and the Ocean Reference, and the mean total PCB concentration was just below the TEL value of 21.55 ug/kg. Sediment quality Inside Site 104 has been influenced by past placement activities (some from Baltimore Harbor) and some of the chemical concentrations reported in the sediments may have been influenced by these past placement activities. Total PCBs for Outside Site 104 was comparable to or below the value reported for the approach channels.

Only one PCB congener was measured in sediments from the Ocean Reference area. The Ocean Reference area is located offshore in an area that is not impacted by watershed deposition of organic constituents or anthropogenic contaminants.

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The TOC-normalized concentrations of Total PCBs reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-30; Eskin et al. 1996).

6.6.3.4 Pesticides

Pesticides, such as DDT and DDE, are persistent within the environment and have the potential to bioaccumulate in aquatic organisms and biomagnify in the food chain (Suedel et al. 1994). Only a few pesticides were detected in the channel sediments, and the majority of detected pesticides were present in the eastern channel reaches (C&D Approach, Tolchester Channel-North, Tolchester Channel - South, and Tolchester Straightening) and Inside Site 104. Concentrations of pesticides in the eastern channel reaches may originate from agricultural applications of pesticides or atmospheric deposition. Overall, the upper ranges of pesticides concentrations for all approach channels combined were slightly higher than the upper ranges reported by Eskin et al. (1996) (Figure 6-31). It is important to note that these ranges may be biased slightly high due to the high sand/low TOC concentrations measured in one of the Craighill Channel samples.

With the exception of Craighill Channel, the mean TOC-normalized concentrations of DDD, DDE, and DDT reported in the upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figures 6-32 (DDD), 6-33 (DDE), and 6-34 (DDT); Eskin et al. 1996). It is important to note that the mean normalized DDD, DDE, and DDT concentrations reported for Craighill Channel may be skewed high due to the high sand/low TOC concentration measured in one of the three channel samples.

With the exception of Craighill Channel and Crighill Upper Range, the TOC-normalized concentrations of dieldrin reported in the individual upper Chesapeake Bay approach channels were within or below the range of normalized values reported in previous Upper Bay studies (Table 6-25A; Figure 6-35; Eskin et al. 1996). It is important to note that the mean normalized dieldrin concentration reported for Craighill Channel may be skewed high due to the high sand/low TOC concentration measured in one of the three channel samples. In addition, only one sample was analyzed for dieldrin in the Eskin et al. (1996) report.

Inside Site had the highest number of detected pesticides (five), compared to the channels, Outside Site 104, and the Ocean reference. Sediment quality Inside Site 104 has been influenced by past placement activities (some from Baltimore Harbor) and some of the chemical concentrations reported in the sediments may have been influenced by these past placement activities.

There were no detectable concentrations of chlorinated pesticides reported in sediments from the Ocean Reference area. The Ocean Reference area is located offshore in an area that is not impacted by watershed agricultural practices and atmospheric deposition that influence the distribution of organic constituents.

6.6.3.5 Dioxin and Furan Congeners

Dioxin and furan congeners are found throughout the environment (USEPA 1999b), and small quantities may be detected in any type of environmental sample (USACE–WES 1992a,b). 2,3,7,8 TCDD is the most toxic dioxin congener and is the most frequently studied congener in published literature. Both natural and man-made processes may produce dioxins. Forest fires are a natural source of dioxin to the environment. The majority of polychlorinated dioxin and furan congeners, however, are the product of incomplete combustion in the presence of chlorine or the product of industrial chlorination processes (Miller, Norris, and Hawkes 1973). The most common anthropogenic sources of dioxins include incinerators and pulp and paper mills (USEPA 1999b).

Dioxins bind tightly to particulates and are not water-soluble (USEPA 1993c); therefore, dioxin impacts are more likely to be associated with sediments than with the water column. Toxicity Equivalency Quotients (TEQs) represent a weighted summation of all dioxin and furan congeners based on the toxicity of each congener relative to 2,3,7,8, TCDD (the most toxic congener). 2,3,7,8-TCDD was detected in only one channel sample (Tolchester Channel - North) at an estimated concentration of 0.89 ng/kg.

OCDD (octochlorodibenzo-p-dioxin), the least toxic congener, was frequently detected and was the congener detected in the highest concentrations in all of the channel sediments. Sediment quality studies by Eskin et al. (1996) detected OCDD in 13 of 16 mainstem Chesapeake Bay stations with concentrations ranging from 100 to 2670 ng/kg. The concentrations of OCDD reported in the channel sediments ranged from 85.1 to 1040 ng/kg. Overall, the range of OCDD concentrations for all channels combined was comparable to the range reported in Eskin et al. (1996) (Figure 6-36).

With the exception of Craighill Entrance, the TOC-normalized concentrations of OCDD reported in the individual upper Chesapeake Bay approach channels were below the mean normalized value reported in a previous Upper Bay study (Table 6-25A; Figure 6-37; Eskin et al. 1996). Only two OCDD concentrations were reported for Region 3 of the Upper Bay in the Eskin et al. (1996) study.

TEQs (ND=DL) were similar Inside and Outside Site 104, although more congeners were detected Inside Site 104. 2,3,7,8-TCDD was detected Inside Site 104. A low TEQ (ND=DL) value was reported in the Ocean Reference (0.27 ng/kg) sediments.

There are no known point sources of dioxin to the upper Chesapeake Bay. Atmospheric deposition is the most likely source of this contaminant to the Upper Bay region. The distribution of dioxins and furans in the channel sediments and reference sediments does not appear to follow any consistent pattern. This suggests a more ubiquitous source and likely represents general background values throughout the sampling area. The presence of dioxin in the Ocean Reference sediment also suggests that the low concentrations are likely background values.

6.6.4 Comparisons to 1998 Channel and 1997 Site 104 Sediment Data

Comparisons of the 1997 Site 104 data (see Chapter 3), the 1998 channel data (see Chapter 3), and the 1999 channel data reveal similar results for the majority of tested and detected constituents. Metal TEL/PEL comparisons for the 1999 data yielded consistently similar results to the 1998 channel data comparisons (Brewerton Channel Eastern Extension, Craighill Channel, Craighill Angle, Craighill Entrance, Craighill Upper Range, Cutoff Angle, Swan Point Channel, and Tolchester Channel). PAH TEL/PEL comparisons for the 1999 data also yielded similar results to the 1998 data comparisons. In the 1999 samples, however, a greater number of PAHs were detected above TEL values.

Comparisons of chlorinated and organophosphorus pesticides indicated that a similar combination of pesticides was detected Inside Site 104 both sampling years. Overall, fewer pesticides were detected in Brewerton Channel Eastern Extension and Outside Site 104 in the 1999 sampling compared to the 1998 sampling. PCB aroclors were detected in 6 of the 8 tested channels in 1998, but were not detected in 1999. In addition, comparisons of VOCs and SVOCs results in 1998 and 1999 indicated that a similar suite of analytes was detected in both fractions in the channel sediments both sampling years.

Overall, comparison of the two sets of sediment chemistry data indicates that the analytical methods are consistently detecting a similar or equivalent subset of analytes in the channel reaches (for those channels that were sampled both years). This consistency yields a level of confidence that the sampling is adequately characterizing the areas proposed for dredging.

6.6.5 Theoretical Bioaccumulation Potential

Results of the TBP calculations and reference site comparisons indicated that several pesticides and the majority of the PCB congeners, PAHs, and dioxin/furan congeners have the potential to bioaccumulate to higher levels in aquatic organisms exposed to channel sediments than in organisms exposed to one or more of the placement site/reference sediments. Although a substance may have the potential to bioaccumulate and cause an adverse effect, the actual likelihood of an adverse effect is a function of: (1) physical and chemical properties of the constituent, (2) actual concentration in the tissue, and (3) the period of exposure (USACE–WES 1999).

Results of the TBP comparisons indicated that further evaluation in the Tier III would be necessary to assess actual bioaccumulation from the channel sediments.

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6.6.6 Tier II Sediment Conclusions

According to the ITM (USEPA/USACE 1998), after consideration of the Tier II TBP data in a manner comparable to that which would be used to make a decision in higher tiers, one of the following two conclusions is reached:

1. The dredged material is predicted to not result in unacceptable adverse effects due to bioaccumulation of the measured non-polar organic compounds, or

2. The available information is not sufficient to predict whether the dredged material will result in unacceptable adverse effects due to bioaccumulation of the measured non-polar organic compounds, and further evaluation of bioaccumulation in Tier III is necessary to furnish information to make determinations under the guidelines.

Results of the TBP evaluation indicate that bioaccumulation testing in Tier III is warranted to determine the actual bioaccumulation of chemical constituents in tissues exposed to the channel sediments and placement site/reference sediments. Methodology and results of the bioaccumulation studies are provided in Chapter 9.

Results of the TEL/PEL comparisons indicated that none of the sediments could be ruled out as non-toxic. Sediments from each channel and placement/reference area were directly tested for acute water column and sediment toxicity in Tier III. Methodology and results of the toxicity testing are provided in Chapter 8.

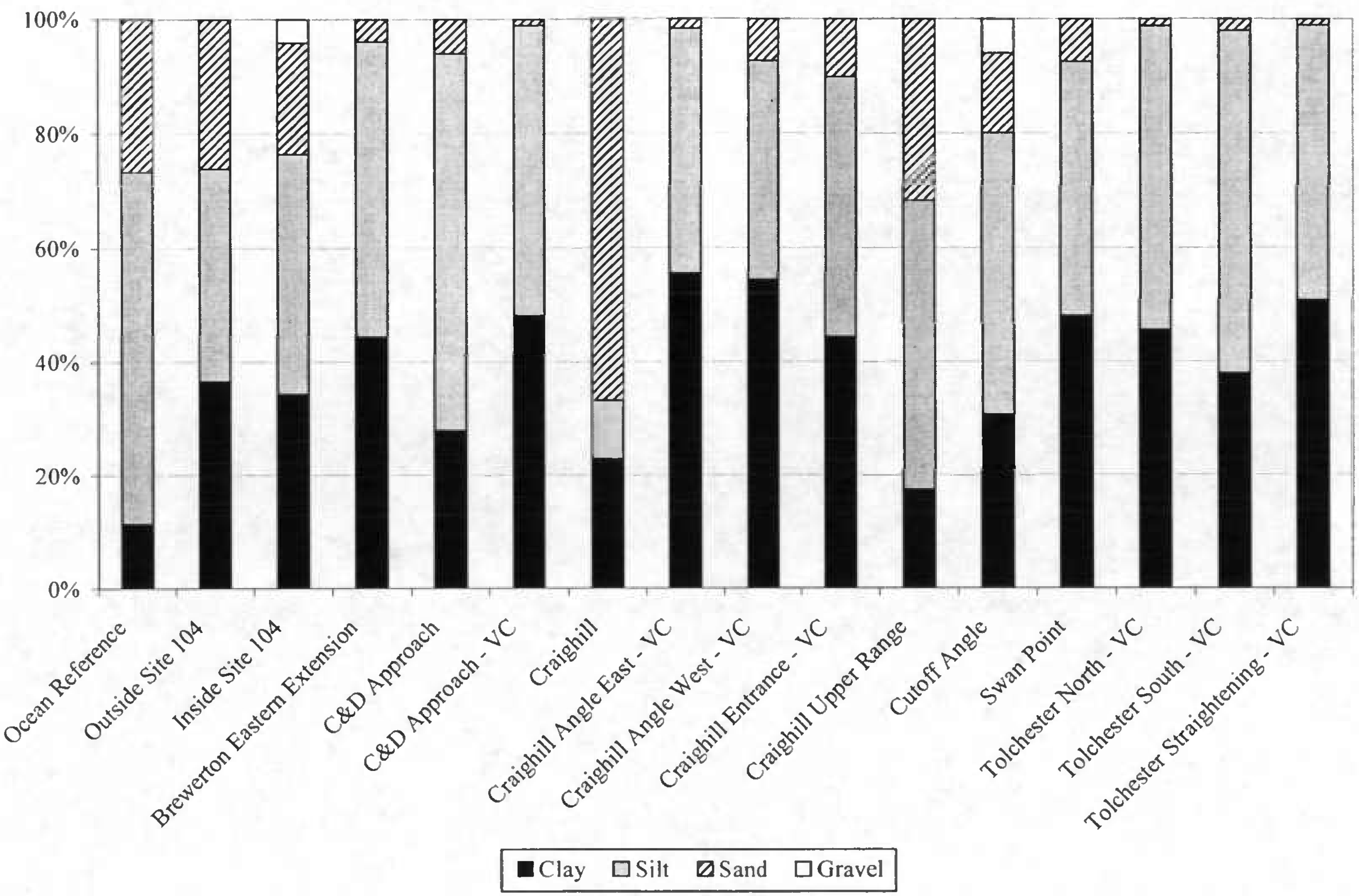

Figure 6-1. Mean grain size distributions for bulk sediments from Baltimore Harbor Approach Channels, Outside Site 104, Inside Site 104, and Ocean Reference. VC = Vibracore Sample. Sample sizes provided in Table 6-2.

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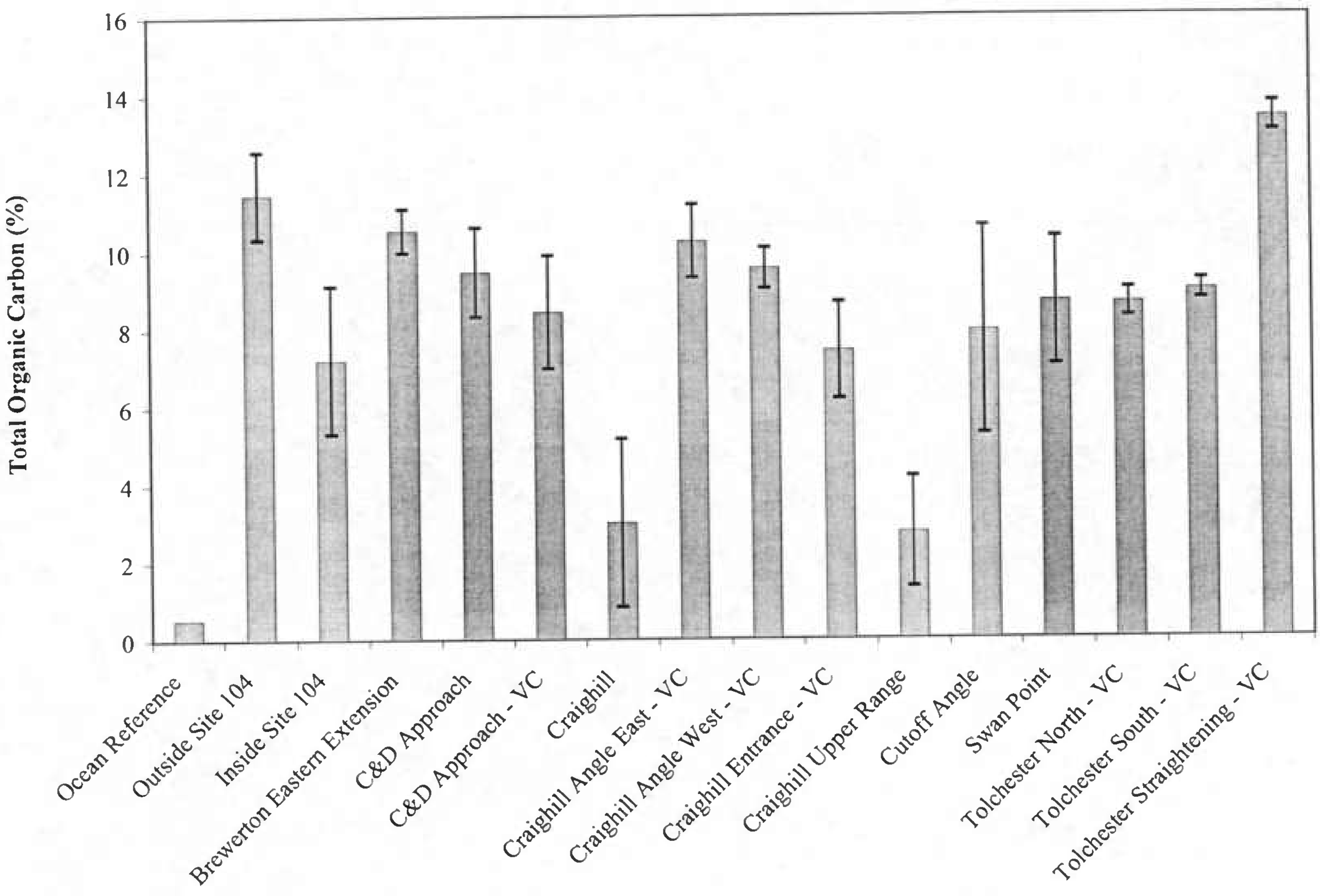

Figure 6-2. Mean Total Organic Carbon (%) from Baltimore Harbor Approach Channels, Outside Site 104, Inside Site 104, and Ocean Reference. I-bars represent ± one standard error (SE) of the mean. VC = Vibracore Sample. Sample sizes provided in Table 6-3.

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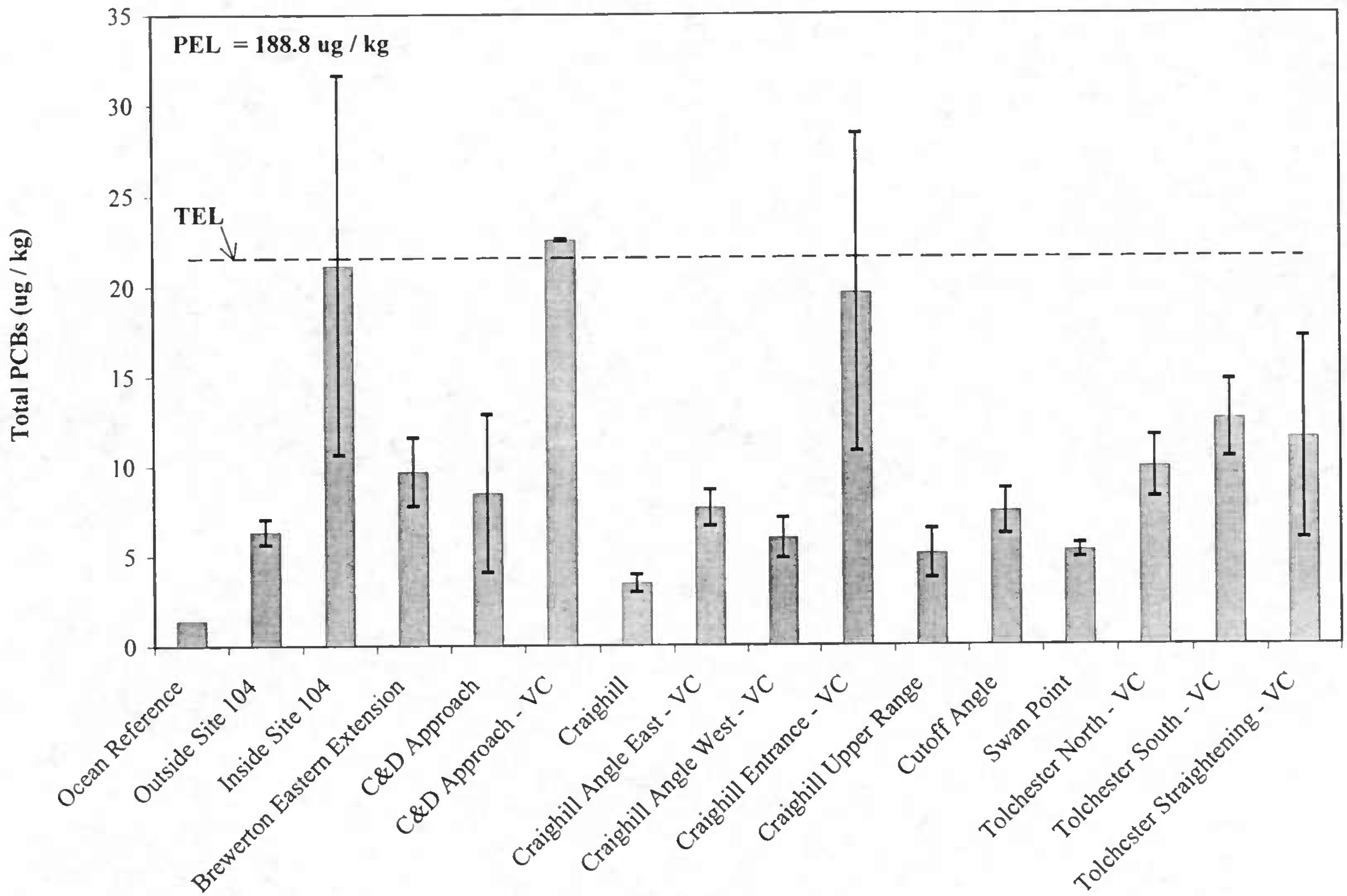

Figure 6-3. Mean concentrations of total PCBs (µg/kg) based on congener data in bulk sediment from Baltimore Harbor Approach Channels, Outside Site 104, Inside Site 104, and Ocean Reference. ND=DL. I-bars represent ± one standard error (SE) of the mean. VC = Vibracore Sample. Sample sizes are provided in Table 6-9.

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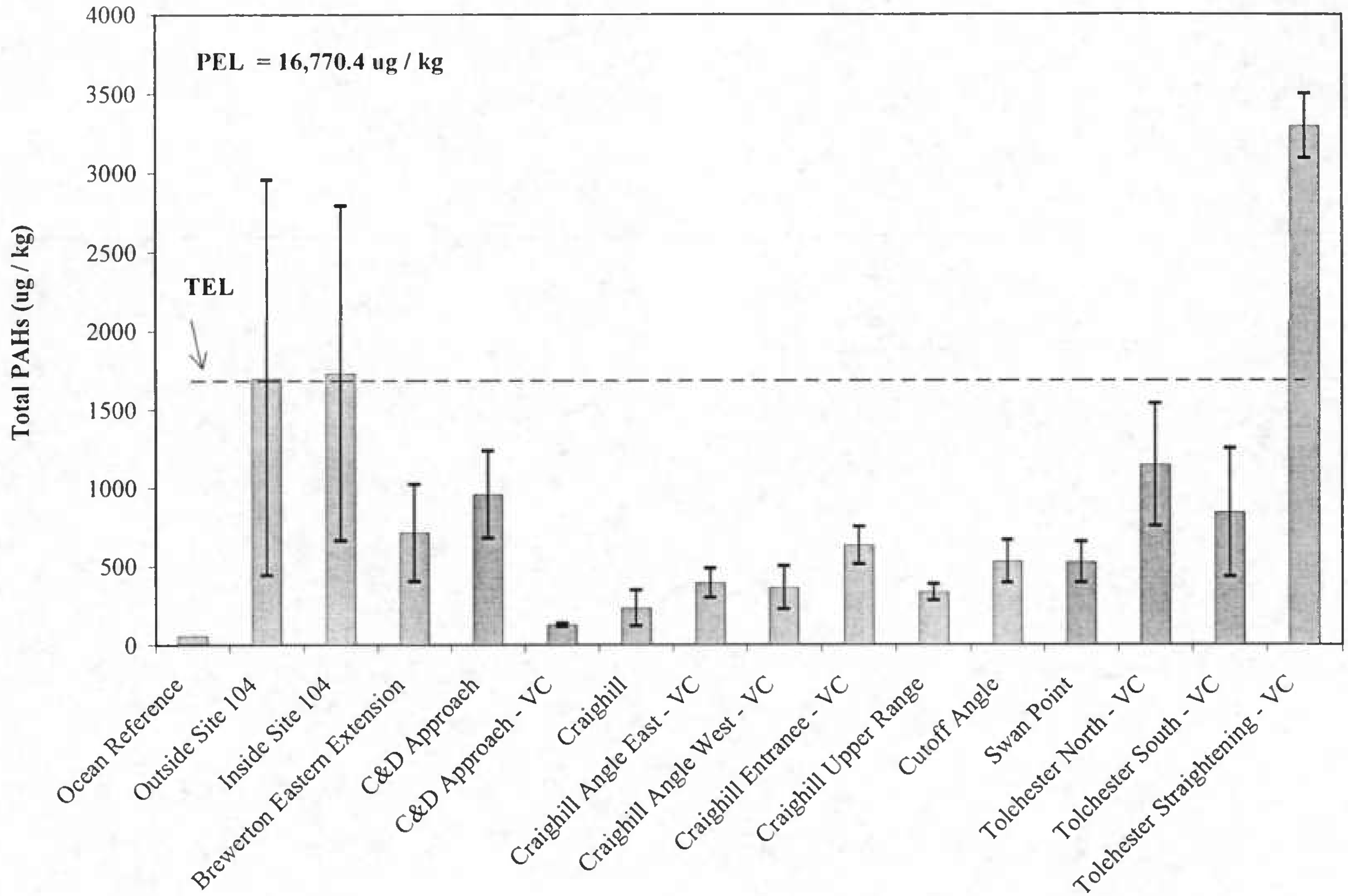

Figure 6-4. Mean concentrations of total PAHs (μg/kg) in bulk sediment from Baltimore Harbor Approach Channels, Outside Site 104, Inside Site 104, and Ocean Reference. ND=DL. I-bars represent ± one standard error of the mean. VC = Vibracore Sample. Sample sizes are provided in Table 6-10.

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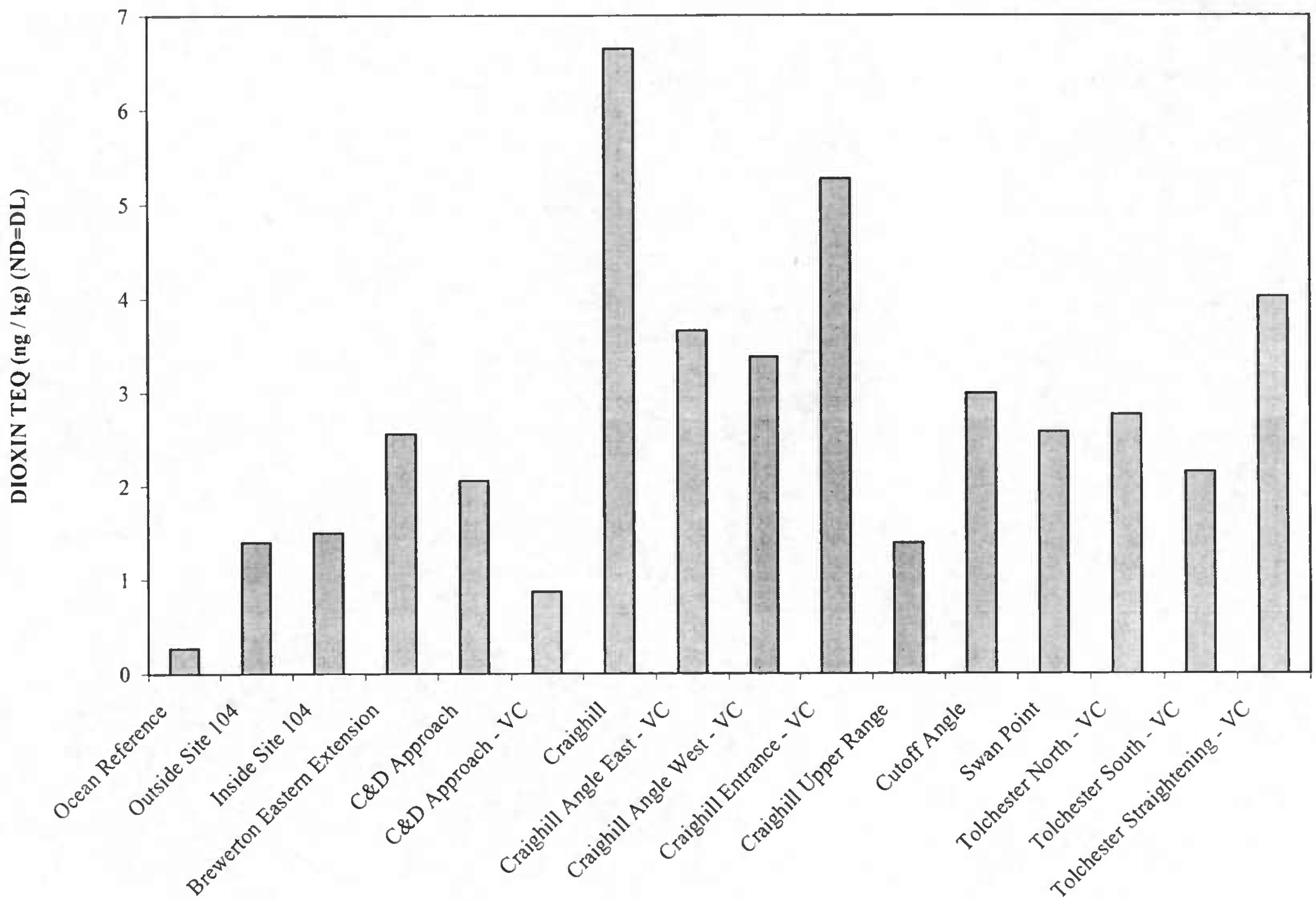

Figure 6-5. Dioxin / Furan TEQs (ND=DL) for sediment composites from Baltimore Harbor Approach Channels, Outside Site 104, Inside Site 104, and Ocean Reference. VC = Vibracore Sample.

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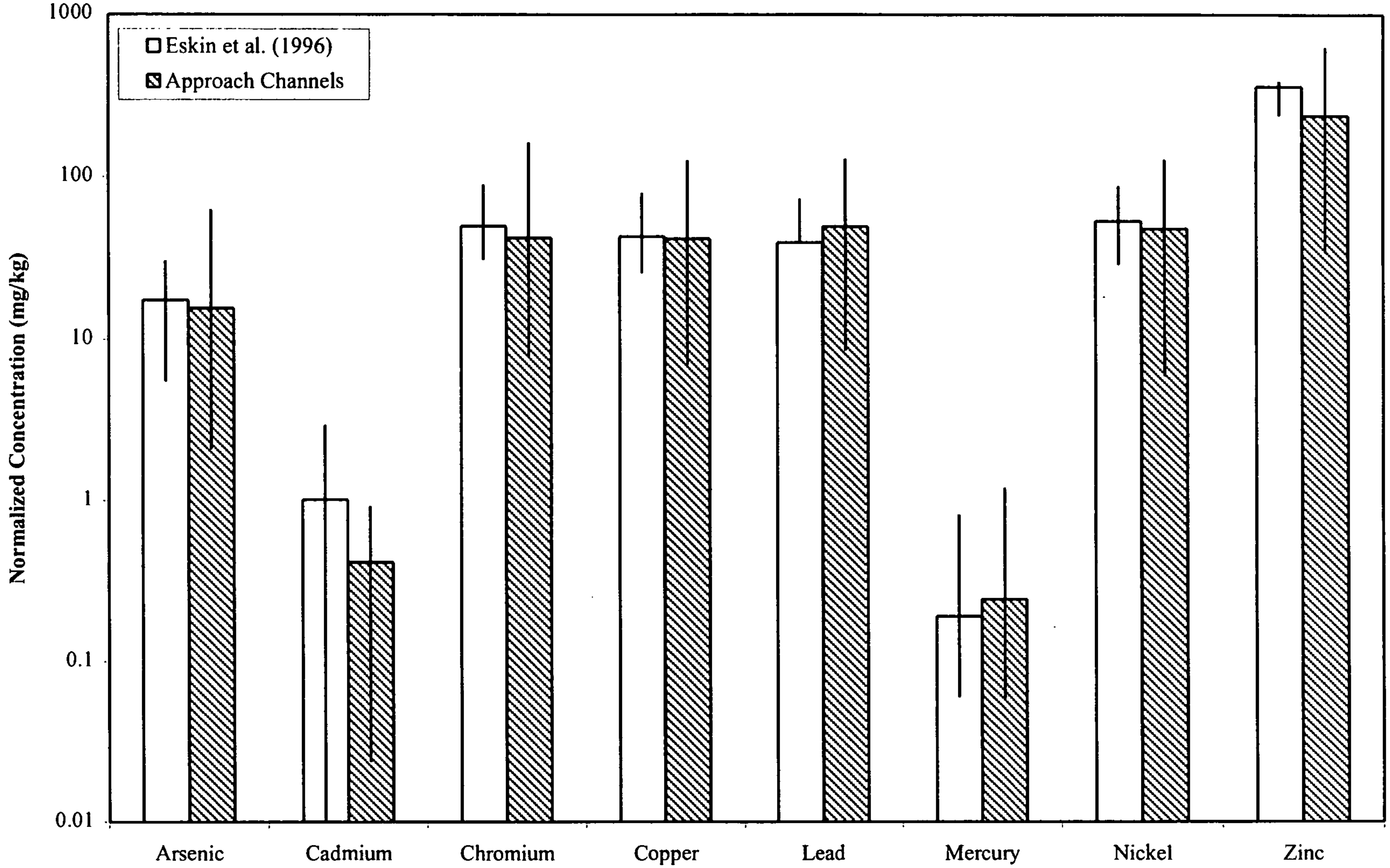

Figure 6-7: Mean normalized concentrations of metals in bulk sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al*. 1996. The vertical lines represent the range of values normalized to the TOC fraction of the bulk sediment. Means were calculated using data from all channels (n=49).

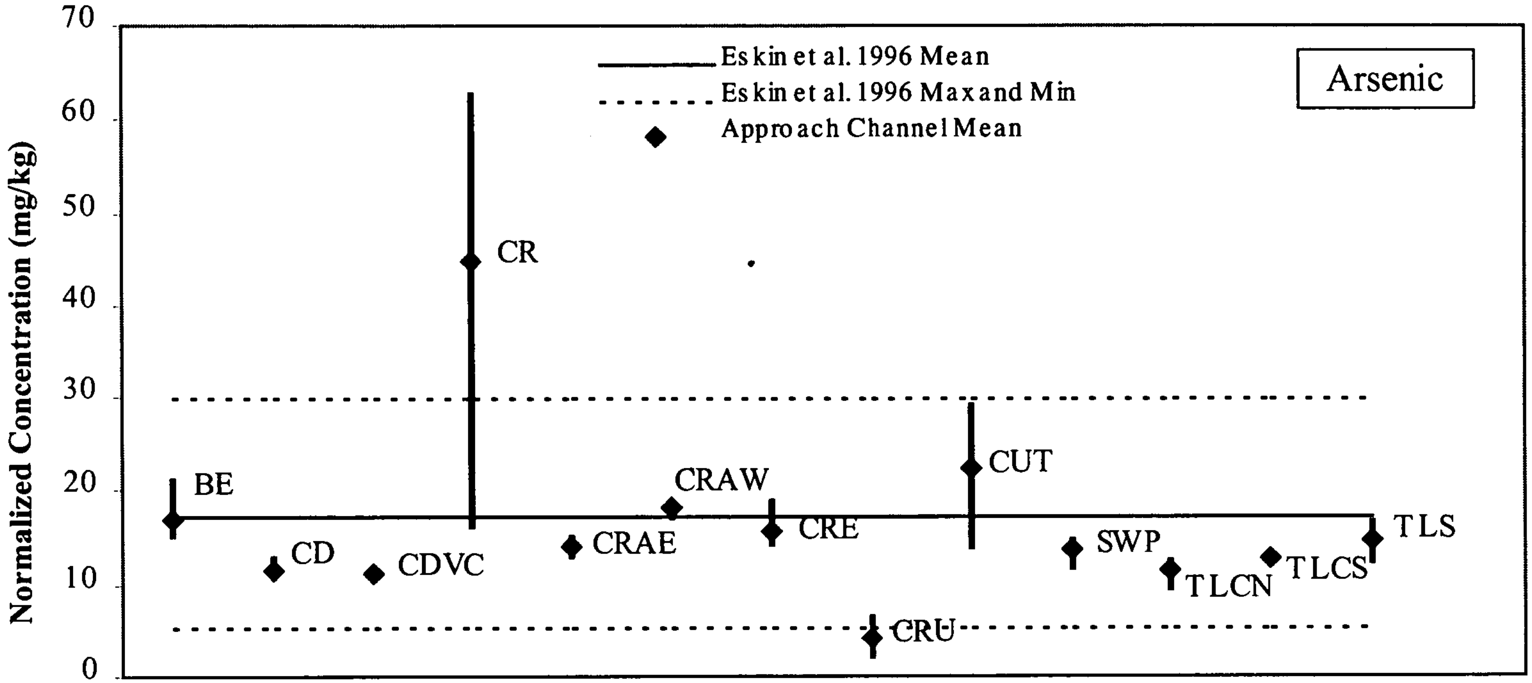

Figure 6-8: Mean normalized arsenic concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized arsenic concentration (17.4 mg/kg) from Eskin *et al.* 1996, calculated with an n=12. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

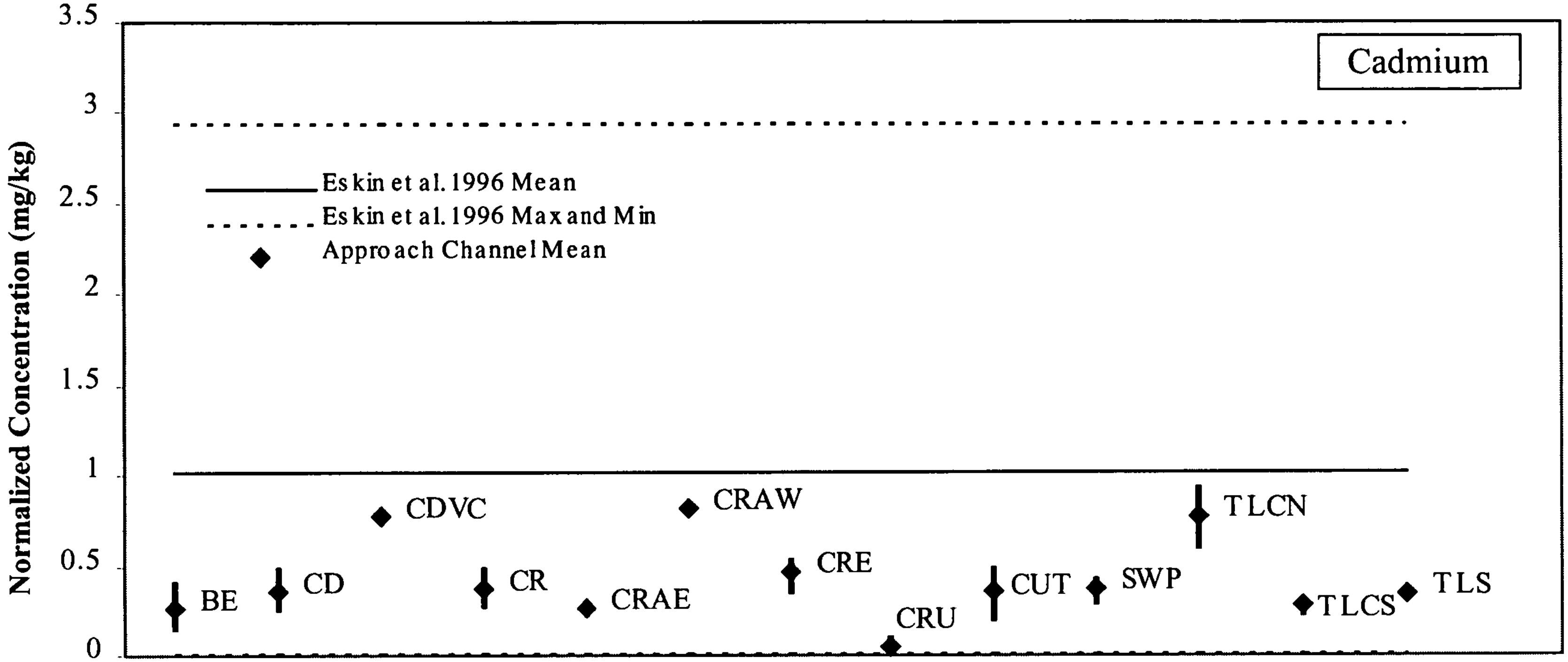

Figure 6-9: Mean normalized cadmium concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized cadmium concentration (1.01 mg/kg) from Eskin *et al.* 1996, calculated with an n=12. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

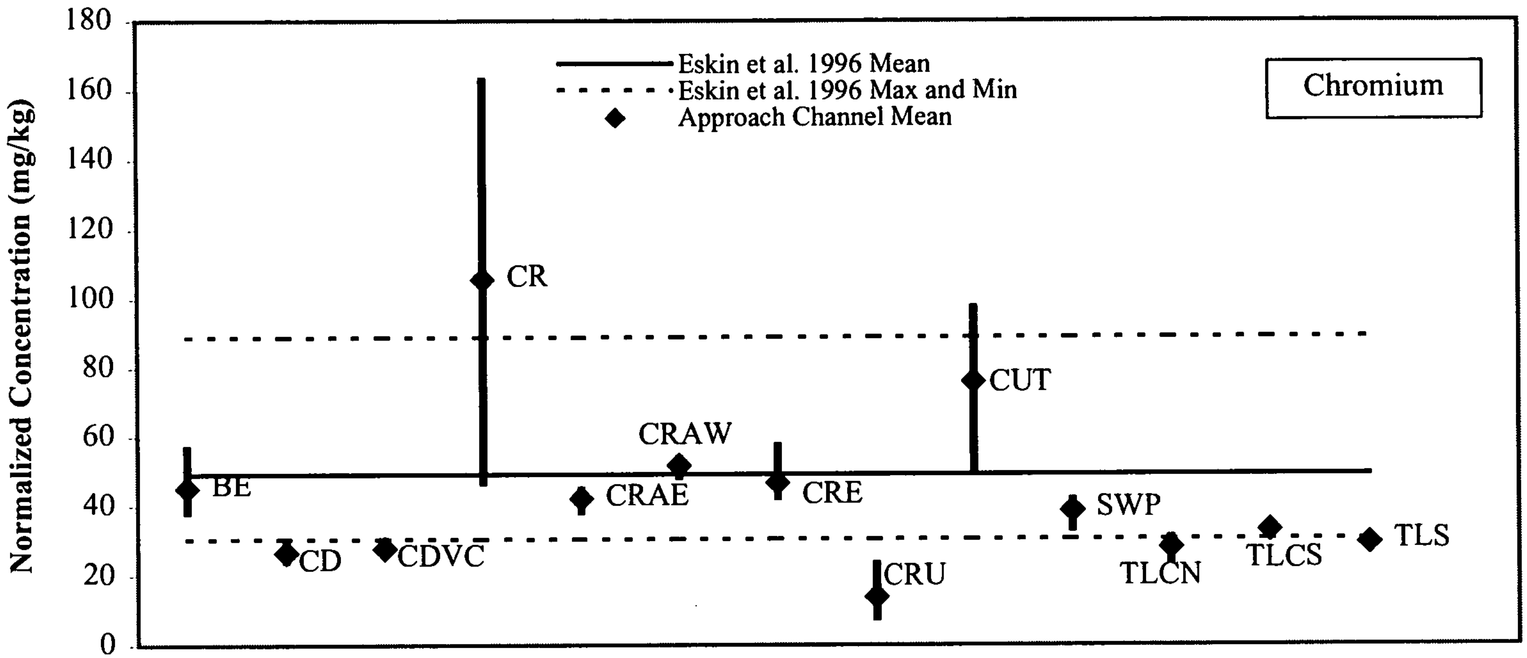

Figure 6-10: Mean normalized chromium concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized chromium concentration (49.2 mg/kg) from Eskin *et al.* 1996, calculated with an n=12. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

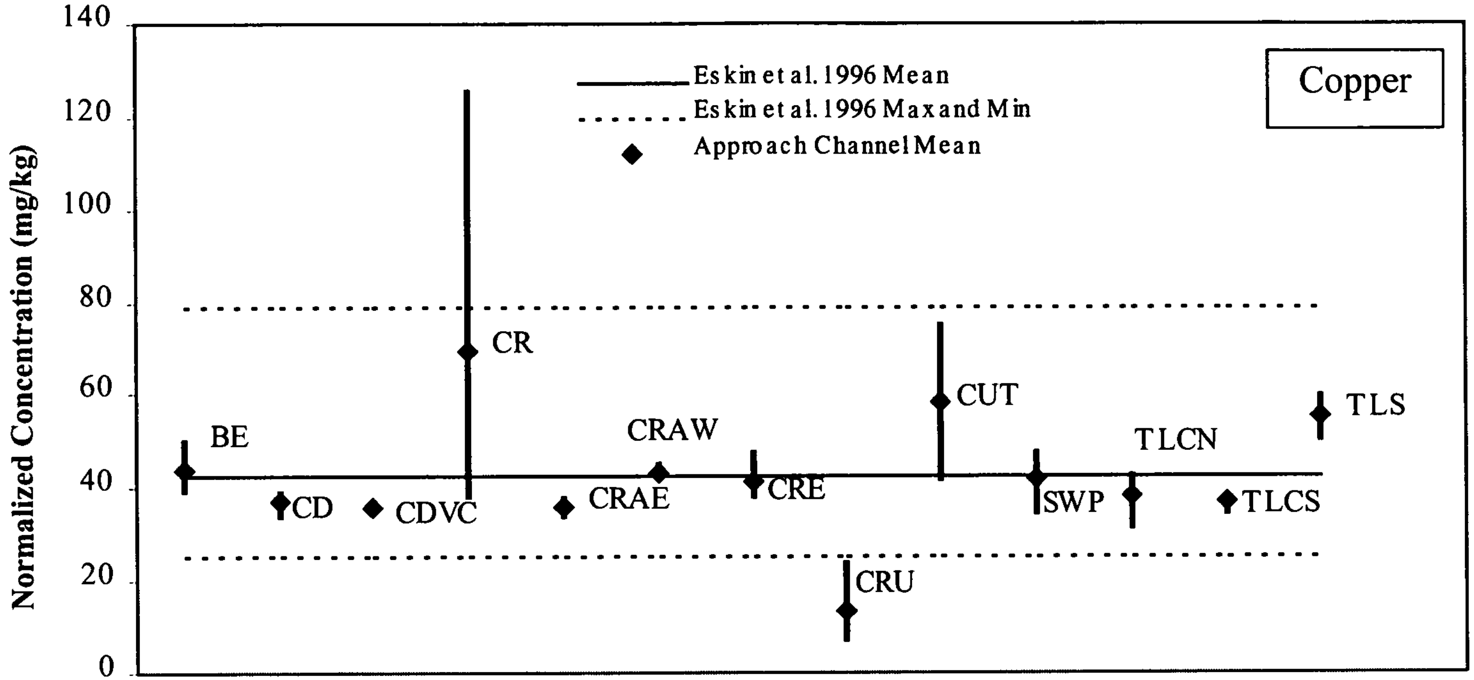

Figure 6-11: Mean normalized copper concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized copper concentration (42.5 mg/kg) from Eskin *et al.* 1996, calculated with an n=12. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

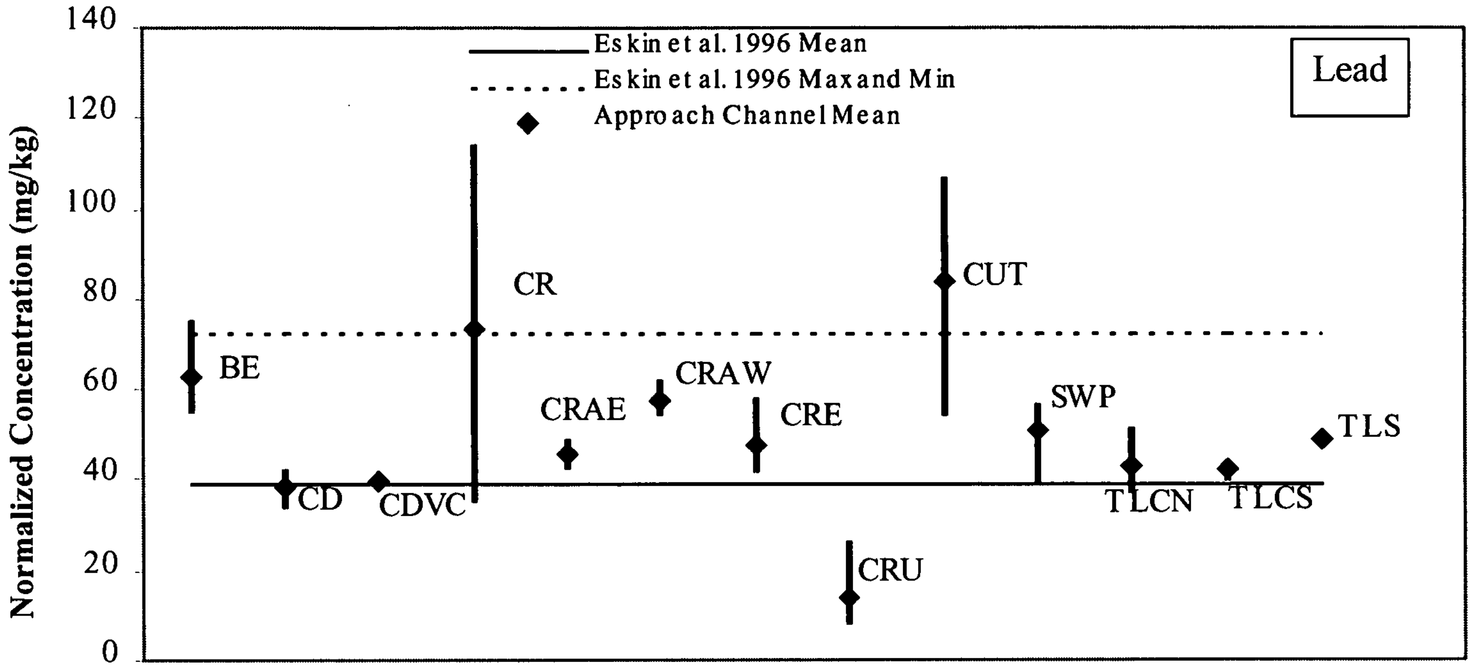

Figure 6-12: Mean normalized lead concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized lead concentration (39 mg/kg) from Eskin *et al.* 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

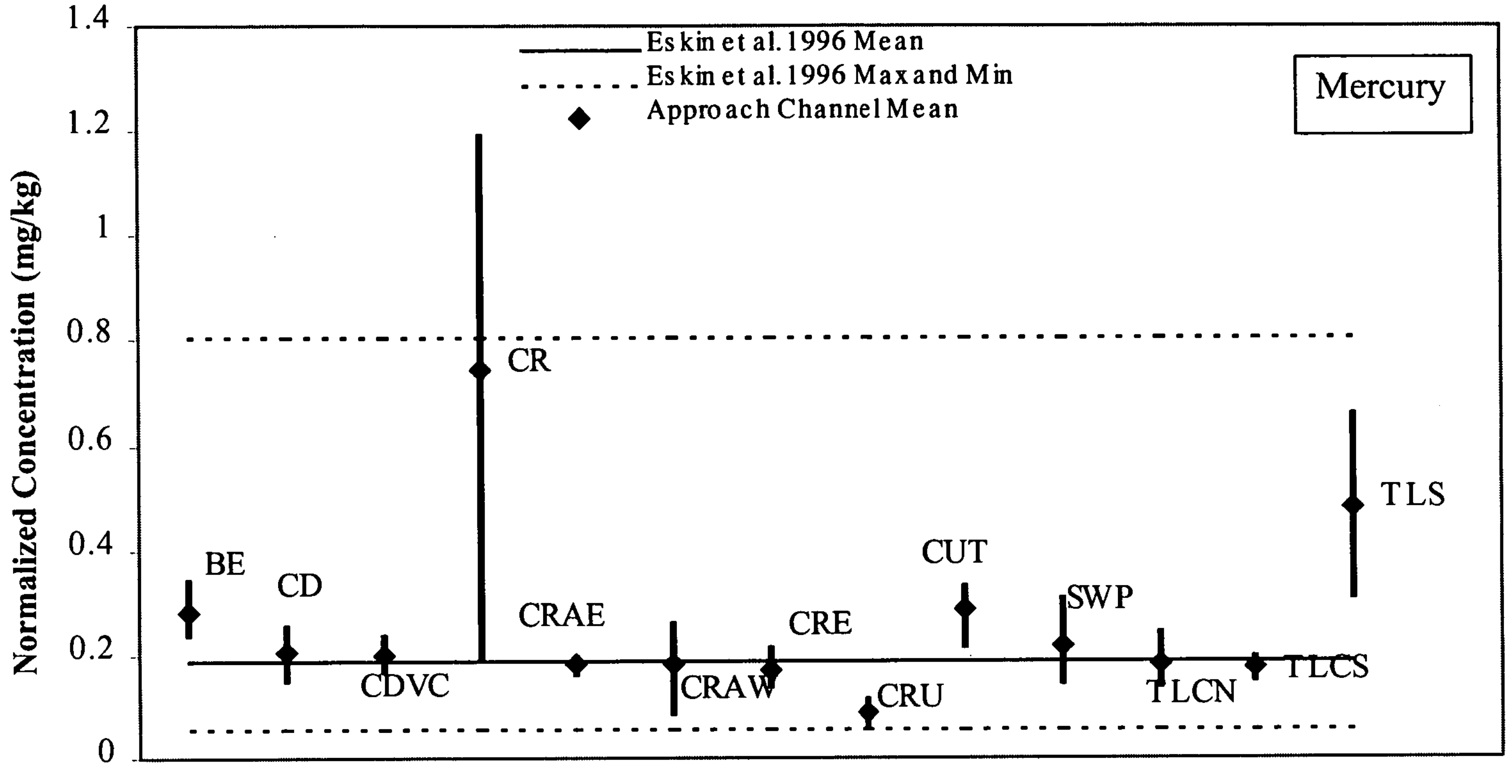

Figure 6-13: Mean normalized mercury concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized mercury concentration (0.19 mg/kg) from Eskin *et al.* 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

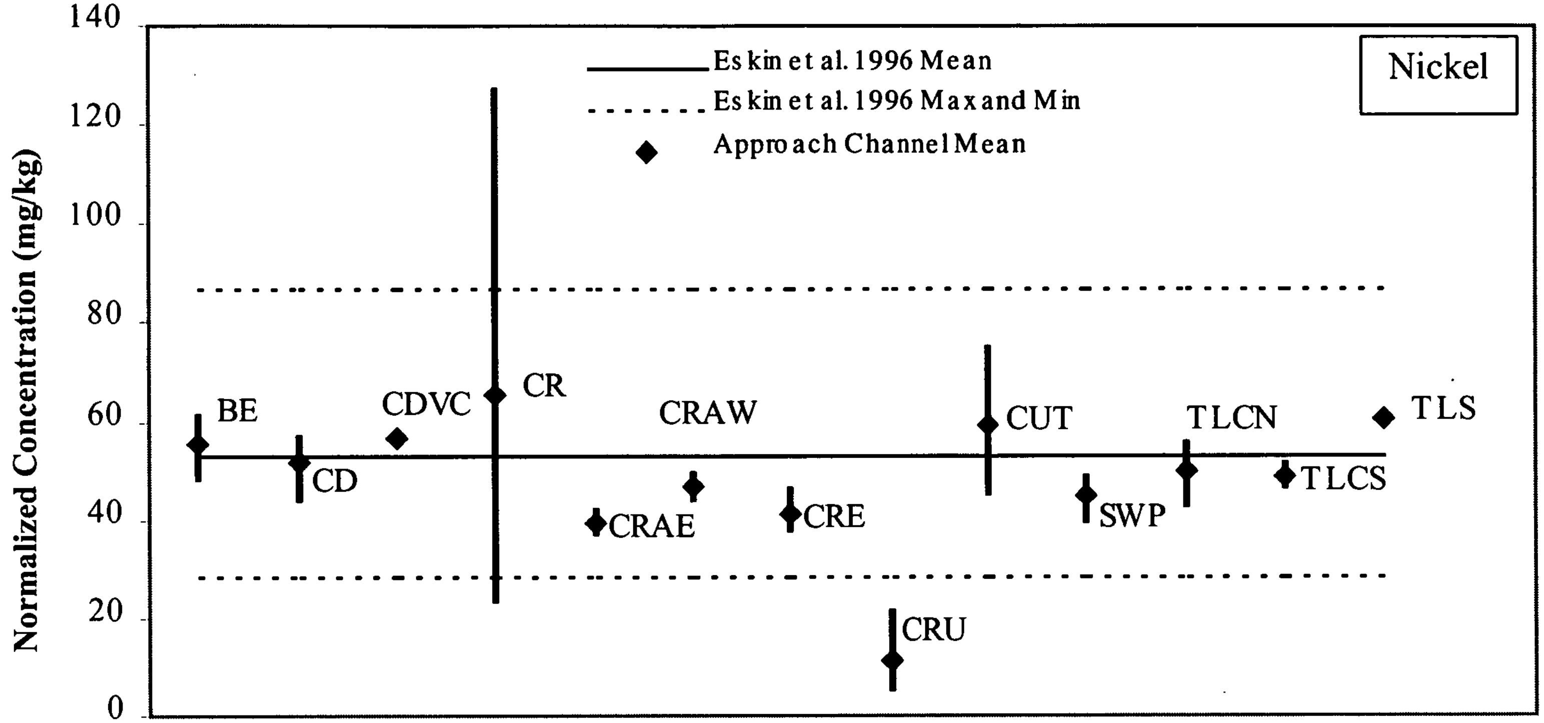

Figure 6-14: Mean normalized nickel concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized nickel concentration (52.9 mg/kg) from Eskin *et al.* 1996, calculated with an n=12. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

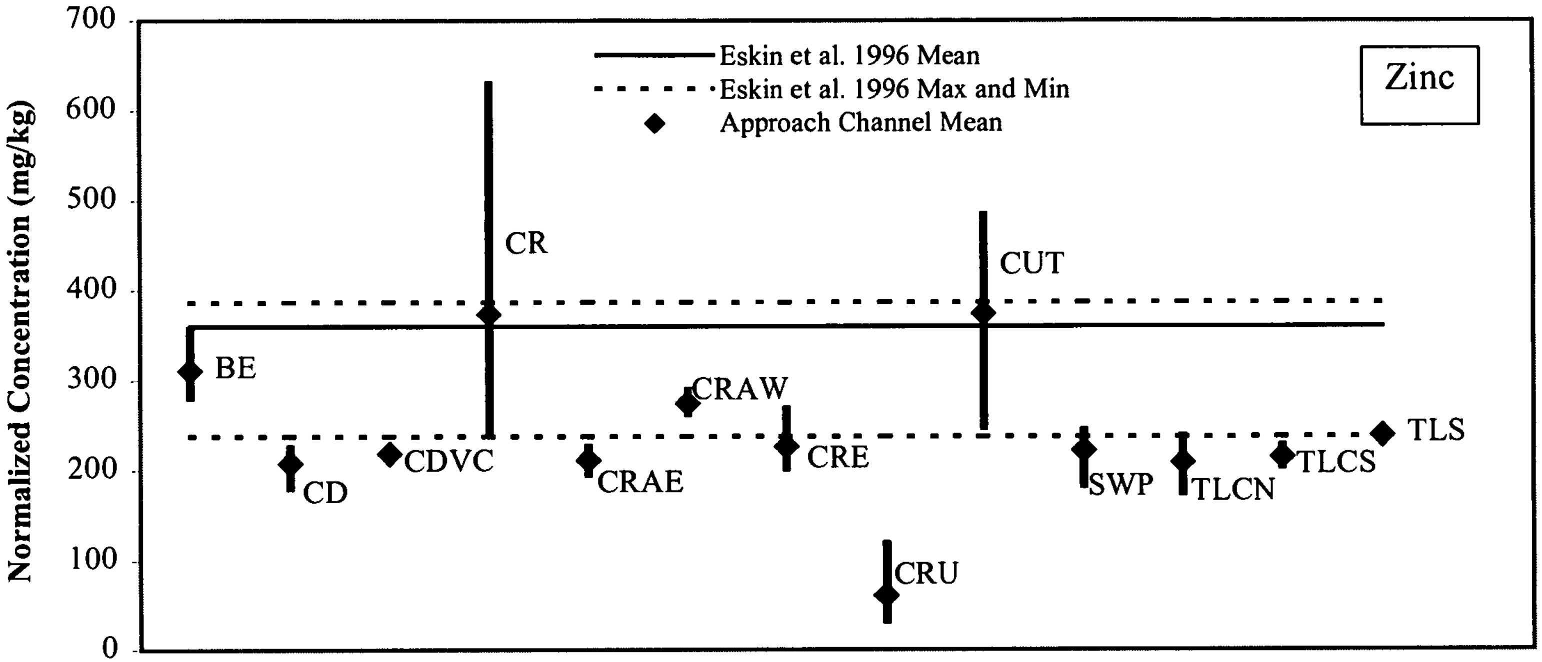

Figure 6-15: Mean normalized zinc concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin et al. 1996. The solid line is the mean normalized zinc concentration (360 mg/kg) from Eskin et al. 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the silt-clay fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

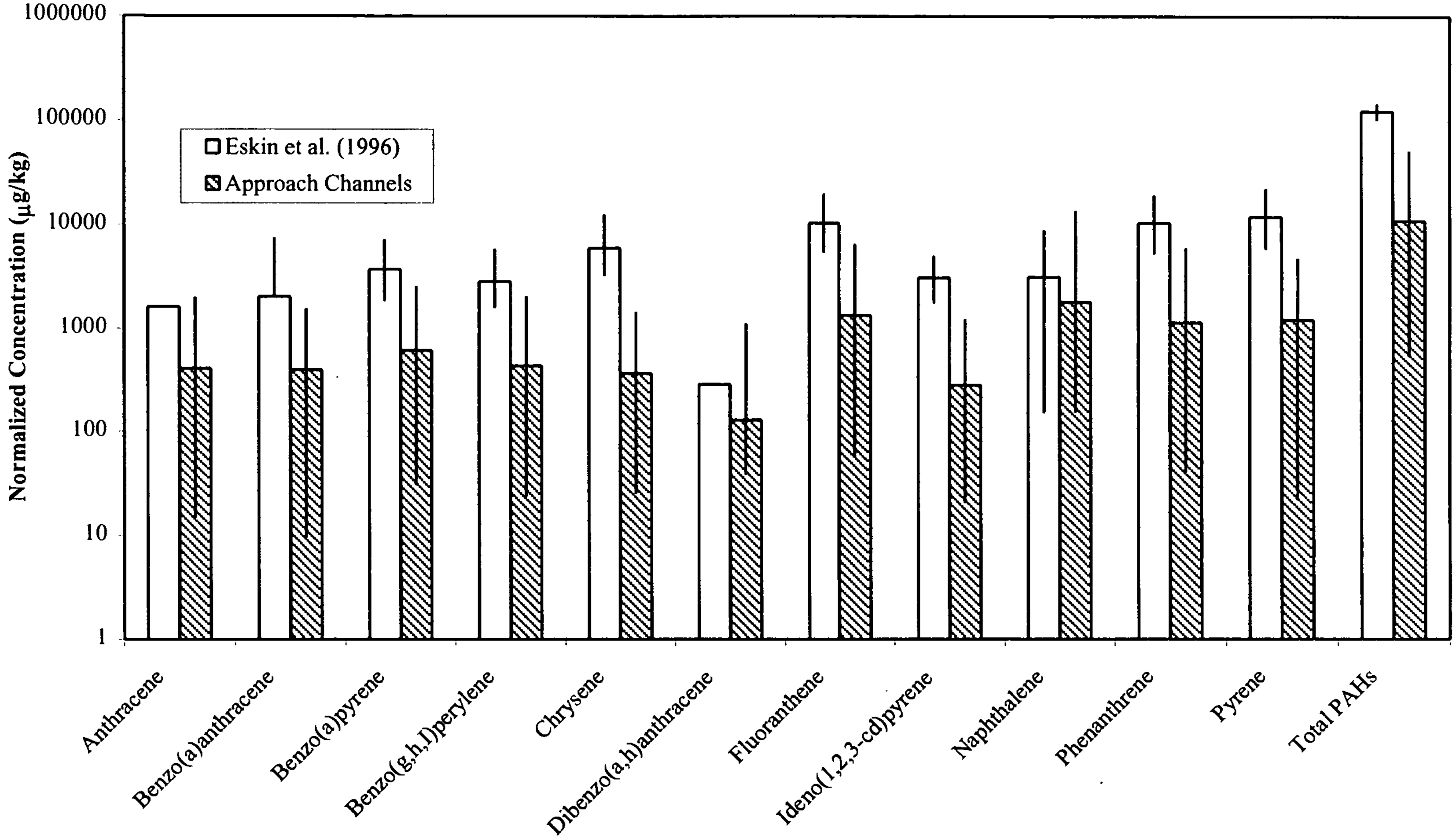

Figure 6-16: Mean normalized concentrations of PAHs in bulk sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al*. 1996. The vertical lines represent the range of values normalized to the TOC fraction of the bulk sediment. Means were calculated using data from all channels (n=49).

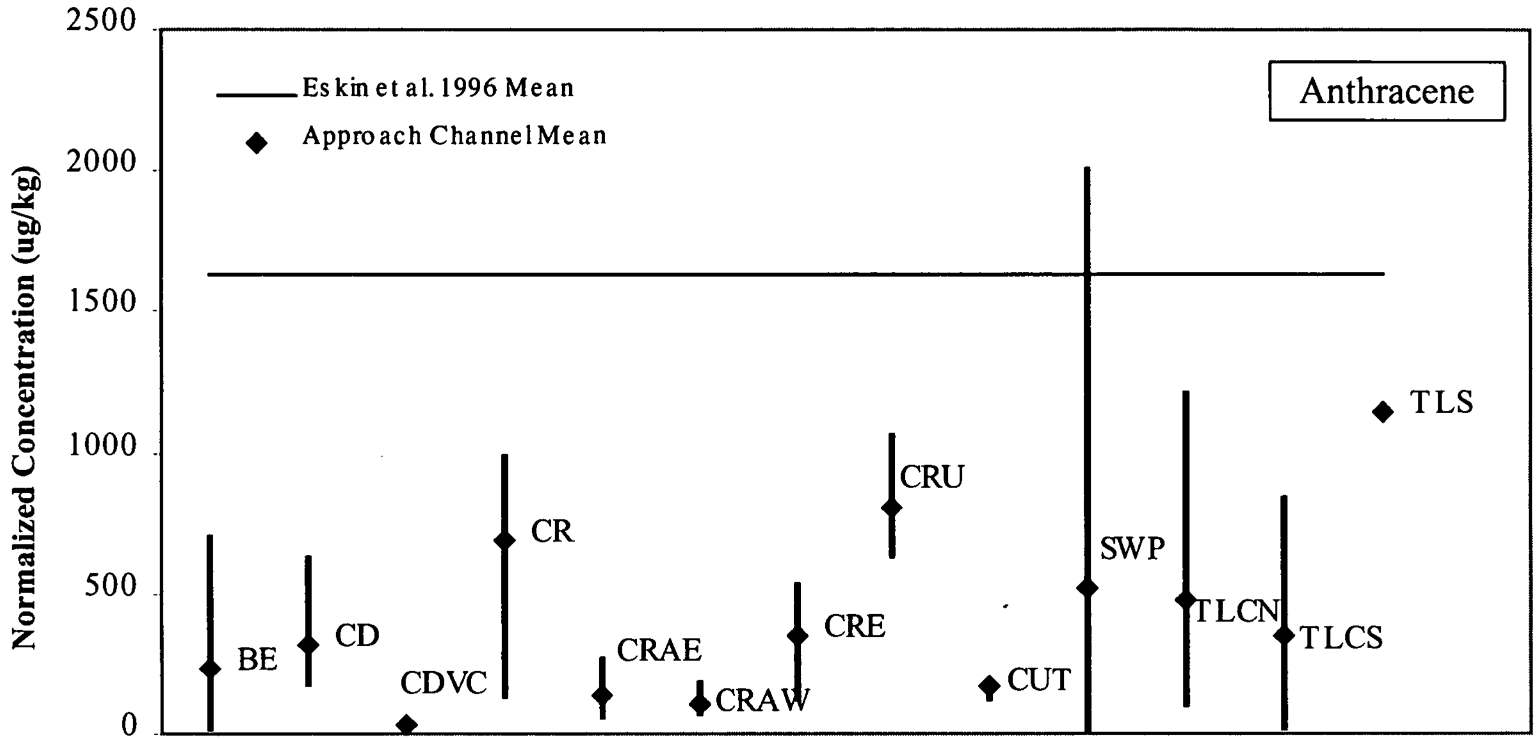

Figure 6-17: Mean normalized anthracene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin et al. 1996. The solid line is the mean normalized anthracene concentration (1630 μg/kg) from Eskin et al. 1996, calculated with an n=1. Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

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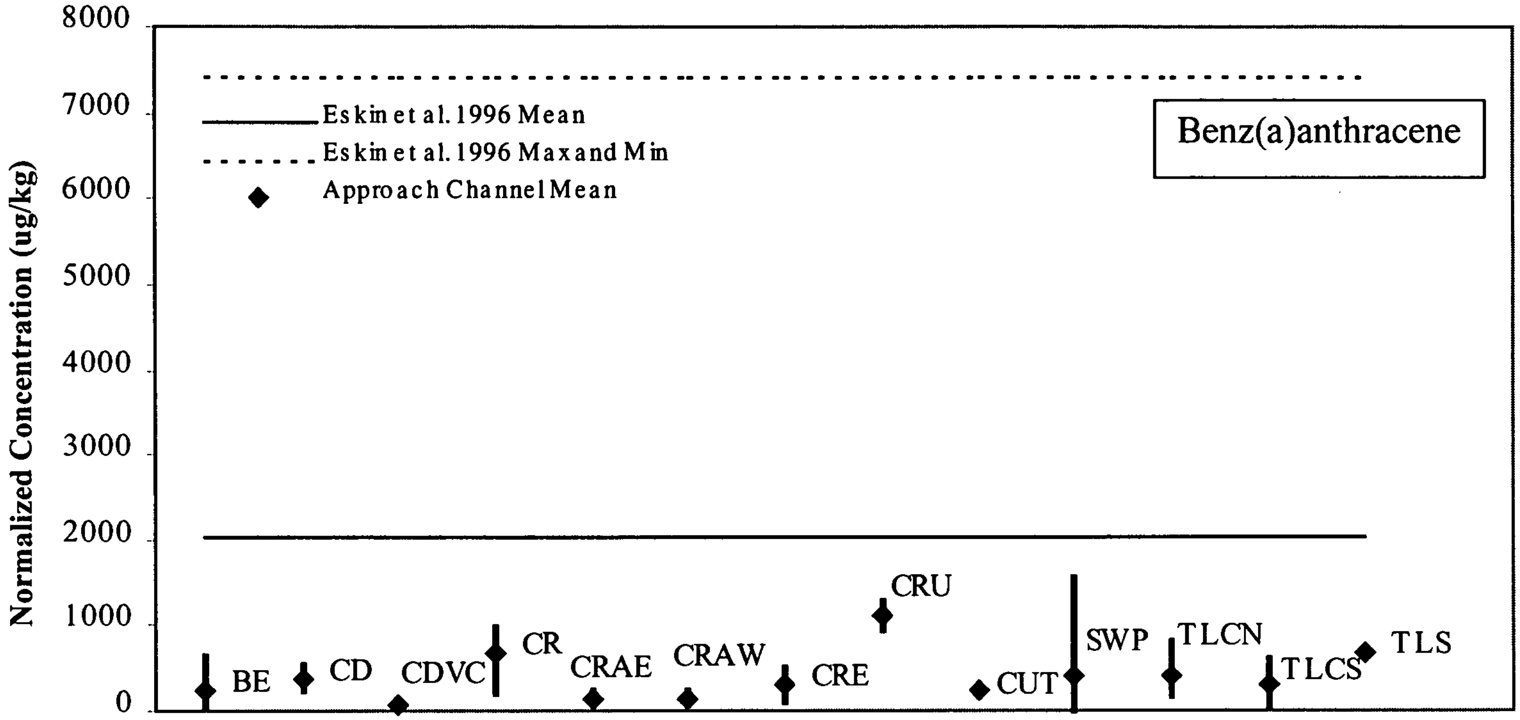

Figure 6-18: Mean normalized benz(a)anthracene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized benz(a)anthracene concentration (2033 µg/kg) from Eskin *et al.* 1996, calculated with an n=6. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

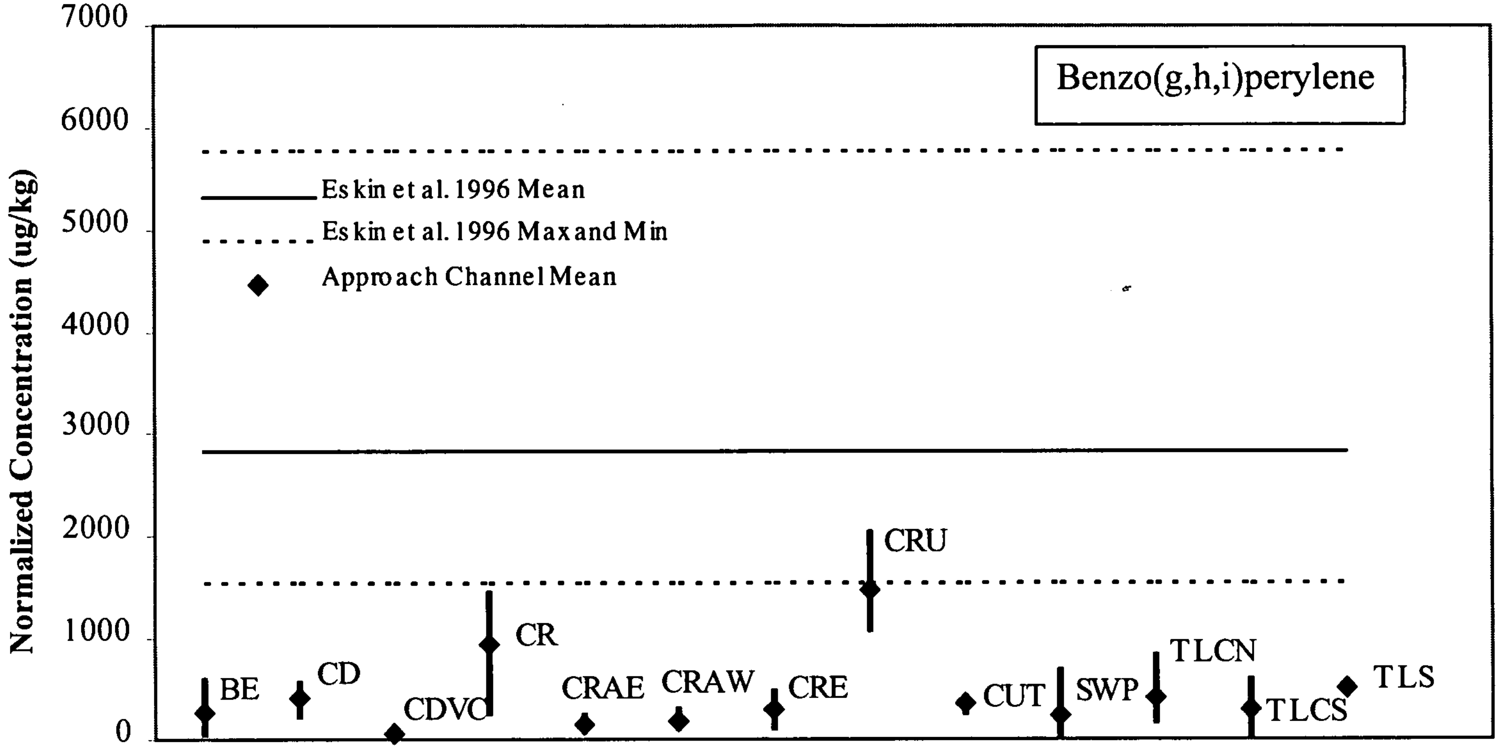

Figure 6-19: Mean normalized benzo(g,h,i)perylene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized benzo(g,h,i)perylene concentration (2827 µg/kg) from Eskin *et al.* 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

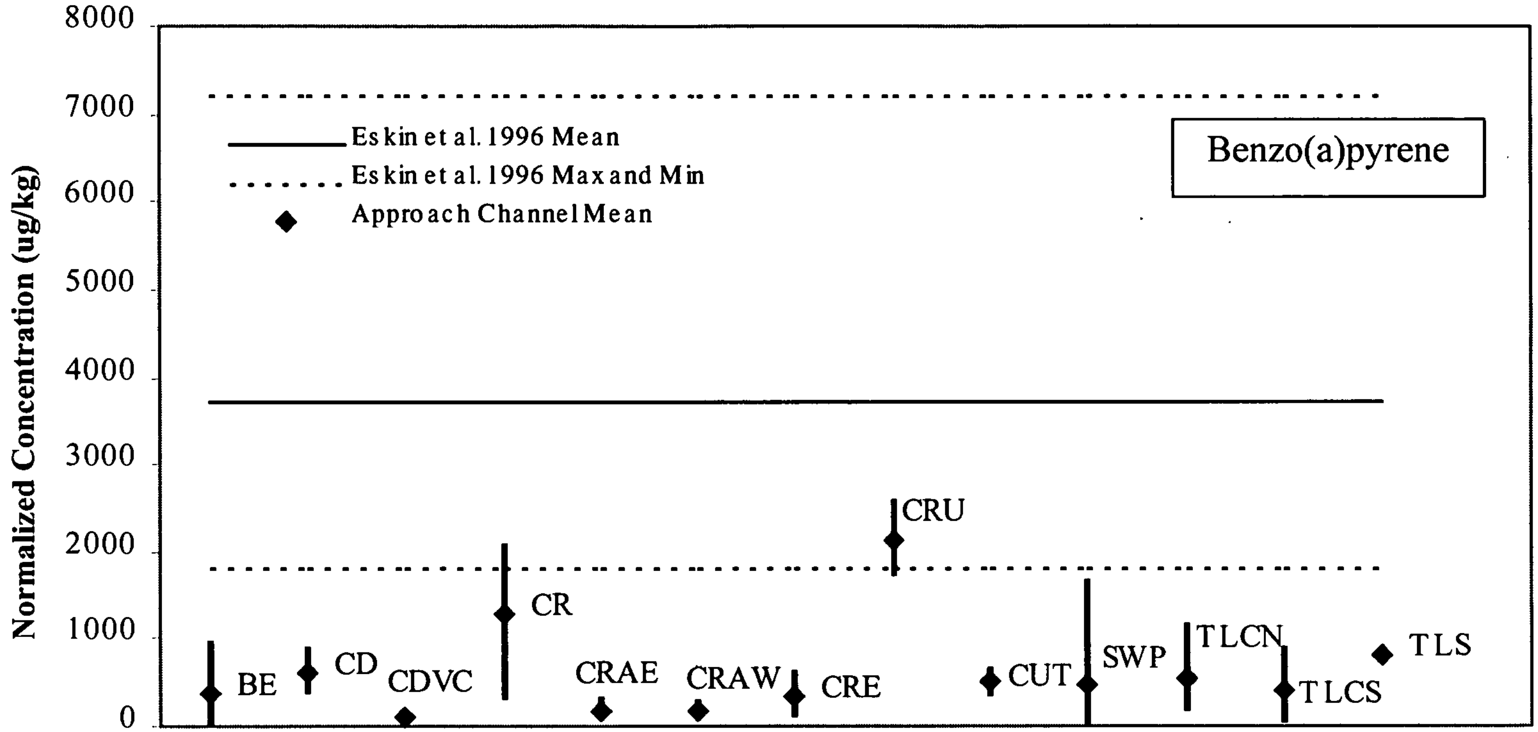

Figure 6-20: Mean normalized benzo(a)pyrene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized benzo(a)pyrene concentration (3711 μg/kg) from Eskin *et al.* 1996, calculated with an n=6. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

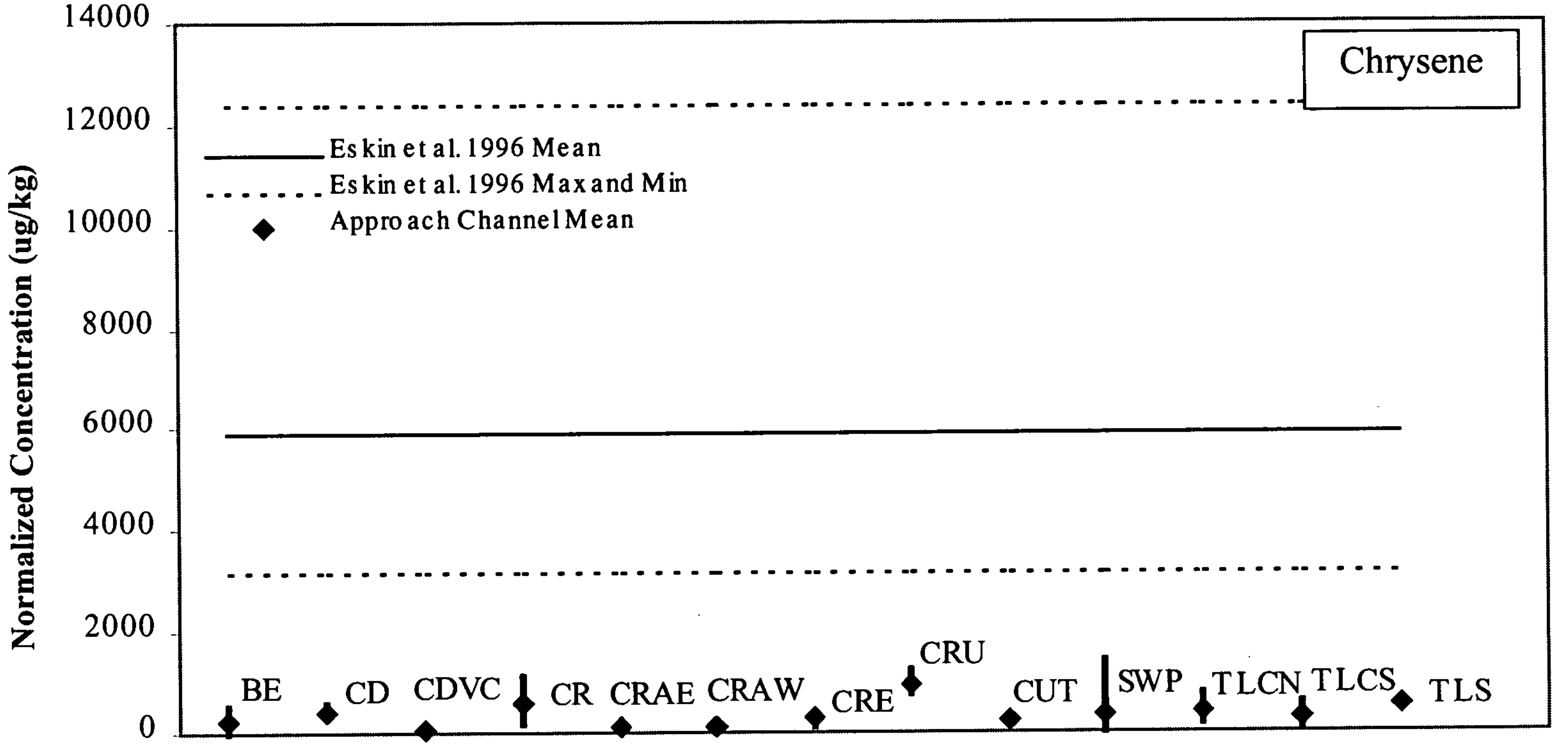

Figure 6-21: Mean normalized chrysene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized chrysene concentration (5933 μg/kg) from Eskin *et al.* 1996, calculated with an n=6. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

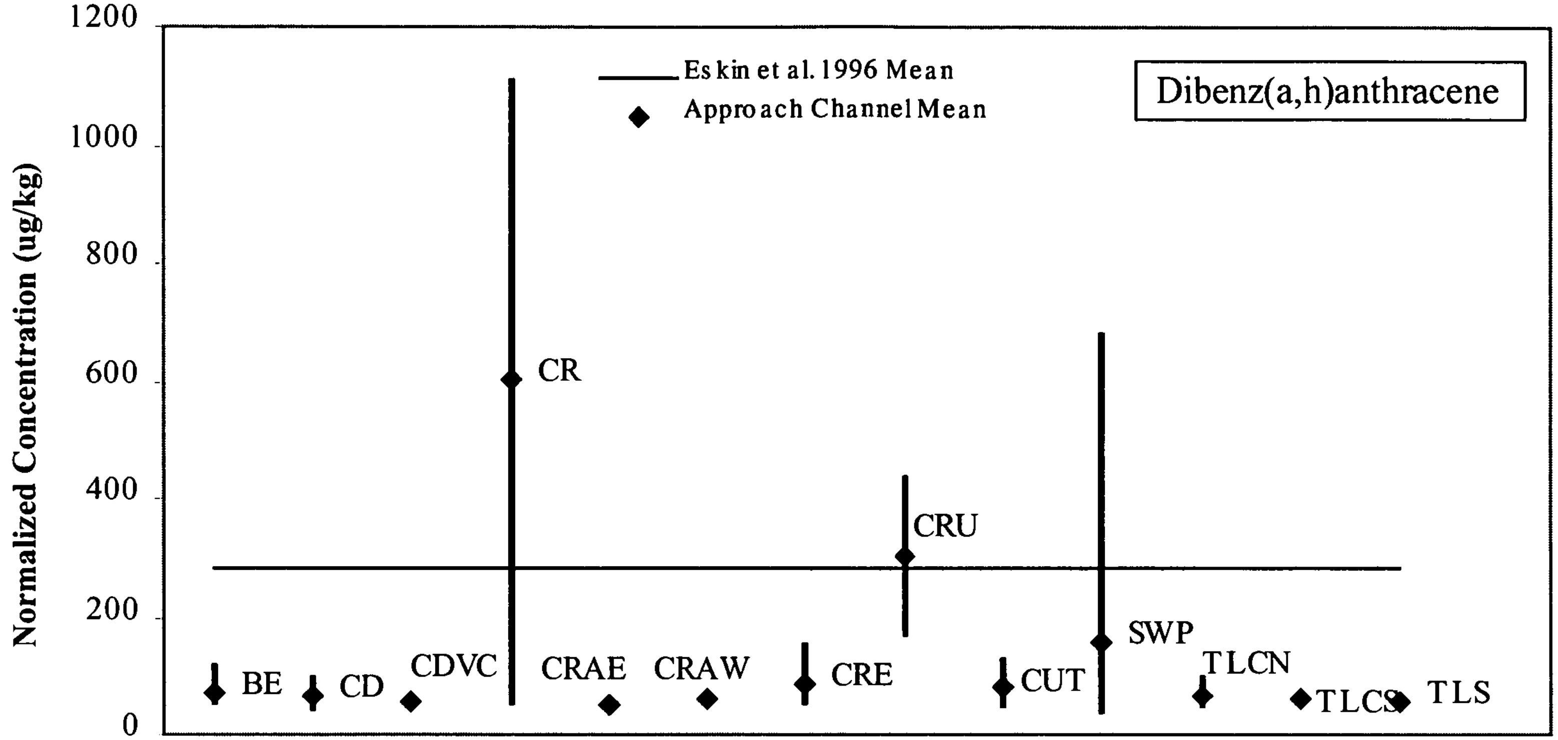

Figure 6-22: Mean normalized dibenz(a,h)anthracene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized dibenz(a,h)anthracene concentration (286 µg/kg) from Eskin *et al.* 1996, calculated with an n=1. Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

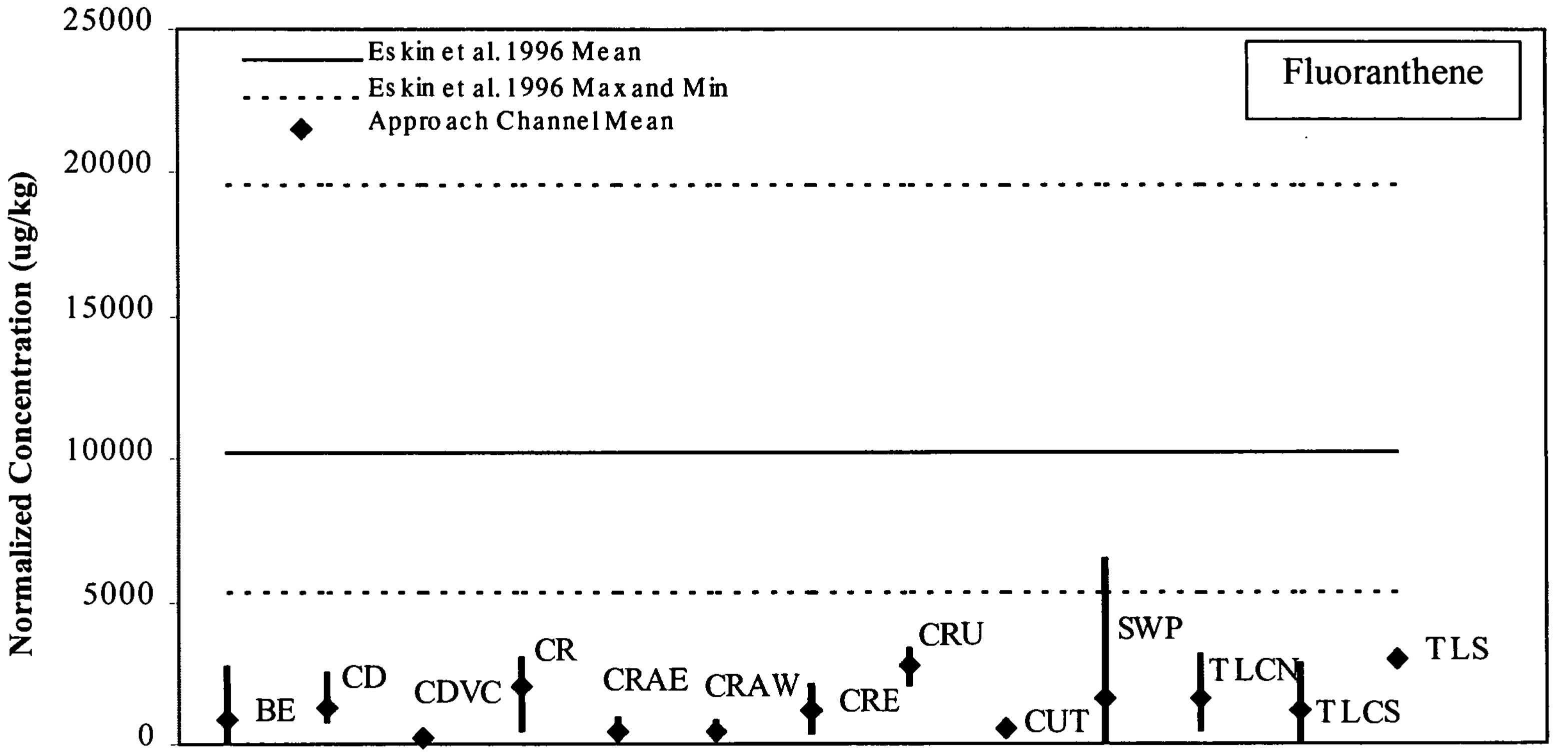

Figure 6-23: Mean normalized fluoranthene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore to Eskin *et al.* 1996. The solid line is the mean normalized fluoranthene concentration (10267 µg/kg) from Eskin *et al.* 1996, calculated with an n=6. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

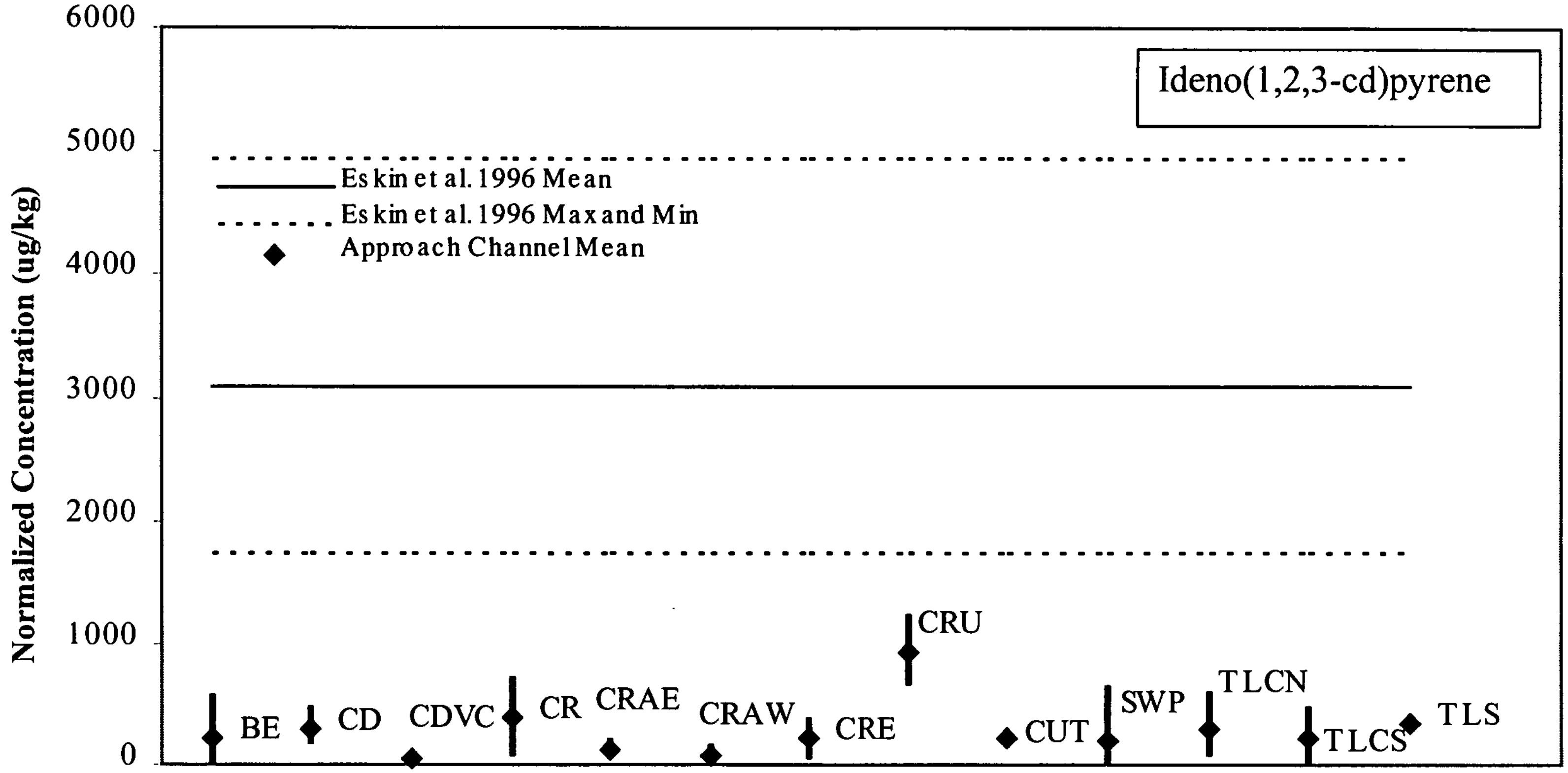

Figure 6-24: Mean normalized ideno(1,2,3-cd)pyrene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized ideno(1,2,3-cd)pyrene concentration (3075 µg/kg) from Eskin *et al.* 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

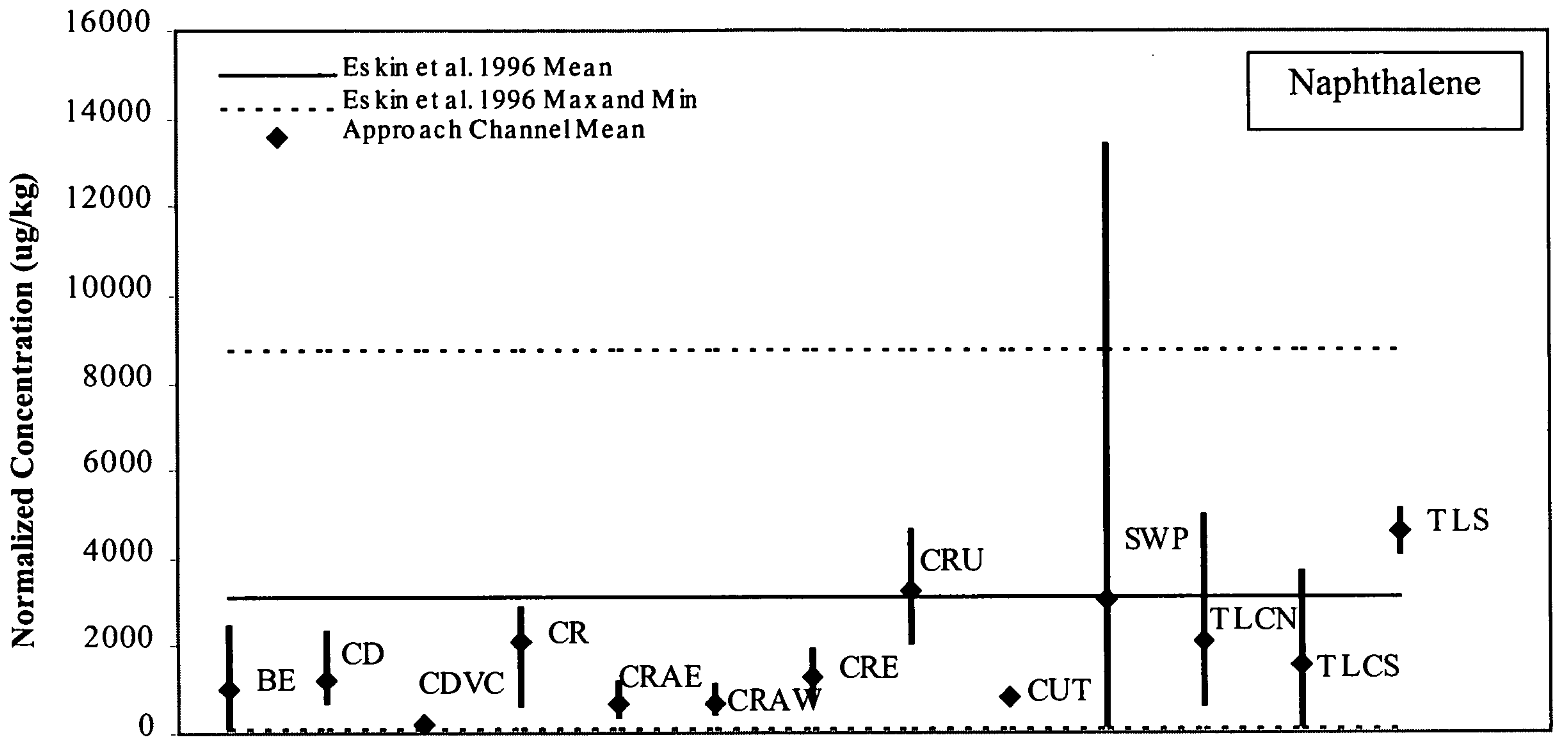

Figure 6-25: Mean normalized naphthalene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized naphthalene concentration (3107 µg/kg) from Eskin *et al.* 1996, calculated with an n=2. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

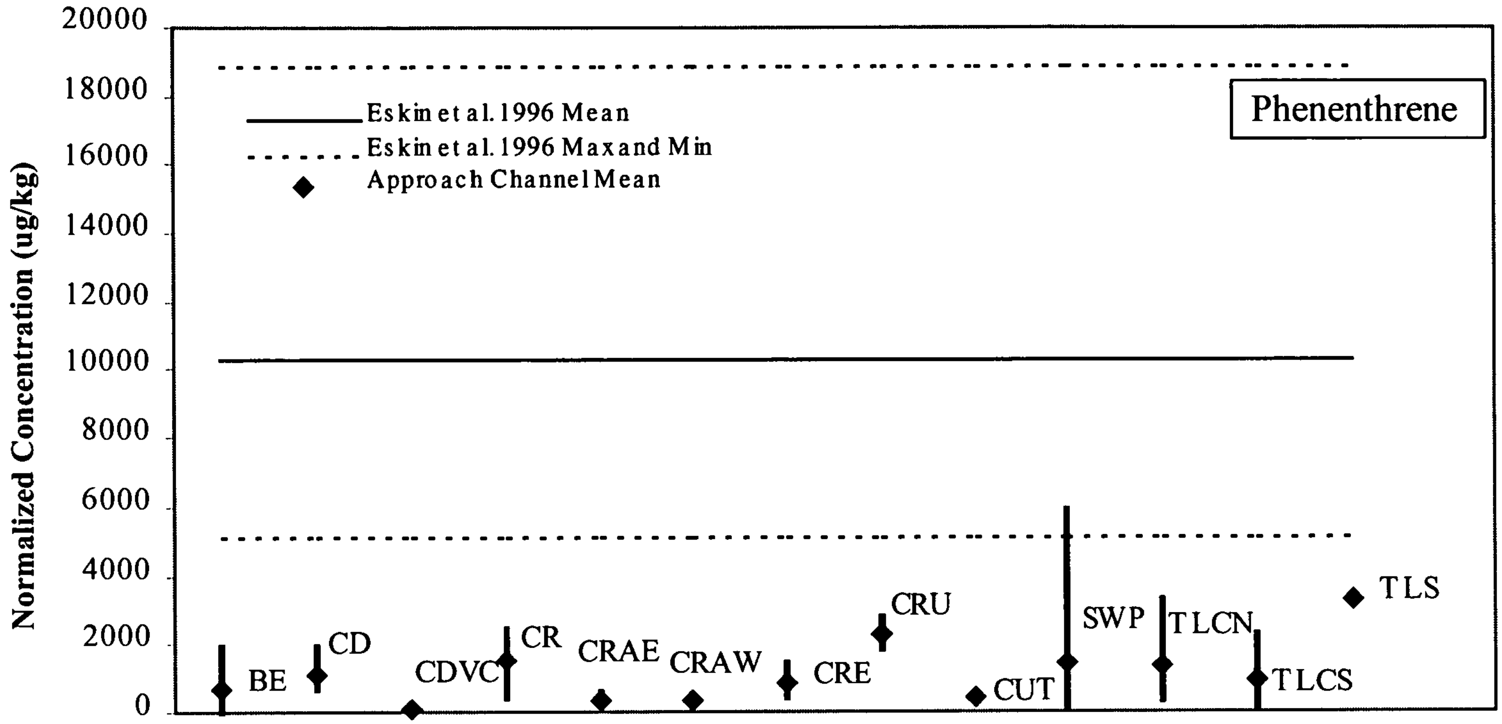

Figure 6-26: Mean normalized phenanthrene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized phenanthrene concentration (10266 μg/kg) from Eskin *et al.* 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

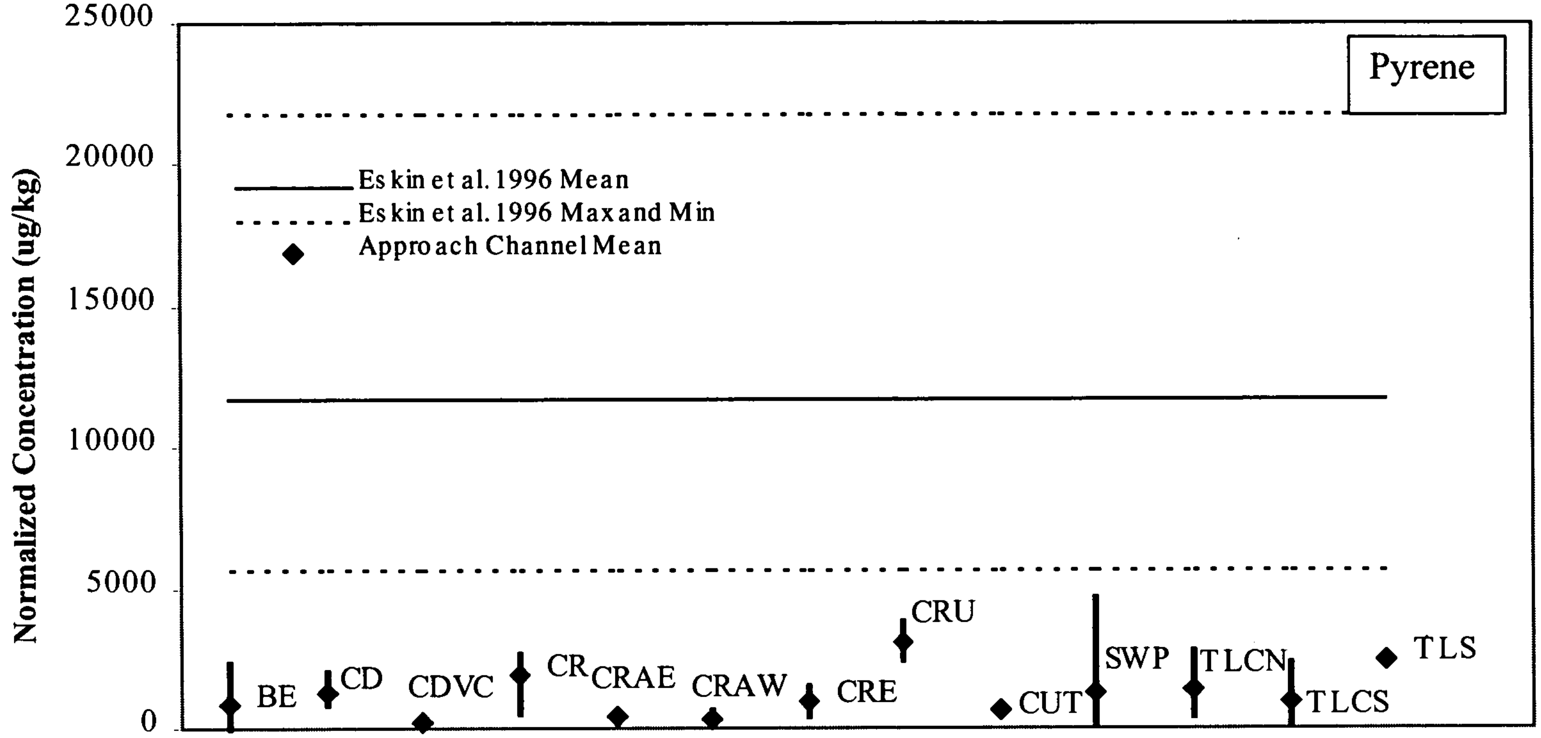

Figure 6-27: Mean normalized pyrene concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized pyrene concentration (11680 µg/kg) from Eskin *et al.* 1996, calculated with an n=5. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

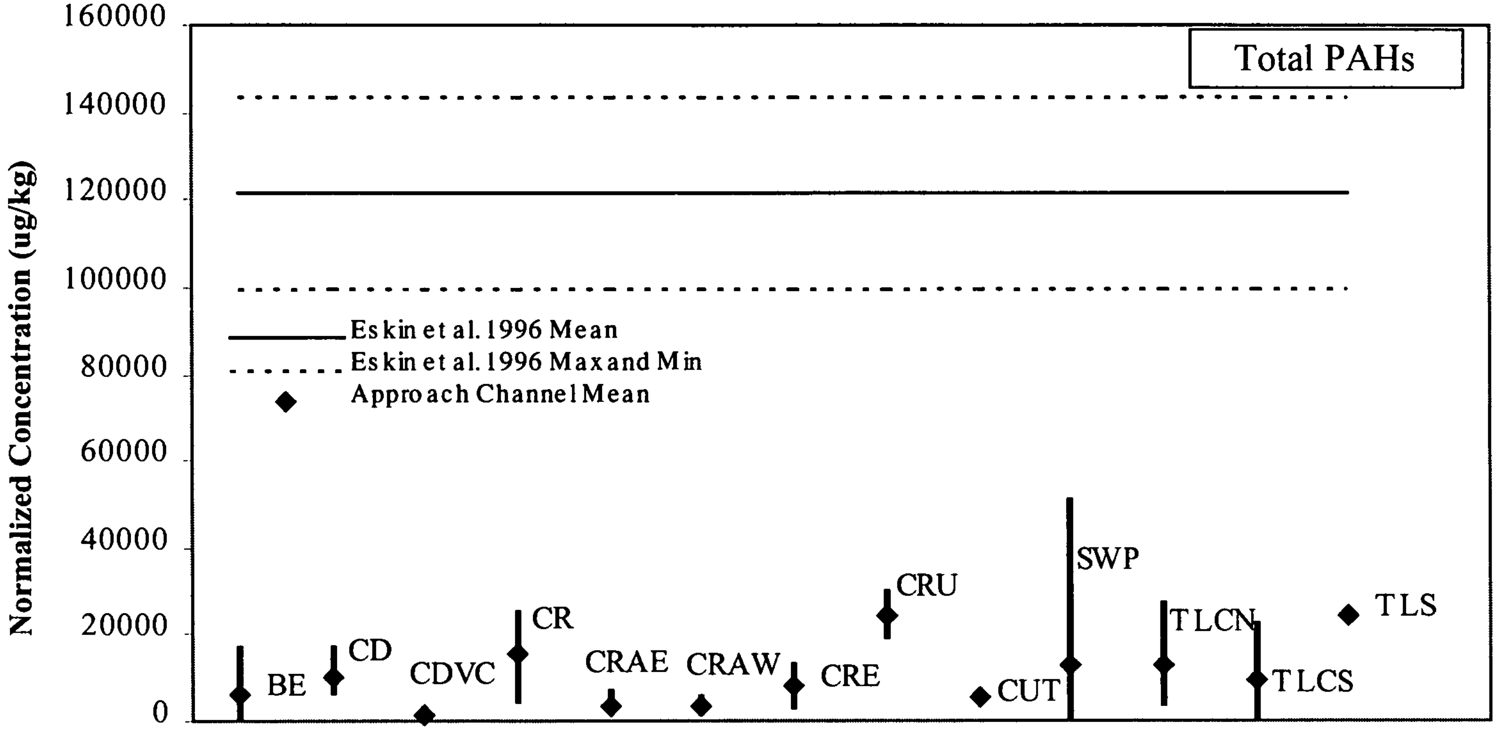

Figure 6-28: Mean normalized total PAH concentrations (ND=0) in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore Harbor compared to Eskin *et al.* 1996. The solid line is the mean normalized total PAH concentration (121855 μg/kg) from Eskin *et al.* 1996, calculated with an n=2. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

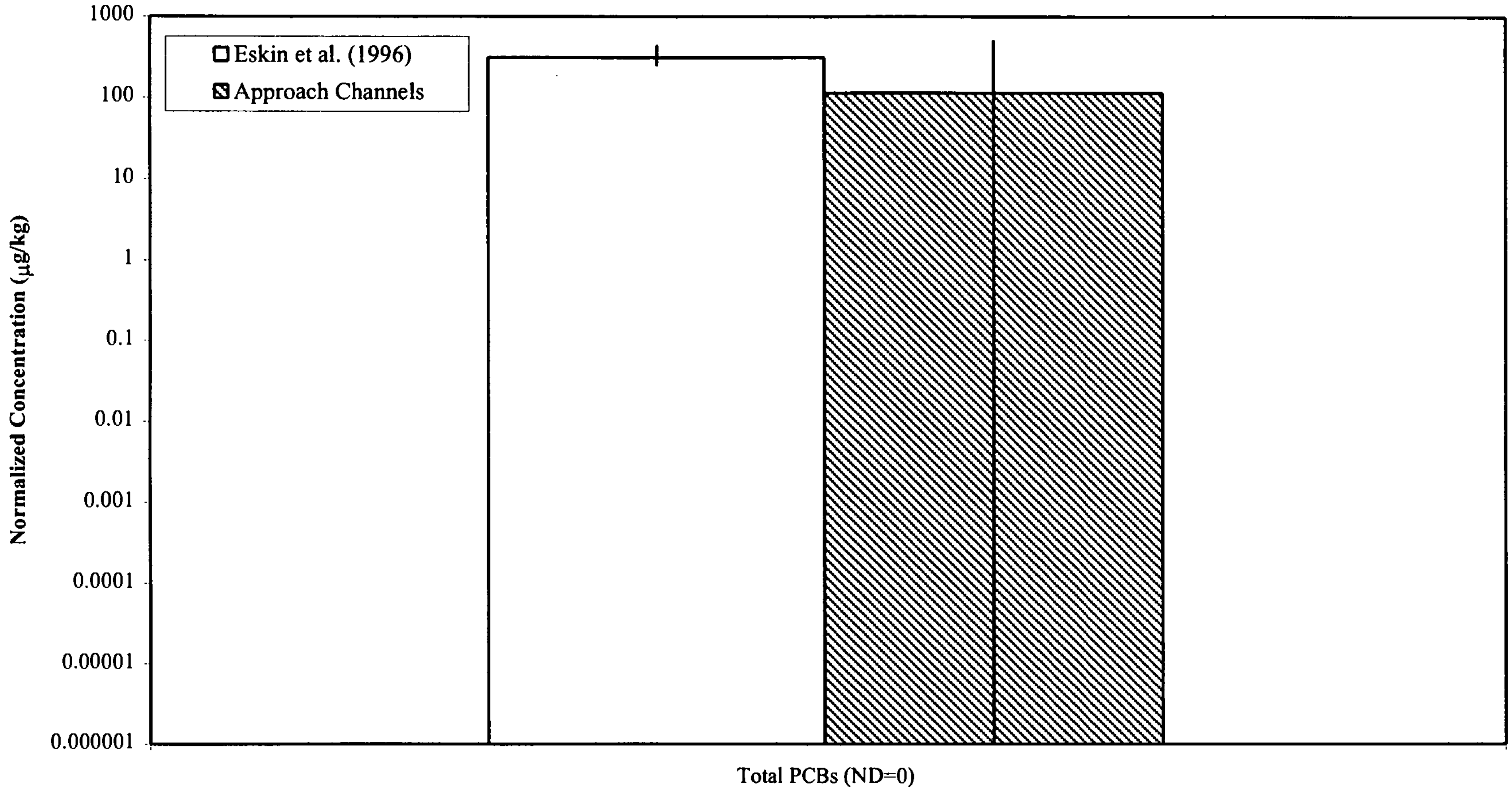

Figure 6-29: Mean normalized concentrations of total PCBs in bulk sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al*. 1996. The vertical lines represent the range of values normalized to the TOC fraction of the bulk sediment. Means were calculated using data from all channels (n=49).

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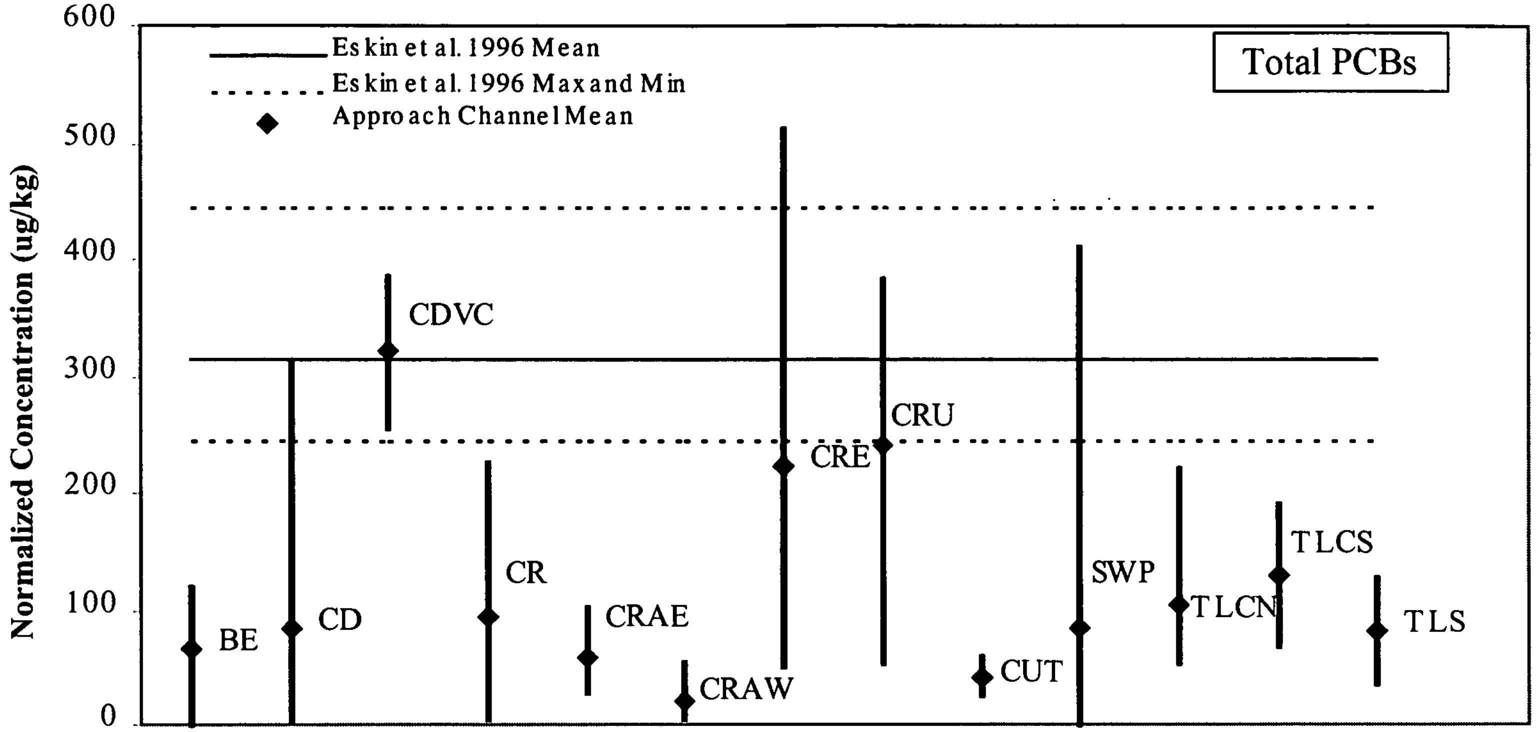

Figure 6-30: Mean normalized total PCB concentrations (ND=0) in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized total PCB concentration (313.7 µg/kg) from Eskin *et al.* 1996, calculated with an n=3. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

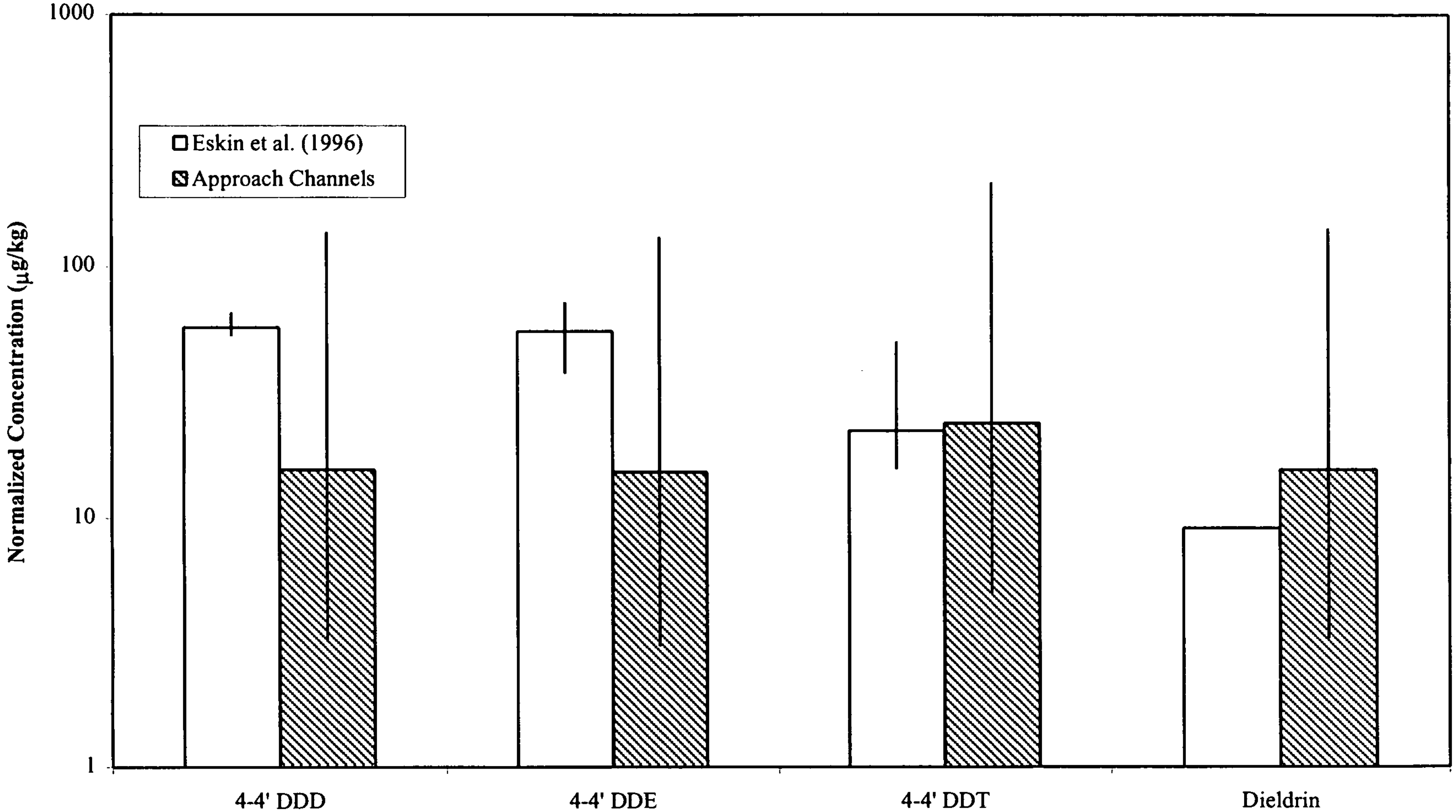

Figure 6-31: Mean normalized concentrations of pesticides in bulk sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al*. 1996. The vertical lines represent the range of values normalized to the TOC fraction of the bulk sediment. Means were calculated using data from all channels (n=49).

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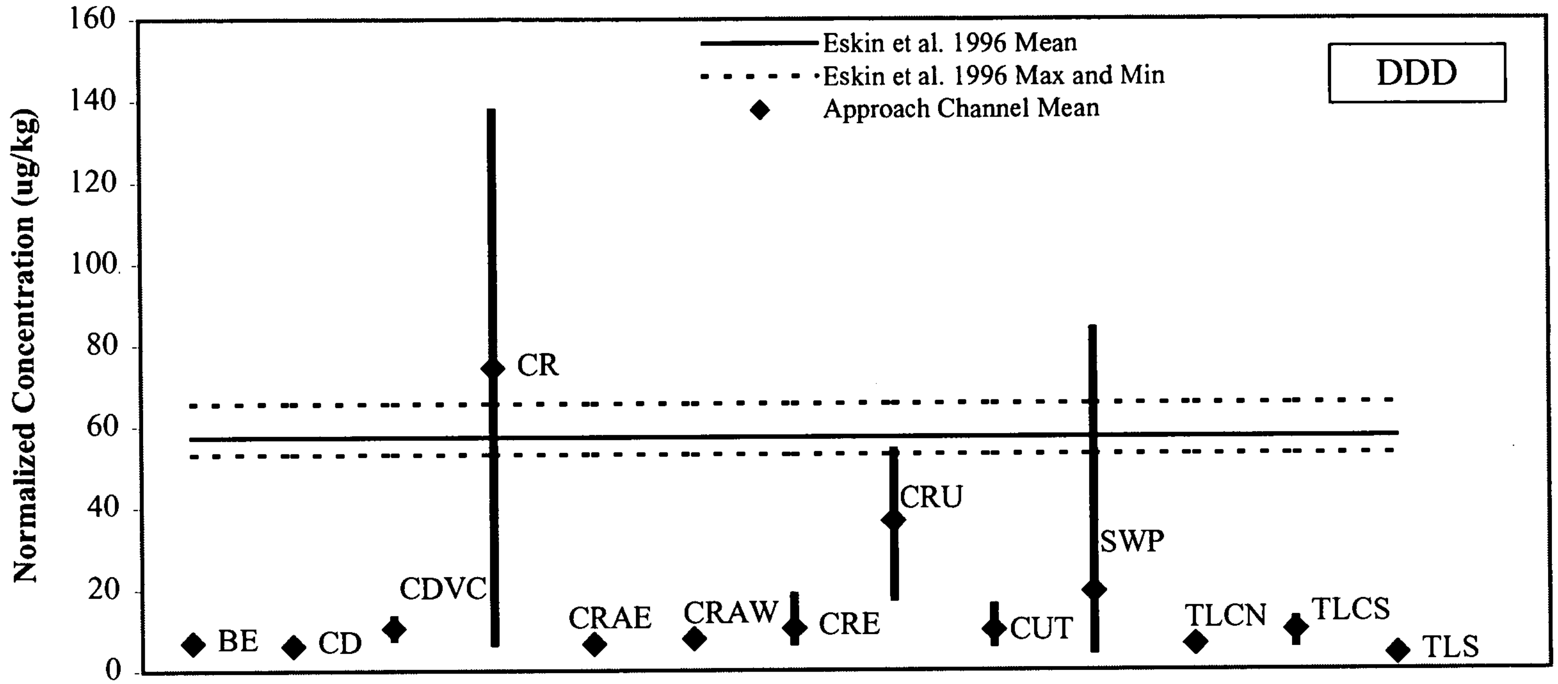

Figure 6-32: Mean normalized DDD concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized DDD concentration (57.2 µg/kg) from Eskin *et al.* 1996, calculated with an n=3. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

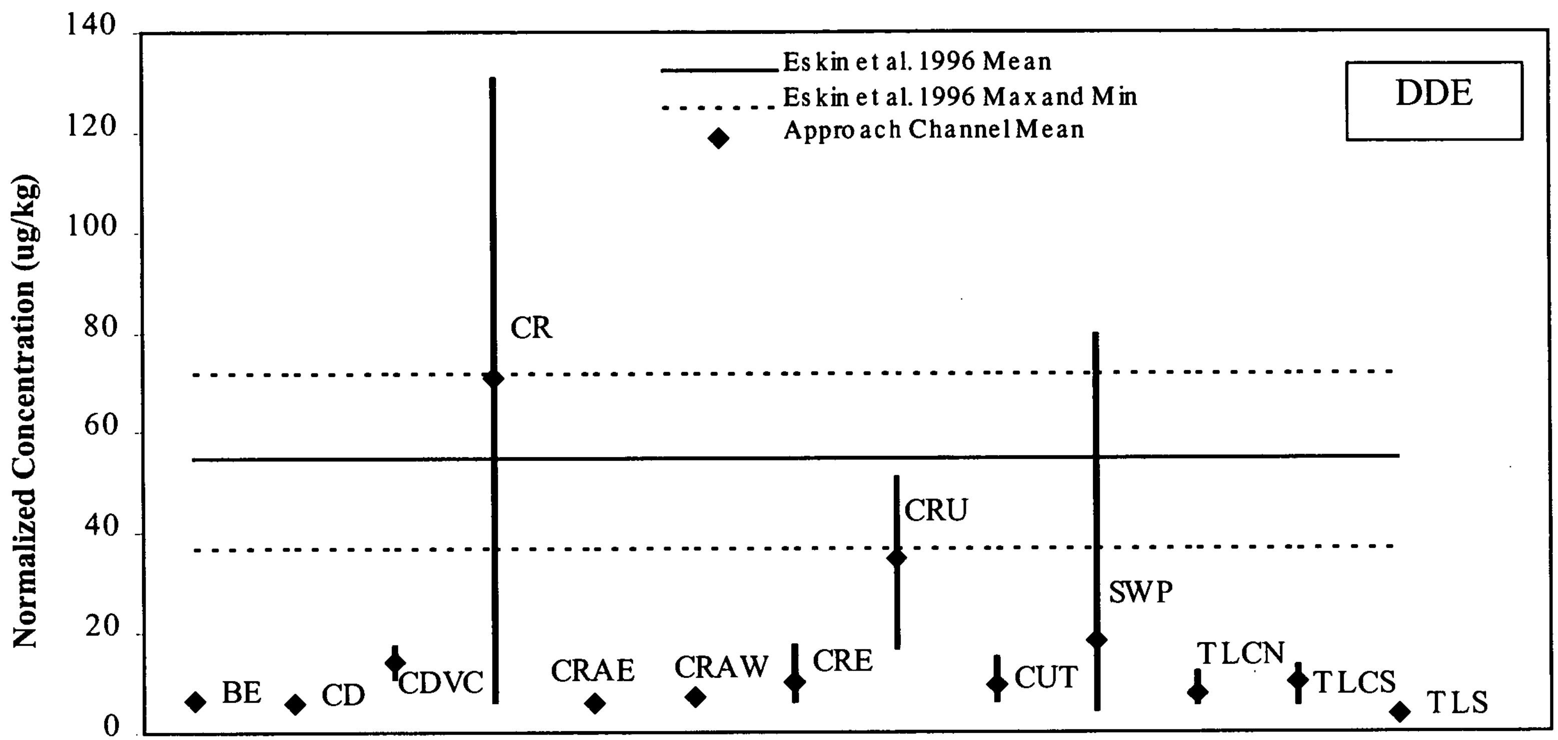

Figure 6-33: Mean normalized DDE concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized DDE concentration (55.2 µg/kg) from Eskin *et al.* 1996, calculated with an n=3. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

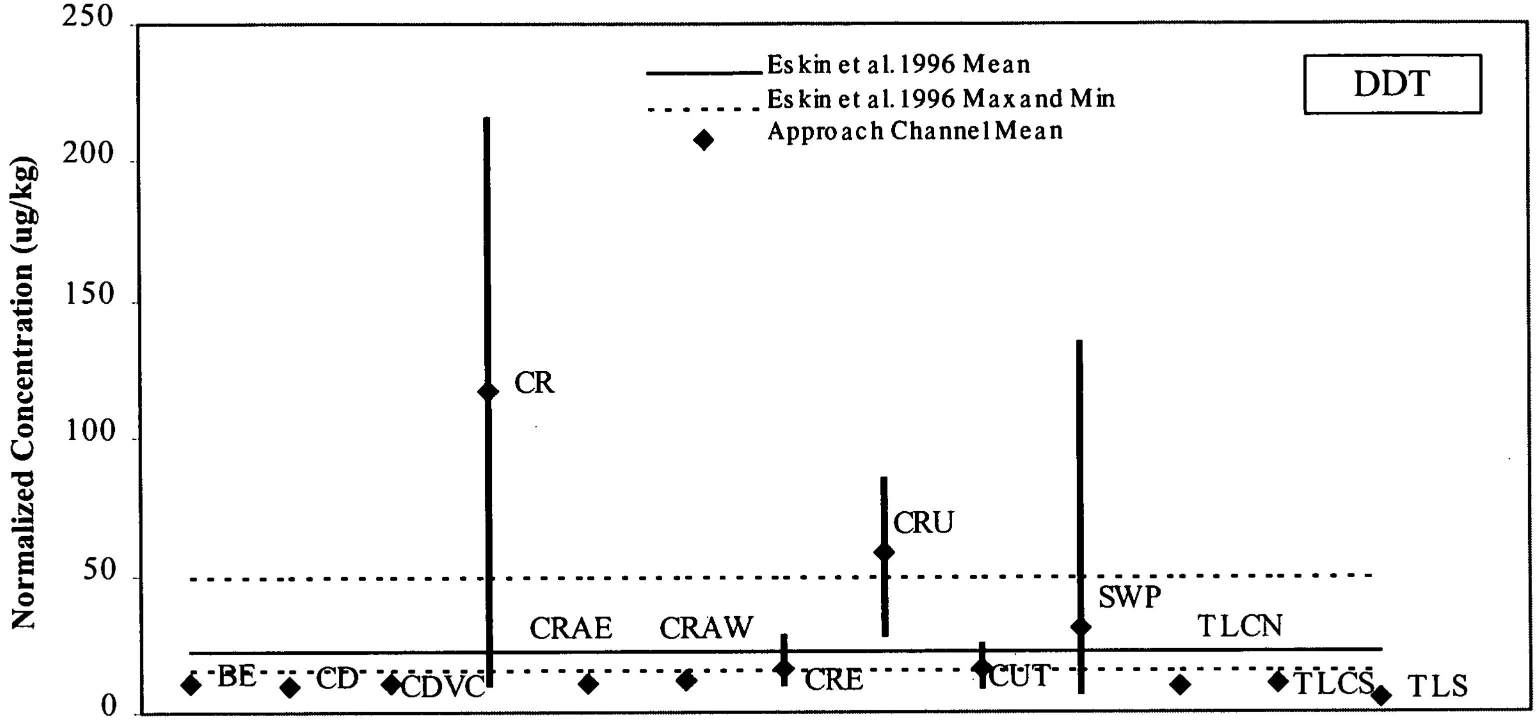

Figure 6-34: Mean normalized DDT concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized DDT concentration (25 μg/kg) from Eskin *et al.* 1996, calculated with an n=3. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

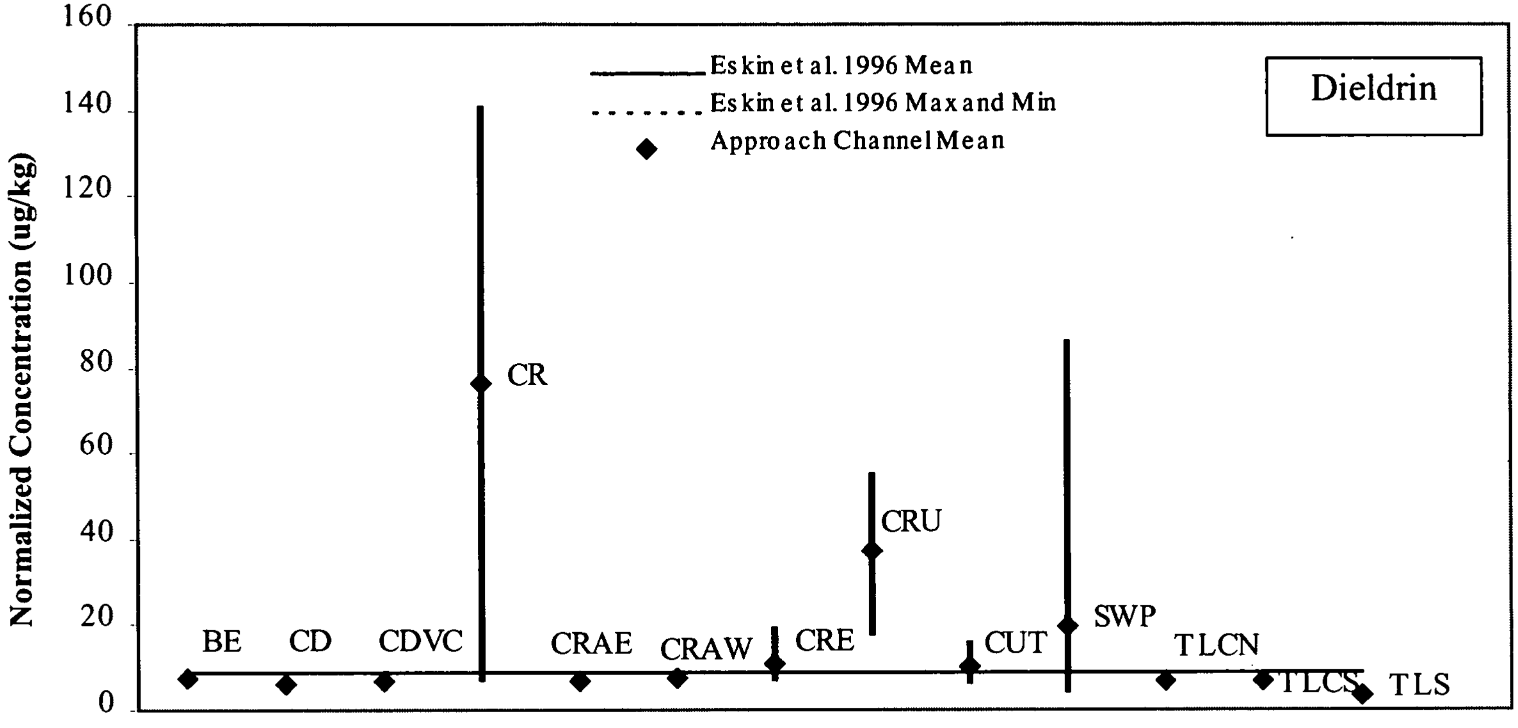

Figure 6-35: Mean normalized dieldrin concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized dieldrin concentration (9.1 µg/kg) from Eskin *et al.* 1996, calculated with an n=1. Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

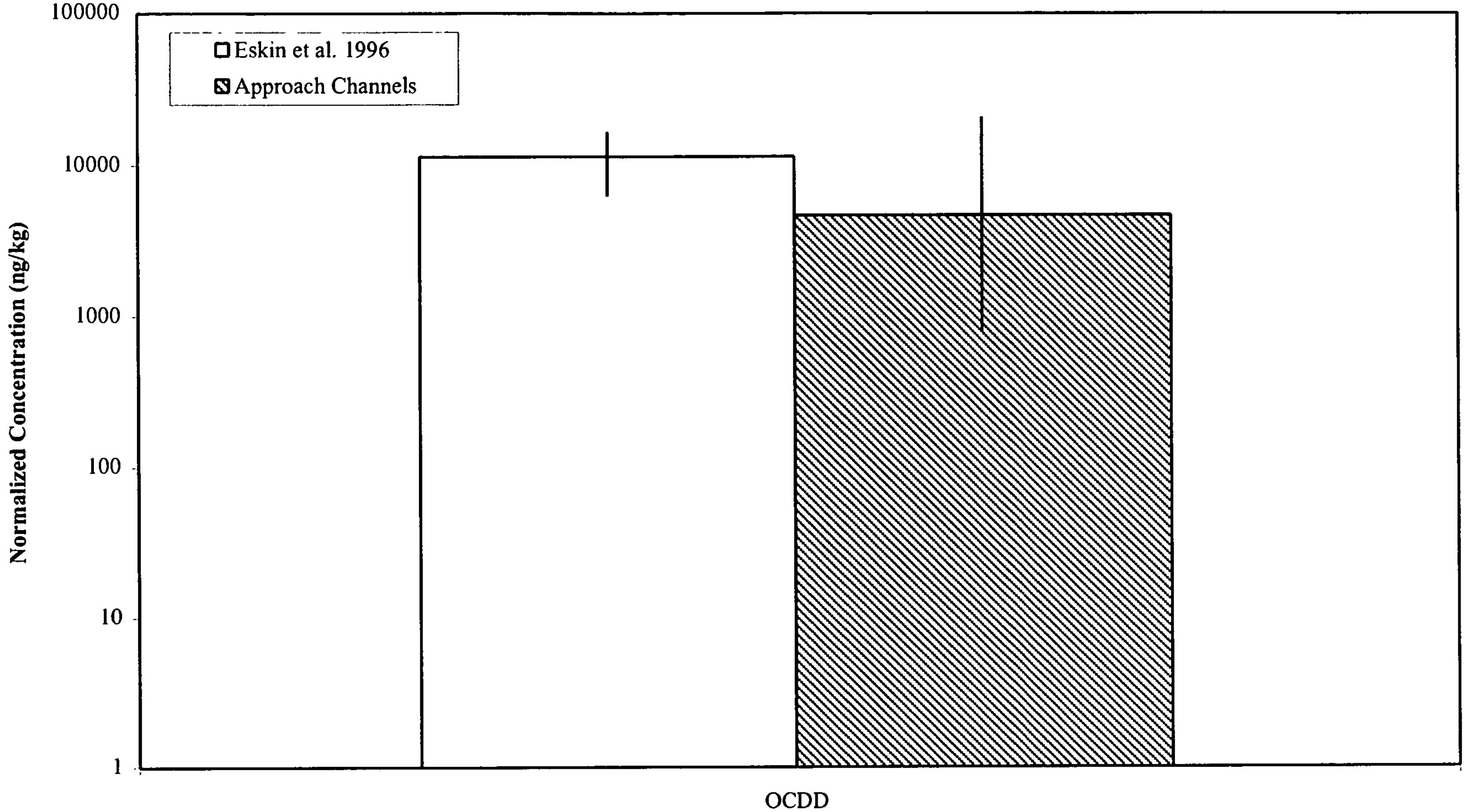

Figure 6-36: Mean normalized concentrations of OCDD in bulk sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al*. 1996. The vertical lines represent the range of values normalized to the TOC fraction of the bulk sediment. Means were calculated using data from all channels (n=13).

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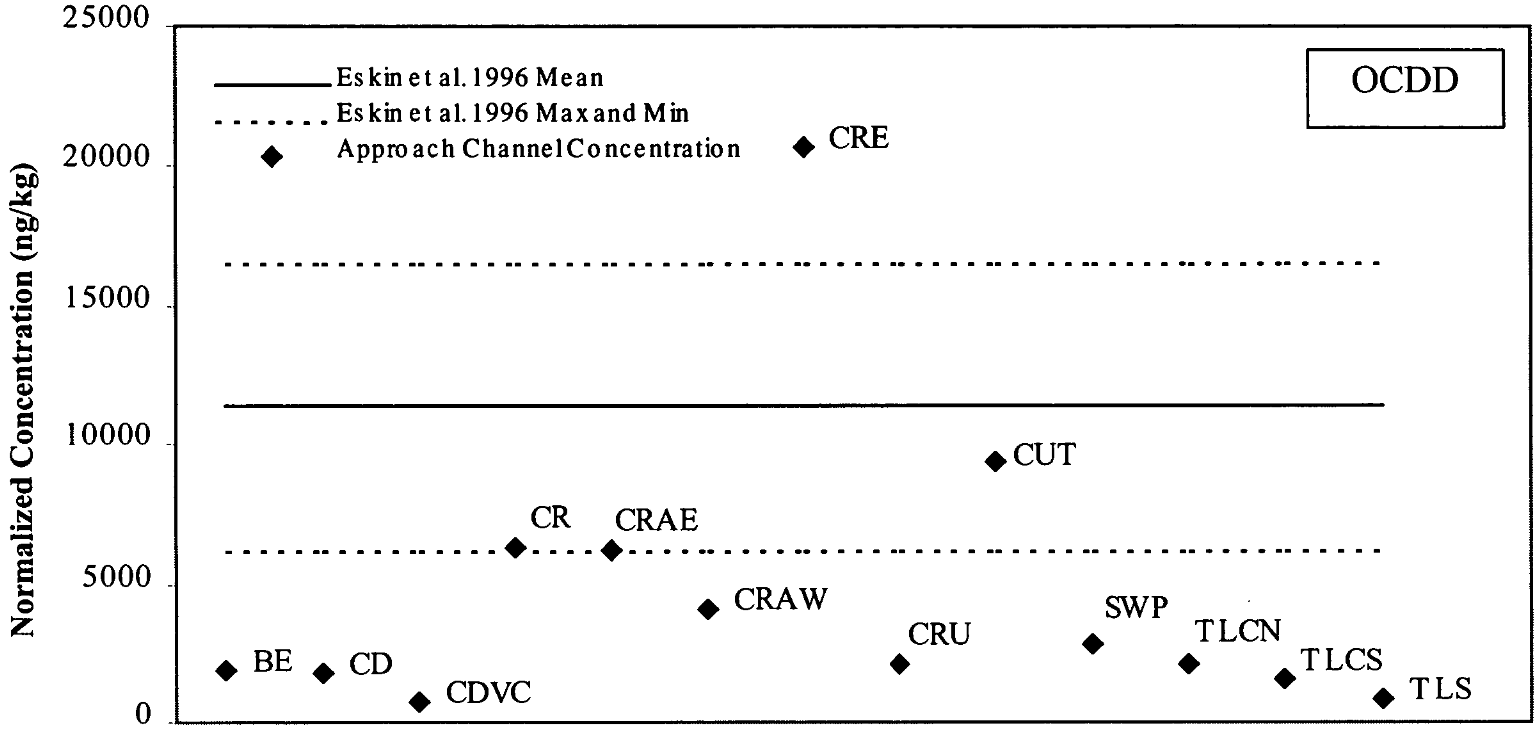

Figure 6-37: Normalized OCDD concentrations in sediments from Upper Chesapeake Bay approach channels to the Port of Baltimore compared to Eskin *et al.* 1996. The solid line is the mean normalized OCDD concentration (11406 µg/kg) from Eskin *et al.* 1996, calculated with an n=2. Only one sample was tested in each of the approach channels. The dashed lines represent minimum and maximum concentrations (Eskin *et al.* 1996). Vertical lines on each channel mean represent the range of normalized concentrations for stations sampled within that channel. All values are normalized to the TOC fraction of the bulk sediment. Sample sizes for channel concentrations are provided in Table 6-25B.

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TABLE 6-1 DIOXIN AND FURAN DATA QUALIFIERS

A or J	Amount detected is less than the Method Calibration Limit.
B	Detected in the blank.
E	Amount detected is over the Method Calibration Limit.
DPE	Denotes the presence of possible polychlorinated diphenylesters.
EDL	"Estimated Detection Limit"
EMPC	"Estimated Maximum Possible Concentration"
ppt	Parts-per-trillion (pg/g; ng/L)
Q	Indicated the presence of quantitative interferences. They generally result in an underestimation of the affected total homologue groups.
V	Recovery is lower than 40%. The data have been validated based upon a favorable signal-to-noise and detection limit.

TABLE 6-2 MEAN VALUES FOR PHYSICAL CHARACTERISTICS IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

REACH ID:		Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
SAMPLE TYPE:		Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
SAMPLE SIZE (N):		1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
% MOISTURE		21.5	71.2	60.1	71.7	62.4	56.5	42.1	69.1	72.0	69.6	40.8	68.4	68.3	62.1	64.3	55.0
ANALYTE	**UNIT**																
CLAY	%	11.4	36.58	34.3	44.42	27.92	48.23	22.94	55.5	54.43	44.34	17.34	30.75	48.06	45.54	37.84	50.77
GRAVEL	%	0	0	4.04	0	0	0	0	0	0	0	0	5.95	0	0	0	0
SAND	%	26.6	26.1	19.47	3.87	5.96	1.07	66.74	1.67	7.3	10.1	31.7	13.98	7.4	1.17	2.06	1.1
SILT	%	62	37.32	42.19	51.72	66.12	50.7	10.32	42.83	38.27	45.56	50.96	49.33	44.54	53.29	60.1	48.13
SPECIFIC GRAVITY	T/4C	1.7	1.25	1.35	1.22	1.33	1.4	1.57	1.2	1.23	1.2	1.73	1.2	1.22	1.33	1.29	1.4

TABLE 6-3 MEAN CONCENTRATIONS OF INORGANIC NON-METALS (MG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

ANALYTE	UNIT	DL (RANGE)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		STATIONS SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
CYANIDE	MG/KG	0.04 - 0.22	0.06 U	**1.44**	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.11 U	**0.14**	0.06 U	0.06 U	**0.2**	**0.09**	0.09 U	**0.33**
NITROGEN, AMMONIA	MG/KG	1 - 3.4	**2.0 B**	**182.35**	**36.7**	**104.56**	**19.48**	**35.5**	**14.1**	**113.97**	**131.23**	**223.0**	**12.0**	**63.6**	**146.17**	**87.02**	**160.0**	**67.0**
NITROGEN, NITRATE AND NITRITE	MG/KG	0.02 - 0.08	**0.52**	**0.82**	**0.32**	**1.47**	**1.01**	**1.6**	**0.99**	**0.25**	**0.37**	**0.54**	**0.71**	**2.46**	0.05 U	**0.86**	**0.18**	0.03 U
NITROGEN, TOTAL KJELDAHL	MG/KG	4.2 - 91.5	**180.0**	**2990.0**	**1326.38**	**3714.0**	**561.0**	**1825.0**	**225.17**	**734.67**	**2863.33**	**1093.75**	**759.25**	**1816.67**	**1031.0**	**1121.17**	**1138.75**	**339.0**
OXYGEN DEMAND, BIOCHEMICAL	MG/KG	0.37 - 3175	**118.0**	**2015.25**	**2169.5**	**846.66**	**1004.5**	**1049.0**	**1025.67**	**1162.67**	**1150.0**	**1270.0**	**774.75**	**1470.0**	**1640.18**	**1134.33**	**1625.0**	**1540.0**
OXYGEN DEMAND, CHEMICAL	MG/KG	243 - 8900	**6150.0**	**69625.0**	**123287.5**	**141940.0**	**173000.0**	**41100.0**	**25841.0**	**219800.0**	**305333.33**	**142350.0**	**24402.5**	**127666.67**	**162933.33**	**211233.33**	**144450.0**	**213000.0**
PHOSPHORUS, TOTAL	MG/KG	1.8 - 5.2	**218.0**	**478.25**	**345.75**	**501.6**	**425.75**	**435.5**	**258.7**	**537.67**	**632.0**	**588.0**	**198.0**	**514.0**	**571.0**	**472.5**	**523.5**	**421.0**
SULFIDE, TOTAL	MG/KG	30.6 - 98.4	30.7 U	**1735.0**	**1146.5**	**93.56**	**331.07**	30.7 U	**643.0**	**591.67**	**409.33**	**317.9**	**195.63**	**668.97**	**1535.67**	**695.9**	**559.8**	**1183.0**
TOTAL ORGANIC CARBON	MG/KG	474 - 7200	**5310.0**	**114480.0**	**72222.2**	**105333.33**	**94680.0**	**84400.0**	**29997.5**	**102425.0**	**95475.0**	**74320.0**	**27530.0**	**79400.0**	**86827.14**	**86371.43**	**89660.0**	**133666.67**

U = not detected in any sample within reach; value represents mean detection limit (DL). **B** = value <RL but >IDL/MDL.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

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TABLE 6-4 MEAN CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

		REACH ID:	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	5*	4*	4	2	3	3	3	4	3*	3	6	6	4	2
ANALYTE	UNIT	DL (RANGE)																
1,1,1-TRICHLOROETHANE	UG/KG	0.7 - 2	0.60 U	1.75 U	1.18 U	2.00 U	1.00 U	1.00 U	0.90 U	1.50 U	2.00 U	1.50 U	0.933 U	2.00 U	1.50 U	1.17 U	2.00 U	1.00 U
1,1,2,2-TETRACHLOROETHANE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.667 U	2.00 U	2.00 U	1.67 U	2.00 U	1.00 U
1,1,2-TRICHLOROETHANE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.667 U	2.00 U	2.00 U	1.67 U	2.00 U	1.00 U
1,1-DICHLOROETHANE	UG/KG	0.5 - 2	0.50 U	1.50 U	1.12 U	1.00 U	1.00 U	0.95 U	0.77 U	1.00 U	1.67 U	1.00 U	0.90 U	1.00 U	1.17 U	0.97 U	1.00 U	0.80 U
1,1-DICHLOROETHYLENE	UG/KG	0.7 - 2	0.60 U	1.75 U	1.18 U	2.00 U	1.00 U	1.00 U	0.90 U	1.50 U	2.00 U	1.50 U	0.93 U	2.00 U	1.50 U	1.17 U	2.00 U	1.00 U
1,2-DICHLOROBENZENE	UG/KG	1 - 5	1.00 U	3.25 U	3.00 U	3.50 U	2.75 U	2.50 U	1.67 U	3.17 U	4.00 U	3.00 U	2.33 U	3.33 U	3.17 U	2.33 U	3.25 U	2.00 U
1,2-DICHLOROETHANE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.67 U	2.00 U	2.00 U	1.67 U	2.00 U	1.00 U
1,2-DICHLOROPROPANE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.67 U	2.00 U	2.00 U	1.67 U	2.00 U	1.00 U
1,4-DICHLOROBENZENE	UG/KG	1 - 4	1.00 U	3.00 U	2.20 U	2.50 U	2.00 U	2.00 U	1.67 U	2.50 U	3.00 U	2.25 U	1.67 U	2.67 U	2.50 U	2.00 U	3.00 U	2.00 U
2-CHLOROETHYL VINYL ETHER	UG/KG	3 - 10	2.00 U	7.25 U	5.80 U	6.50 U	5.25 U	5.00 U	4.00 U	6.17 U	7.67 U	6.00 U	4.67 U	6.67 U	6.50 U	5.17 U	6.75 U	4.00 U
ACROLEIN	UG/KG	27 - 95	25.00 U	70.75 U	56.80 U	66.25 U	52.50 U	49.00 U	37.67 U	61.33 U	77.00 U	59.00 U	46.33 U	66.67 U	63.00 U	51.17 U	68.00 U	41.00 U
ACRYLONITRILE	UG/KG	11 - 38	10.00 U	28.25 U	22.80 U	26.75 U	20.75 U	20.00 U	15.00 U	24.67 U	31.00 U	23.75 U	18.33 U	27.00 U	25.33 U	20.50 U	27.50 U	16.00 U
BENZENE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.67 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
BROMODICHLOROMETHANE	UG/KG	0.9 - 3	0.90 U	2.50 U	2.00 U	2.00 U	2.00 U	2.00 U	1.30 U	2.00 U	2.17 U	2.00 U	1.17 U	2.00 U	2.17 U	2.00 U	2.00 U	1.00 U
BROMOMETHANE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.67 U	2.00 U	1.00 U
CARBON DISULFIDE	UG/KG	0.5 - 9	0.50 U	**5.50**	**7.98**	**3.75**	**2.25**	0.95 U	**3.43**	1.00 U	1.17 U	1.00 U	**5.90**	**5.33**	**7.33**	0.97 U	**3.75**	**3.90**
CARBON TETRACHLORIDE	UG/KG	0.7 - 2	0.60 U	1.75 U	1.18 U	2.00 U	1.00 U	1.00 U	0.90 U	1.50 U	2.00 U	1.50 U	0.93 U	2.00 U	1.50 U	1.17 U	2.00 U	1.00 U
CFC-11	UG/KG	0.5 - 2	0.50 U	1.50 U	1.12 U	1.00 U	1.00 U	0.95 U	0.77 U	1.00 U	1.17 U	1.00 U	0.90 U	1.00 U	1.17 U	0.97 U	1.00 U	0.80 U
CFC-12	UG/KG	0.7 - 2	0.60 U	1.75 U	1.18 U	2.00 U	1.00 U	1.00 U	0.90 U	1.50 U	2.00 U	1.50 U	0.93 U	2.00 U	1.50 U	1.17 U	2.00 U	1.00 U
CHLOROBENZENE	UG/KG	1 - 4	1.00 U	3.25 U	2.60 U	3.00 U	2.00 U	2.00 U	1.17 U	2.50 U	3.67 U	2.75 U	2.00 U	3.00 U	3.00 U	2.17 U	3.00 U	2.00 U
CHLORODIBROMOMETHANE	UG/KG	1 - 5	1.00 U	3.25 U	3.00 U	3.50 U	2.75 U	2.50 U	1.17 U	3.17 U	4.00 U	3.00 U	2.33 U	3.33 U	3.17 U	2.33 U	3.25 U	2.00 U
CHLOROETHANE	UG/KG	1 - 5	1.00 U	3.25 U	3.00 U	3.50 U	2.75 U	2.50 U	1.17 U	3.17 U	4.00 U	3.00 U	2.33 U	3.33 U	3.17 U	2.33 U	3.25 U	2.00 U
CHLOROFORM	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
CHLOROMETHANE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
CIS-1,3-DICHLOROPROPENE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
DICHLOROMETHANE	UG/KG	1 - 6	1.00 U	**12.25**	**12.20**	**15.75**	**8.00**	2.00 U	**8.00**	**4.83**	3.67 U	2.75 U	2.00 U	3.00 U	3.00 U	2.17 U	3.00 U	2.00 U
ETHYLBENZENE	UG/KG	0.7 - 2	0.60 U	1.75 U	1.18 U	2.00 U	1.00 U	1.00 U	0.90 U	1.50 U	2.00 U	1.50 U	0.93 U	2.00 U	1.50 U	1.17 U	2.00 U	1.00 U
M-DICHLOROBENZENE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
METHYLBENZENE	UG/KG	0.9 - 3	0.90 U	2.50 U	2.00 U	2.00 U	2.00 U	2.00 U	1.30 U	2.00 U	2.17 U	2.00 U	1.17 U	2.00 U	2.17 U	2.00 U	2.00 U	1.00 U
TETRACHLOROETHENE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	UG/KG	0.8 - 3	0.80 U	2.25 U	1.80 U	2.00 U	1.75 U	1.50 U	0.93 U	1.83 U	2.00 U	2.00 U	1.17 U	2.00 U	2.00 U	1.17 U	2.00 U	1.00 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	1 - 4	1.00 U	3.25 U	2.60 U	3.00 U	2.00 U	2.00 U	1.17 U	2.50 U	3.67 U	2.75 U	2.00 U	3.00 U	3.00 U	2.17 U	3.00 U	2.00 U
TRIBOMOMETHANE	UG/KG	1 - 4	1.00 U	3.25 U	2.60 U	3.00 U	2.00 U	2.00 U	1.17 U	2.50 U	3.67 U	2.75 U	2.00 U	3.00 U	3.00 U	2.17 U	3.00 U	2.00 U
TRICHLOROETHYLENE	UG/KG	0.9 - 3	0.90 U	2.50 U	2.00 U	2.00 U	2.00 U	2.00 U	1.30 U	2.00 U	2.17 U	2.00 U	1.17 U	2.00 U	2.17 U	2.00 U	2.00 U	1.00 U
VINYL CHLORIDE	UG/KG	0.7 - 2	0.60 U	1.75 U	1.18 U	2.00 U	1.00 U	1.00 U	0.90 U	1.50 U	2.00 U	1.50 U	0.93 U	2.00 U	1.50 U	1.17 U	2.00 U	1.00 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

* = volatiles analyzed for 5 samples Inside Site 104, 4 samples Brewerton Eastern Extension, and 3 samples Craighill Upper Range.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 6-5 MEAN CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

		REACH ID:	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
ANALYTE	UNIT	DL (RANGE)																
1,2,4-TRICHLOROBENZENE	UG/KG	74 - 180	76.00 U	129.75 U	104.00 U	136.00 U	101.00 U	82.50 U	90.00 U	120.00 U	130.00 U	130.00 U	75.50 U	136.67 U	118.33 U	98.33 U	102.75 U	85.00 U
1,2-DICHLOROBENZENE	UG/KG	53 - 130	NA	94.50 U	75.88 U	97.20 U	73.00 U	59.50 U	64.00 U	87.00 U	93.33 U	92.50 U	54.00 U	100.00 U	85.83 U	70.50 U	74.75 U	61.50 U
1,2-DIPHENYLHYDRAZINE	UG/KG	54 - 130	55.00 U	97.50 U	76.75 U	100.00 U	74.25 U	60.50 U	65.33 U	88.67 U	94.33 U	94.00 U	55.00 U	103.67 U	87.33 U	71.83 U	75.75 U	62.50 U
1,4-DICHLOROBENZENE	UG/KG	72 - 170	NA	129.00 U	102.00 U	136.00 U	99.75 U	80.50 U	85.33 U	119.33 U	123.33 U	125.00 U	73.50 U	136.667 U	115.00 U	94.50 U	101.25 U	83.00 U
1-METHYLNAPHTHALENE	UG/KG	12 - 180	12.00 U	**44.50**	**103.88**	**31.80**	**36.25**	13.50 U	**15.67**	**22.00**	**23.00**	**26.00**	**12.75**	22.33 U	**29.00**	**53.17**	**41.25**	**210.00**
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	81 - 200	84.00 U	**123.25**	117.00 U	148.00 U	111.00 U	91.00 U	98.67 U	133.33 U	143.33 U	140.00 U	83.50 U	153.33 U	133.33 U	108.33 U	115.00 U	94.00 U
2,4,6-TRICHLOROPHENOL	UG/KG	76 - 180	78.00 U	135.00 U	107.385 U	138.00 U	102.00 U	84.50 U	91.33 U	123.33 U	133.33 U	130.00 U	77.50 U	143.33 U	123.33 U	99.67 U	106.00 U	87.50 U
2,4-DICHLOROPHENOL	UG/KG	67 - 160	69.00 U	119.75 U	95.125 U	126.00 U	91.75 U	74.50 U	82.00 U	110.33 U	116.67 U	120.00 U	68.00 U	126.67 U	107.83 U	89.00 U	93.25 U	77.50 U
2,4-DIMETHYLPHENOL	UG/KG	130 - 310	130.00 U	227.50 U	181.25 U	234.00 U	175.00 U	145.00 U	153.33 U	206.67 U	226.67 U	220.00 U	130.00 U	240.00 U	206.67 U	170.00 U	180.00 U	150.00 U
2,4-DINITROPHENOL	UG/KG	620 - 1500	630.00 U	1107.50 U	883.75 U	1160.00 U	852.50 U	690.00 U	750.00 U	1016.67 U	1100.00 U	1095.00 U	630.00 U	1176.67 U	996.67 U	823.33 U	870.00 U	720.00 U
2,4-DINITROTOLUENE	UG/KG	50 - 120	51.00 U	89.00 U	71.25 U	92.80 U	68.75 U	56.00 U	60.667 U	82.33 U	88.00 U	87.50 U	51.00 U	94.33 U	81.17 U	66.67 U	70.25 U	58.00 U
2,6-DINITROTOLUENE	UG/KG	57 - 140	58.00 U	101.50 U	81.50 U	106.00 U	78.00 U	64.00 U	69.00 U	92.67 U	101.00 U	100.25 U	58.00 U	108.33 U	91.17 U	75.67 U	80.00 U	66.00 U
2-CHLORONAPHTHALENE	UG/KG	73 - 180	75.00 U	129.25 U	103.63 U	136.00 U	100.25 U	81.50 U	89.33 U	119.67 U	126.67 U	130.00 U	74.50 U	136.67 U	118.33 U	97.17 U	101.75 U	84.00 U
2-CHLOROPHENOL	UG/KG	63 - 150	65.00 U	111.00 U	89.25 U	116.00 U	86.25 U	70.50 U	76.00 U	102.00 U	113.33 U	110.00 U	64.00 U	118.00 U	100.33 U	83.67 U	88.25 U	73.00 U
2-METHYL-4,6-DINITROPHENOL	UG/KG	63 - 150	65.00 U	111.00 U	89.25 U	116.00 U	86.25 U	70.50 U	76.00 U	102.00 U	113.33 U	110.00 U	64.00 U	118.00 U	100.33 U	83.67 U	88.25 U	73.00 U
2-METHYLNAPHTHALENE	UG/KG	7.8 - 110	7.90 U	**178.25**	**346.38**	**61.20**	**86.25**	**11.50**	**19.93**	**27.33**	**29.00**	**59.50**	**23.25**	**32.00**	**54.67**	**135.67**	**84.50**	**490.00**
2-METHYLPHENOL	UG/KG	76 - 180	78.00 U	135.00 U	107.38 U	138.00 U	102.00 U	84.50 U	91.33 U	123.33 U	133.33 U	130.00 U	77.50 U	143.33 U	123.33 U	99.67 U	106.00 U	87.50 U
2-NITROPHENOL	UG/KG	54 - 130	55.00 U	97.50 U	76.75 U	100.00 U	74.25 U	60.50 U	65.33 U	88.67 U	94.33 U	94.00 U	55.00 U	103.67 U	87.33 U	71.83 U	75.75 U	62.50 U
3,3'-DICHLOROBENZIDINE	UG/KG	46 - 110	47.00 U	82.50 U	65.38 U	85.20 U	63.25 U	51.50 U	55.67 U	75.67 U	81.00 U	80.50 U	47.00 U	86.33 U	74.67 U	61.33 U	64.75 U	53.50 U
3,4-METHYLPHENOL	UG/KG	160 - 380	160.00 U	**342.50**	**213.38**	**308.00**	**292.50**	**290.00**	**166.67**	**336.67**	**323.33**	**362.50**	**132.25**	**210.00**	**310.00**	**295.00**	**300.00**	**205.00**
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	UG/KG	79 - 190	82.00 U	142.50 U	112.50 U	148.00 U	110.50 U	89.00 U	97.33 U	130.00 U	140.00 U	140.00 U	81.50 U	153.33 U	128.33 U	106.50 U	112.25 U	92.50 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	60 - 150	61.00 U	107.50 U	86.13 U	112.00 U	82.25 U	67.00 U	72.33 U	97.33 U	103.33 U	103.75 U	61.00 U	113.33 U	97.50 U	79.50 U	84.00 U	69.50 U
4-CHLORO-3-METHYLPHENOL	UG/KG	69 - 170	71.00 U	123.00 U	97.63 U	126.00 U	93.00 U	77.00 U	83.33 U	111.33 U	123.33 U	120.00 U	70.00 U	126.67 U	110.00 U	91.167 U	96.75 U	79.50 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	70 - 170	72.00 U	125.75 U	98.50 U	128.00 U	93.75 U	78.00 U	84.00 U	115.00 U	123.33 U	120.00 U	71.00 U	130.00 U	113.33 U	92.83 U	97.75 U	80.50 U
4-NITROPHENOL	UG/KG	51 - 120	52.00 U	**83.00**	72.38 U	94.40 U	70.50 U	57.00 U	61.67 U	83.67 U	89.67 U	89.00 U	52.00 U	95.67 U	82.83 U	67.83 U	72.00 U	59.00 U
BENZOIC ACID	UG/KG	1600 - 3800	1600.00 U	2825.00 U	2250.00 U	2940.00 U	2175.00 U	1750.00 U	1900.00 U	2533.33 U	2800.00 U	2775.00 U	600.00 U	3000.00 U	2566.67 U	2083.33 U	2225.00 U	1800.00 U
BENZYL ALCOHOL	UG/KG	57 - 140	58.00 U	101.50 U	81.50 U	106.00 U	78.00 U	64.00 U	69.00 U	92.67 U	101.00 U	100.25 U	58.00 U	108.33 U	91.17 U	75.67 U	80.00 U	66.00 U
BENZYL BUTYL PHTHALATE	UG/KG	55 - 130	56.00 U	98.50 U	77.88 U	**93.40**	75.50 U	62.00 U	66.67 U	90.00 U	95.33 U	95.00 U	56.00 U	104.00 U	89.17 U	73.17 U	77.25 U	63.50 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	68 - 160	70.00 U	120.25 U	95.75 U	126.00 U	92.25 U	75.50 U	82.67 U	111.00 U	120.00 U	120.00 U	69.00 U	126.67 U	108.00 U	90.17 U	93.75 U	78.50 U
BIS(2-CHLOROETHYL) ETHER	UG/KG	62 - 150	63.00 U	110.75 U	88.38 U	116.00 U	85.25 U	69.00 U	75.00 U	101.67 U	110.00 U	109.50 U	63.00 U	117.67 U	99.67 U	82.33 U	87.00 U	72.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	52 - 130	53.00 U	**93.00**	**75.25**	**95.00**	**66.75**	**60.50**	63.00 U	**135.00**	91.33 U	90.75 U	53.00 U	99.33 U	**90.17**	69.33 U	73.25 U	60.50 U
DI-N-BUTYL PHTHALATE	UG/KG	45 - 110	46.00 U	**77.50**	64.50 U	83.40 U	62.25 U	**53.50**	54.67 U	**94.00**	**178.67**	**104.00**	46.00 U	85.67 U	73.33 U	60.17 U	63.75 U	52.50 U
DI-N-OCTYL PHTHALATE	UG/KG	63 - 150	65.00 U	**103.25**	89.25 U	116.00 U	86.25 U	70.50 U	76.00 U	102.00 U	113.33 U	110.00 U	64.00 U	118.00 U	100.33 U	83.67 U	88.25 U	73.00 U
DIBENZOFURAN	UG/KG	72 - 170	74.00 U	**142.50**	**105.50**	136.00 U	99.75 U	80.50 U	85.33 U	119.33 U	123.33 U	125.00 U	73.50 U	136.67 U	115.00 U	94.50 U	101.25 U	**63.50**
DIETHYL PHTHALATE	UG/KG	46 - 110	47.00 U	**142.00**	65.375 U	85.20 U	63.25 U	51.50 U	55.67 U	75.67 U	81.00 U	80.50 U	47.00 U	86.33 U	74.67 U	61.33 U	64.75 U	53.50 U
DIMETHYL PHTHALATE	UG/KG	54 - 130	55.00 U	97.50 U	76.75 U	100.00 U	74.25 U	60.50 U	65.33 U	88.67 U	94.33 U	94.00 U	55.00 U	103.67 U	87.33 U	71.83 U	75.75 U	62.50 U
HEXACHLORO-1,3-BUTADIENE	UG/KG	66 - 160	68.00 U	117.00 U	94.00 U	122.00 U	90.50 U	73.50 U	78.00 U	110.00 U	113.33 U	115.00 U	67.00 U	126.33 U	105.67 U	87.67 U	92.25 U	76.50 U
HEXACHLOROBENZENE	UG/KG	58 - 140	59.00 U	104.50 U	82.63 U	106.00 U	79.75 U	65.00 U	70.00 U	93.00 U	102.00 U	100.50 U	59.00 U	109.00 U	95.33 U	77.00 U	81.50 U	67.00 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	130 - 310	61.00 U	227.50 U	181.25 U	234.00 U	175.00 U	145.00 U	153.33 U	206.67 U	226.67 U	220.00 U	130.00 U	240.00 U	206.67 U	170.00 U	180.00 U	150.00 U
HEXACHLOROETHANE	UG/KG	60 - 150	130.00 U	107.50 U	86.13 U	112.00 U	82.25 U	67.00 U	72.33 U	97.33 U	103.33 U	103.75 U	61.00 U	113.33 U	97.50 U	79.50 U	84.00 U	69.50 U
M-DICHLOROBENZENE	UG/KG	71 - 170	NA	126.25 U	101.63 U	128.00 U	99.25 U	79.50 U	84.67 U	115.67 U	123.33 U	120.00 U	72.50 U	136.67 U	115.00 U	93.67 U	100.75 U	82.00 U
METHANAMINE, N-METHYL-N-NITROSO	UG/KG	56 - 140	57.00 U	98.75 U	80.25 U	105.20 U	77.00 U	63.00 U	67.67 U	91.33 U	100.00 U	98.75 U	57.00 U	104.67 U	90.00 U	74.50 U	78.75 U	64.50 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	84 - 200	87.00 U	147.50 U	120.75 U	158.00 U	117.00 U	94.50 U	100.67 U	140.00 U	146.67 U	147.50 U	86.50 U	163.33 U	135.00 U	111.67 U	117.50 U	95.50 U
N-NITROSODIPHENYLAMINE	UG/KG	56 - 140	57.00 U	98.75 U	80.25 U	105.20 U	77.00 U	63.00 U	67.67 U	91.33 U	100.00 U	98.75 U	57.00 U	104.67 U	90.00 U	74.50 U	78.75 U	64.50 U
NITROBENZENE	UG/KG	71 - 170	73.00 U	126.25 U	101.625 U	128.00 U	99.25 U	79.50 U	84.67 U	115.67 U	123.33 U	120.00 U	72.50 U	136.67 U	115.00 U	93.67 U	100.75 U	82.00 U
PENTACHLOROPHENOL	UG/KG	300 - 740	310.00 U	542.50 U	433.75 U	564.00 U	420.00 U	340.00 U	366.67 U	500.00 U	536.67 U	530.00 U	310.00 U	576.67 U	491.67 U	406.67 U	430.00 U	355.00 U
PHENOL	UG/KG	65 - 160	67.00 U	**111.00**	**85.13**	118.00 U	89.00 U	**125.00**	77.33 U	**183.33**	**140.00**	**155.75**	66.00 U	122.33 U	**199.00**	**478.33**	**260.00**	**440.00**

U = not detected in any sample within reach, value represents mean detection limit (DL)

NA = not analyzed.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

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TABLE 6-6 MEAN CONCENTRATIONS OF CHLORINATED PESTICIDES (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

ANALYTE	UNIT	DL (RANGE)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
4,4'-DDD	UG/KG	0.42 - 1	0.42 U	0.74 U	0.59 U	0.76 U	0.57 U	**0.72**	0.5 U	0.68 U	**0.76**	0.72 U	0.42 U	0.78 U	0.67 U	0.55 U	**0.86**	**0.51**
4,4'-DDE	UG/KG	0.4 - 0.95	0.4 U	0.7 U	**0.98**	0.72 U	0.54 U	**0.99**	0.47 U	0.64 U	0.69 U	0.68 U	0.4 U	0.74 U	0.63 U	**0.67**	**0.89**	**0.48**
4,4'-DDT	UG/KG	0.65 - 1.6	0.66 U	1.17 U	0.93 U	1.18 U	0.89 U	0.72 U	0.77 U	1.06 U	1.13 U	1.1 U	0.66 U	1.22 U	1.05 U	0.87 U	0.91 U	0.75 U
ALDRIN	UG/KG	0.52 - 1.2	0.52 U	0.9 U	**0.73**	0.94 U	0.7 U	0.57 U	0.62 U	0.84 U	0.9 U	0.89 U	0.52 U	0.95 U	0.83 U	0.68 U	0.71 U	0.59 U
ALPHA-BHC	UG/KG	0.38 - 0.9	0.38 U	0.67 U	0.53 U	0.69 U	0.51 U	0.42 U	0.45 U	0.62 U	0.65 U	0.65 U	0.38 U	0.71 U	0.6 U	0.5 U	0.52 U	0.43 U
BETA-BHC	UG/KG	0.49 - 1.2	0.49 U	0.86 U	0.69 U	0.89 U	0.66 U	0.54 U	0.58 U	0.79 U	0.85 U	0.84 U	0.49 U	0.92 U	0.78 U	0.65 U	0.68 U	0.56 U
CHLORDANE	UG/KG	1.6 - 3.8	1.6 U	2.82 U	2.25 U	2.94 U	2.17 U	1.75 U	1.9 U	2.6 U	2.8 U	2.77 U	1.6 U	3.0 U	2.55 U	2.1 U	2.23 U	1.85 U
CHLORBENSIDE	UG/KG	3.3 - 7.9	3.3 U	5.77 U	4.67 U	6.04 U	4.5 U	3.65 U	3.93 U	5.37 U	5.8 U	5.7 U	3.33 U	6.17 U	5.28 U	4.42 U	4.6 U	3.8 U
DACTHAL	UG/KG	3.3 - 20	10.0 U	17.5 U	4.67 U	6.04 U	4.5 U	3.65 U	3.93 U	5.37 U	5.8 U	5.7 U	3.33 U	6.17 U	5.28 U	4.42 U	4.6 U	3.8 U
DELTA-BHC	UG/KG	0.49 - 1.2	0.49 U	0.86 U	0.69 U	0.89 U	0.66 U	0.54 U	0.58 U	0.79 U	0.85 U	0.84 U	0.49 U	0.92 U	0.78 U	0.65 U	0.68 U	0.56 U
DIELDRIN	UG/KG	0.43 - 1	0.43 U	0.76 U	0.6 U	0.78 U	0.58 U	0.47 U	0.51 U	0.7 U	0.75 U	0.74 U	0.43 U	0.8 U	0.68 U	0.57 U	0.59 U	0.49 U
ENDOSULFAN I	UG/KG	0.71 - 1.7	0.72 U	1.26 U	1.02 U	1.28 U	0.99 U	0.79 U	0.85 U	1.16 U	1.23 U	1.2 U	0.72 U	1.37 U	1.15 U	0.95 U	1.01 U	0.82 U
ENDOSULFAN II	UG/KG	0.36 - 0.86	0.36 U	0.63 U	**0.60**	0.65 U	0.48 U	0.4 U	0.43 U	0.58 U	0.62 U	0.62 U	0.36 U	0.66 U	0.57 U	0.47 U	0.5 U	0.41 U
ENDOSULFAN SULFATE	UG/KG	0.83 - 2	0.85 U	1.48 U	1.18 U	1.52 U	1.11 U	0.92 U	0.99 U	1.33 U	1.47 U	1.43 U	0.84 U	1.53 U	1.33 U	1.1 U	1.15 U	0.95 U
ENDRIN	UG/KG	1.5 - 3.6	1.5 U	2.65 U	2.11 U	2.74 U	2.03 U	1.65 U	1.77 U	2.43 U	2.6 U	2.58 U	1.5 U	2.8 U	2.38 U	1.98 U	2.08 U	1.7 U
ENDRIN ALDEHYDE	UG/KG	0.93 - 2.2	0.95 U	1.65 U	**1.39**	1.68 U	1.27 U	1.05 U	1.12 U	1.53 U	1.63 U	1.6 U	0.94 U	1.73 U	1.5 U	1.23 U	1.27 U	1.05 U
GAMMA-BHC	UG/KG	0.45 - 1.1	0.45 U	0.79 U	0.63 U	0.82 U	0.6 U	0.5 U	0.53 U	0.73 U	0.78 U	0.77 U	0.45 U	0.84 U	0.71 U	0.59 U	0.62 U	0.52 U
HEPTACHLOR	UG/KG	0.59 - 1.4	0.6 U	1.07 U	0.84 U	1.08 U	0.81 U	0.66 U	0.71 U	0.97 U	1.03 U	1.01 U	0.6 U	1.13 U	0.96 U	0.79 U	0.83 U	0.69 U
HEPTACHLOR EPOXIDE	UG/KG	0.8 - 1.9	0.82 U	**3.17**	**1.40**	1.48 U	1.11 U	0.89 U	0.97 U	1.3 U	1.43 U	1.4 U	0.81 U	1.53 U	1.28 U	1.08 U	1.12 U	**1.29**
METHOXYCHLOR	UG/KG	2.6 - 6.2	2.6 U	4.55 U	3.64 U	4.72 U	3.5 U	2.85 U	3.1 U	4.2 U	4.47 U	4.47 U	2.6 U	4.83 U	4.1 U	3.42 U	3.58 U	3.0 U
MIREX	UG/KG	3.3 - 7.9	3.3 U	5.77 U	4.66 U	6.04 U	4.5 U	3.65 U	3.93 U	5.37 U	5.8 U	5.7 U	3.33 U	6.17 U	5.28 U	4.42 U	4.6 U	3.8 U
TOXAPHENE	UG/KG	14 - 33	14.0 U	24.5 U	19.63 U	25.4 U	19.0 U	15.5 U	16.67 U	22.67 U	24.0 U	24.0 U	14.0 U	26.0 U	22.33 U	18.5 U	19.25 U	16.0 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 6-7 MEAN CONCENTRATIONS OF ORGANOPHOSPHORUS PESTICIDES (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
SAMPLE TYPE:			Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
SAMPLE SIZE (N):			1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
ANALYTE	UNIT	DL (RANGE)																
AZINPHOS METHYL	UG/KG	22 - 52	22.0 U	38.5 U	30.75 U	40.0 U	29.5 U	24.0 U	26.0 U	35.67 U	37.67 U	37.75 U	22.0 U	40.67 U	34.67 U	29.0 U	30.25 U	25.0 U
DEMETON	UG/KG	21 - 50	21.0 U	37.0 U	29.38 U	38.0 U	28.5 U	23.0 U	25.0 U	34.0 U	36.33 U	36.0 U	21.0 U	39.0 U	33.33 U	27.83 U	29.0 U	24.0 U
ETHYL PARATHION	UG/KG	33 - 78	33.0 U	57.75 U	46.38 U	59.8 U	44.25 U	36.0 U	39.33 U	53.67 U	57.0 U	56.5 U	33.25 U	61.0 U	52.33 U	43.5 U	45.25 U	37.5 U
MALATHION	UG/KG	16 - 37	16.0 U	27.5 U	22.0 U	28.4 U	21.25 U	17.5 U	18.67 U	25.33 U	27.0 U	26.75 U	16.0 U	29.0 U	24.83 U	20.83 U	21.75 U	18.0 U
METHYL PARATHION	UG/KG	17 - 40	17.0 U	29.75 U	23.88 U	30.6 U	22.75 U	18.5 U	20.33 U	27.33 U	29.0 U	29.0 U	17.0 U	31.67 U	26.83 U	22.33 U	23.5 U	19.5 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 6-8 MEAN CONCENTRATIONS OF PCB AROCLORS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

		REACH ID:	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
ANALYTE	UNIT	DL (RANGE)																
AROCLOR 1016	UG/KG	5.4 - 13	5.4 U	9.43 U	7.58 U	9.72 U	7.25 U	5.9 U	6.4 U	8.73 U	9.33 U	9.25 U	5.4 U	9.97 U	8.57 U	7.12 U	7.45 U	6.15 U
AROCLOR 1221	UG/KG	6.7 - 16	6.8 U	11.98 U	9.5 U	12.6 U	9.15 U	7.45 U	8.2 U	11.07 U	11.67 U	12.0 U	6.8 U	12.67 U	10.78 U	8.97 U	9.3 U	7.75 U
AROCLOR 1232	UG/KG	12 - 29	12.0 U	21.0 U	17.0 U	21.8 U	16.5 U	13.5 U	14.33 U	19.33 U	20.67 U	20.75 U	12.0 U	22.33 U	19.0 U	15.83 U	16.75 U	14.0 U
AROCLOR 1242	UG/KG	8.7 - 21	8.9 U	15.75 U	12.31 U	15.8 U	12.0 U	9.7 U	10.53 U	14.33 U	15.33 U	15.0 U	8.83 U	16.33 U	14.17 U	11.83 U	12.25 U	10.2 U
AROCLOR 1248	UG/KG	2.6 - 6.2	2.6 U	4.55 U	**6.79**	4.72 U	3.5 U	2.85 U	3.1 U	4.2 U	4.47 U	4.47 U	2.6 U	4.83 U	4.1 U	3.42 U	3.58 U	3.0 U
AROCLOR 1254	UG/KG	7.7 - 19	7.9 U	13.75 U	**11.43**	13.8 U	10.23 U	8.55 U	9.2 U	12.67 U	13.33 U	13.0 U	7.8 U	14.33 U	12.33 U	10.12 U	10.63 U	8.9 U
AROCLOR 1260	UG/KG	4.9 - 12	4.9 U	8.6 U	6.9 U	8.88 U	6.6 U	5.4 U	5.8 U	7.9 U	8.5 U	8.4 U	4.9 U	9.2 U	7.78 U	6.47 U	6.75 U	5.6 U

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 6-9 MEAN CONCENTRATIONS OF PCB CONGENERS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

ANALYTE	UNIT	DL (RANGE)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
BZ# 8*	UG/KG	0.1 - 0.24	**0.2 P**	**0.26**	**0.16**	**0.24**	**0.15**	**0.49**	**0.13**	**0.49**	**0.3**	**0.37**	**0.12**	0.19 U	**0.26**	**0.39**	**0.39**	**0.29**
BZ# 18*	UG/KG	0.1 - 0.24	0.1 U	0.18 U	**0.23**	**0.23**	**0.21**	**0.33**	0.12 U	**0.29**	**0.28**	**0.38**	0.1 U	0.19 U	**0.26**	**0.3**	**0.27**	**0.26**
BZ# 28*	UG/KG	0.03 - 0.13	0.03 U	0.06 U	**0.18**	**0.36**	**0.18**	**0.53**	0.04 U	**0.35**	**0.14**	**0.31**	**0.08**	**0.15**	**0.13**	**0.32**	**0.4**	**0.26**
BZ# 44*	UG/KG	0.03 - 0.26	0.11 U	**0.2**	**0.27**	**0.29**	**0.21**	**0.38**	0.13 U	**0.29**	0.19 U	**0.27**	**0.12**	0.2 U	0.18 U	**0.26**	**0.28**	**0.21**
BZ# 49	UG/KG	0.17 - 0.4	0.17 U	**0.3**	**0.37**	**0.39**	**0.27**	**0.3**	0.2 U	**0.29**	0.29 U	**0.31**	**0.16**	0.32 U	0.27 U	**0.29**	**0.27**	**0.23**
BZ# 52*	UG/KG	0.1 - 0.24	0.1 U	**0.22**	**0.38**	**0.51**	**0.27**	**0.48**	0.12 U	**0.18**	0.18 U	**0.24**	**0.12**	0.19 U	0.16 U	**0.3**	**0.22**	**0.16**
BZ# 66*	UG/KG	0.05 - 0.13	0.05 U	**0.13**	**0.24**	**0.28**	**0.22**	**0.61**	0.06 U	**0.19**	**0.15**	**0.27**	**0.1**	**0.23**	**0.1**	**0.28**	**0.35**	**0.28**
BZ# 77*	UG/KG	0.08 - 0.2	0.08 U	**0.19**	**1.45**	**0.2**	**0.55**	**1.65**	**0.13**	**0.15**	0.14 U	**1.11**	**0.39**	**0.48**	**0.16**	**0.38**	**0.82**	**0.76**
BZ# 87	UG/KG	0.04 - 0.1	0.04 U	0.07 U	**0.20**	**0.12**	**0.11**	**0.27**	0.05 U	0.06 U	0.07 U	**0.13**	**0.09**	**0.09**	0.06 U	**0.1**	**0.11**	**0.12**
BZ# 101*	UG/KG	0.05 - 0.14	0.05 U	**0.18**	**0.65**	**0.34**	**0.3**	**0.99**	**0.11**	**0.25**	**0.16**	**0.62**	**0.27**	**0.19**	**0.12**	**0.42**	**0.51**	**0.54**
BZ# 105*	UG/KG	0.18 - 0.43	0.18 U	0.31 U	**0.29**	0.33 U	**0.26**	**0.27**	0.21 U	0.29 U	0.31 U	0.31 U	**0.18**	0.33 U	0.29 U	0.24 U	0.25 U	0.21 U
BZ# 118*	UG/KG	0.06 - 0.16	0.06 U	**0.16**	**0.50**	**0.28**	**0.27**	**0.7**	**0.08**	**0.15**	**0.14**	**0.36**	**0.2**	**0.22**	**0.11**	**0.22**	**0.39**	**0.23**
BZ# 126*	UG/KG	0.04 - 0.12	0.04 U	**0.24**	**1.02**	**0.14**	**0.13**	**0.39**	0.05 U	**0.08**	**0.11**	**0.16**	**0.05**	**0.1**	**0.09**	**0.16**	**0.2**	**0.09**
BZ# 128*	UG/KG	0.04 - 0.11	0.04 U	**0.09**	**0.29**	**0.09**	**0.11**	**0.23**	0.05 U	0.07 U	0.08 U	**0.17**	**0.07**	0.09 U	0.07 U	**0.09**	**0.11**	**0.08**
BZ# 138*	UG/KG	0.04 - 0.11	0.04 U	**0.12**	**0.89**	**0.32**	**0.27**	**0.94**	**0.06**	**0.16**	**0.09**	**0.95**	**0.21**	**0.21**	**0.11**	**0.3**	**0.43**	**0.59**
BZ# 153*	UG/KG	0.03 - 0.1	0.03 U	**0.22**	**1.38**	**0.4**	**0.34**	**1.25**	**0.07**	**0.27**	**0.13**	**1.39**	**0.23**	**0.33**	**0.09**	**0.41**	**0.62**	**0.65**
BZ# 156	UG/KG	0.08 - 0.19	0.08 U	0.14 U	**0.45**	0.15 U	**0.15**	**0.28**	0.09 U	0.13 U	0.14 U	**0.34**	0.08 U	0.15 U	0.13 U	**0.12**	**0.13**	**0.16**
BZ# 169*	UG/KG	0.09 - 0.23	0.09 U	0.17 U	0.13 U	0.17 U	0.13 U	0.11 U	0.11 U	0.15 U	0.17 U	0.16 U	0.09 U	0.18 U	0.15 U	0.13 U	0.13 U	0.11 U
BZ# 170*	UG/KG	0.07 - 0.17	0.07 U	**0.14**	**0.41**	**0.16**	**0.16**	**0.42**	0.08 U	**0.13**	0.12 U	**0.61**	**0.08**	0.13 U	0.11 U	**0.17**	**0.18**	**0.25**
BZ# 180*	UG/KG	0.08 - 0.21	0.08 U	**0.18**	**1.16**	**0.33**	**0.3**	**0.93**	0.1 U	**0.19**	**0.17**	**1.37**	**0.1**	**0.19**	0.14 U	**0.34**	**0.44**	**0.48**
BZ# 183	UG/KG	0.05 - 0.12	0.05 U	0.09 U	**0.29**	0.09 U	**0.1**	**0.19**	0.06 U	0.08 U	0.08 U	**0.4**	0.05 U	0.09 U	0.08 U	0.06 U	**0.09**	**0.12**
BZ# 184	UG/KG	0.05 - 0.13	0.05 U	**0.27**	**0.68**	**0.46**	**0.41**	**1.4**	**0.07**	**0.28**	**0.16**	**1.98**	**0.17**	**0.39**	**0.12**	**0.45**	**0.73**	**0.5**
BZ# 187*	UG/KG	0.05 - 0.14	0.06 U	**0.17**	**0.95**	**0.2**	**0.2**	**0.6**	0.07 U	**0.13**	**0.13**	**0.77**	**0.07**	**0.13**	**0.1**	**0.24**	**0.31**	**0.29**
BZ# 195	UG/KG	0.08 - 0.21	0.08 U	0.15 U	**0.17**	0.16 U	**0.13**	**0.1**	0.1 U	0.14 U	0.15 U	**0.23**	0.08 U	0.16 U	0.14 U	0.11 U	0.12 U	0.1 U
BZ# 206	UG/KG	0.13 - 0.31	0.13 U	**0.64**	**0.63**	**0.52**	**0.58**	**2.1**	0.15 U	**0.3**	**0.29**	**0.37**	**0.16**	**0.35**	**0.29**	**0.64**	**0.87**	**1.04**
BZ# 209	UG/KG	0.16 - 0.38	0.16 U	**1.2**	**0.95**	**0.89**	**0.85**	**3.8**	**0.21**	**0.53**	**0.41**	**0.65**	**0.28**	**0.66**	**0.47**	**1.04**	**1.44**	**1.45**
TOTAL PCB (ND=0)*	UG/KG	-	0.40	2.78	18.97	7.32	5.83	22.34	0.64	5.63	2.26	18.01	3.54	3.85	1.97	8.94	11.40	10.63
TOTAL PCB (ND=1/2DL)	UG/KG	-	1.61	4.56	20.06	8.50	7.15	22.45	2.05	6.64	4.11	18.81	4.32	5.64	3.61	9.43	11.99	11.06
TOTAL PCB (ND=DL)	UG/KG	-	2.82	6.35	21.15	9.69	8.48	22.55	3.45	7.65	5.97	19.61	5.09	7.44	5.24	9.91	12.57	11.49

U = not detected in any sample within reach; value represents mean detection limit (DL). **P** = >25% between two GC columns.

* = PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998). Total multiplied by a factor of 2 as per NOAA 1993

* Note that the mean of total PCB for individual samples is not equivalent to sum of mean congeners for ND=0 and ND=1/2DL.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

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TABLE 6-10 MEAN CONCENTRATIONS OF PAHs (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

ANALYTE	UNIT	DL (RANGE)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
SAMPLE TYPE:			Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
SAMPLE SIZE (N):			1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
ACENAPHTHENE	UG/KG	9.5 - 23	9.7 U	**196.75**	**290.38**	**52.8**	**67.75**	**13.0**	**19.2**	**38.0**	**28.0**	**64.5**	**24.75**	**41.0**	**48.67**	**114.67**	**82.25**	**265.0**
ACENAPHTHYLENE	UG/KG	20 - 48	20.0 U	**51.75**	**28.88**	36.0 U	**38.0**	22.0 U	23.67 U	32.33 U	34.33 U	34.0 U	20.0 U	36.67 U	**35.17**	**54.17**	**41.5**	**220.0**
ANTHRACENE	UG/KG	0.72 - 11	0.73 U	**52.6**	**67.58**	**24.8**	**31.25**	**2.0**	**7.03**	**12.8**	**11.0**	**25.75**	**10.13**	**15.17**	**20.68**	**42.97**	**30.75**	**155.0**
BENZ[A]ANTHRACENE	UG/KG	0.84 - 12	0.86 U	**98.3**	**61.91**	**25.62**	**34.0**	**5.3**	**8.6**	**14.0**	**12.8**	**23.48**	**14.25**	**22.6**	**15.25**	**36.67**	**26.27**	**90.5**
BENZO[A]PYRENE	UG/KG	1.1 - 16	1.1 U	**117.43**	**80.13**	**41.94**	**56.5**	**7.0**	**15.83**	**17.33**	**17.57**	**23.5**	**27.25**	**46.33**	**19.13**	**47.33**	**35.55**	**110.0**
BENZO[B]FLUORANTHENE	UG/KG	1.8 - 4.3	1.8 U	**124.5**	**93.19**	**45.08**	**84.25**	**8.9**	**19.1**	**31.0**	**19.43**	**42.25**	**26.5**	**36.0**	**45.2**	**110.67**	**90.3**	**230.0**
BENZO[G,H,I]PERYLENE	UG/KG	2.1 - 5	2.1 U	**81.63**	**50.23**	**30.38**	**38.25**	**4.7**	**12.17**	**13.8**	**17.5**	**21.0**	**18.5**	**32.33**	**13.5**	**35.83**	**25.2**	**69.0**
BENZO[K]FLUORANTHENE	UG/KG	2.1 - 5	2.1 U	**54.5**	**41.95**	**16.26**	**29.0**	**2.5**	**6.7**	**8.3**	**7.93**	**14.5**	**10.18**	**16.8**	**10.52**	**25.83**	**18.02**	**51.5**
CHRYSENE	UG/KG	1.3 - 19	1.3 U	**80.7**	**40.53**	**25.76**	**37.5**	**5.9**	**8.17**	**12.1**	**10.57**	**20.68**	**12.32**	**19.67**	**14.37**	**36.17**	**24.52**	**73.5**
DIBENZ[A,H]ANTHRACENE	UG/KG	3.4 - 8.1	3.4 U	5.95 U	**9.63**	**7.7**	**6.32**	3.75 U	4.03 U	5.53 U	5.9 U	5.85 U	**3.55**	**6.33**	5.38 U	**5.8**	**5.2**	**7.55**
FLUORANTHENE	UG/KG	2.6 - 38	2.6 U	**263.5**	**225.00**	**94.4**	**124.25**	**11.3**	**24.13**	**46.0**	**40.67**	**87.0**	**35.5**	**50.33**	**61.83**	**137.83**	**103.25**	**395.0**
FLUORENE	UG/KG	1.3 - 3.1	1.3 U	**39.38**	**65.20**	**27.82**	**40.25**	**3.0**	**8.13**	**12.43**	**11.9**	**25.25**	**12.1**	**15.27**	**21.37**	**46.17**	**33.2**	**175.0**
INDENO[1,2,3-CD]PYRENE	UG/KG	1.1 - 6.7	1.1 U	**55.8**	**30.56**	**23.06**	**27.25**	**3.55**	**4.37**	**10.87**	**8.13**	**15.32**	**11.8**	**19.97**	**10.0**	**25.67**	**18.8**	**47.5**
NAPHTHALENE	UG/KG	7.3 - 18	7.5 U	**153.0**	**237.63**	**106.4**	**121.0**	**14.5**	**29.83**	**66.0**	**70.0**	**94.75**	**39.5**	**76.0**	**99.17**	**188.17**	**134.5**	**625.0**
PHENANTHRENE	UG/KG	1.3 - 19	1.3 U	**152.0**	**203.15**	**69.66**	**105.75**	**6.95**	**18.8**	**33.67**	**30.67**	**64.25**	**28.75**	**38.33**	**54.82**	**120.0**	**85.13**	**445.0**
PYRENE	UG/KG	0.62 - 9.3	0.63 U	**171.75**	**202.58**	**86.26**	**116.25**	**11.5**	**24.1**	**38.33**	**36.33**	**69.25**	**38.5**	**55.67**	**48.87**	**116.83**	**85.75**	**335.0**
TOTAL PAH (ND=0)	UG/KG	-	0	1659.83	1699.90	666.56	951.08	100.10	202.60	354.63	321.17	591.48	311.03	487.67	487.38	1123.92	817.63	3294.55
TOTAL PAH (ND=1/2DL)	UG/KG	-	28.76	1679.68	1714.19	690.25	954.33	112.98	218.23	373.57	341.95	611.40	322.30	508.07	505.65	1134.34	828.91	3294.55
TOTAL PAH (ND=DL)	UG/KG	-	57.52	1699.53	1728.49	713.94	957.58	125.85	233.87	392.50	362.73	631.33	333.58	528.47	523.92	1144.77	840.20	3294.55

U = not detected in any sample within reach; value represents mean detection limit (DL).

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 6-11 MEAN CONCENTRATIONS OF METALS (MG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

		REACH ID:	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
ANALYTE	UNIT	DL (RANGE)																
ALUMINUM	MG/KG	1.8 - 36	2150.0	15325.0	12801.25	16680.0	15700.0	15000.0	6173.67	13033.33	17300.0	15675.0	2625.0	17633.33	14816.67	14950.0	14950.0	14450.0
ANTIMONY	MG/KG	0.2 - 0.4	0.21 UN	0.62	3.67	1.48	1.1	1.15	0.6	1.23	1.4	1.15	0.38	1.73	1.09	1.12	0.96	1.04
ARSENIC	MG/KG	0.08 - 0.68	2.0	14.33	32.00	16.76	10.9	11.1	6.0	13.7	16.53	14.52	2.95	17.57	12.72	11.3	12.57	14.55
BERYLLIUM	MG/KG	0.0097 - 0.01	0.1 B	1.35	1.03	1.86	1.6	1.75	0.56	1.43	1.57	1.45	0.3	1.67	1.55	1.68	1.63	2.2
CADMIUM	MG/KG	0.01 - 0.04	0.02 U	0.03 U	1.33	0.26	0.33	0.77	0.08	0.26	0.74	0.42	0.03	0.27	0.34	0.77	0.27	0.34
CHROMIUM	MG/KG	0.08 - 0.09	4.9 E	34.42	83.95	44.3	25.25	27.7	16.17	41.4	46.77	42.9	9.95	59.7	36.08	27.77	32.17	29.2
COPPER	MG/KG	0.06 - 0.7	1.4	38.55	99.50	43.18	35.15	35.8	14.03	35.23	39.07	38.25	9.73	45.9	39.5	38.0	35.92	54.85
IRON	MG/KG	0.8 - 81	5640.0	37225.0	52450.00	40560.0	37100.0	35750.0	16820.0	36100.0	40400.0	38525.0	7767.5	42033.33	35466.67	36716.67	36975.0	38200.0
LEAD	MG/KG	0.08 - 0.11	2.4	49.83	118.84	61.76	36.6	39.2	16.57	44.93	52.27	43.83	10.25	66.13	47.6	42.43	40.95	48.45
MANGANESE	MG/KG	0.24 - 5.2	79.1	1287.75	865.50	7214.0	3425.0	3565.0	897.63	0.26 U	5020.0	3280.0	527.0	5160.0	2313.33	3888.33	3975.0	1385.0
MERCURY	MG/KG	0.04 - 0.05	0.05 U	0.22	0.18	0.28	0.19	0.2	0.08	0.18	0.16	0.16	0.06	0.23	0.2	0.18	0.17	0.48
NICKEL	MG/KG	0.08 - 0.25	3.6	35.1	26.45	54.48	49.02	56.15	13.8	38.57	42.07	38.1	8.07	46.67	41.82	49.35	47.35	59.95
SELENIUM	MG/KG	0.13 - 0.72	0.13 U	2.88	4.19	4.34	2.55	2.75	0.88	2.9	3.33	2.78	0.5	3.53	2.45	2.67	3.08	3.15
SILVER	MG/KG	0.15 - 15.9	0.16 U	0.76 U	2.24	0.52	0.28	0.69	0.16 U	0.16 U	0.6	0.17	0.16 U	0.16 U	0.18	0.58	0.38	0.16 U
THALLIUM	MG/KG	0.09 - 0.37	0.12 U	0.17	0.21	0.13	0.13	0.13	0.11	0.12	0.12	0.13	0.1 U	0.14	0.13	0.12	0.15	0.15
ZINC	MG/KG	0.17 - 0.79	17.6	201.75	273.48	304.6	197.25	217.5	77.07	207.67	248.33	208.5	44.73	294.33	207.5	207.33	209.75	238.0
SEM/AVS	RATIO	-	0.45	0.07	0.42	1.09	1.73	0.54	0.11	0.11	0.27	0.09	0.94	0.05	0.04	0.18	0.62	0.08

U = not detected in any sample within reach; value represents mean detection limit (DL). N = spiked sample not within control limits. B = value <RL but >IDL/MDL. E = estimated due to interference.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

TABLE 6-12 MEAN CONCENTRATIONS OF BUTYLTINS (UG/KG) IN SEDIMENT FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

ANALYTE	UNIT	DL (RANGE)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
		SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
		SAMPLE SIZE (N):	1	4	8	5	4	2	3	3	3	4	4	3	6	6	4	2
MONOBUTYLTIN	UG/KG	1.2 - 4.8	7.9 U	3.72 U	2.59 U	3.68 U	3.08 U	2.4 U	1.97 U	3.37 U	3.53 U	3.35 U	1.45 U	3.53 U	3.33 U	2.52 U	2.95 U	2.1 U
DIBUTYLTIN	UG/KG	1.6 - 6.2	7.1 U	4.85 U	3.34 U	4.82 U	4.05 U	3.1 U	2.53 U	**11.07**	4.6 U	4.4 U	1.9 U	4.63 U	4.32 U	3.28 U	3.85 U	**4.9**
TRIBUTYLTIN	UG/KG	1.9 - 7.1	**3.0 J**	5.65 U	3.86 U	5.6 U	4.67 U	3.55 U	2.93 U	5.07 U	5.3 U	5.05 U	**4.03**	5.37 U	4.98 U	3.75 U	4.42 U	3.15 U
TETRABUTLYTIN	UG/KG	2.1 - 8.1	5.6 U	6.38 U	4.38 U	6.3 U	5.3 U	4.0 U	3.33 U	5.73 U	6.03 U	5.72 U	2.5 U	6.03 U	5.65 U	4.28 U	5.03 U	3.55 U

U = not detected in any sample within reach; value represents mean detection limit (DL). J = value below lowest calibrator.

NOTE: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

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TABLE 6-13 CONCENTRATIONS OF DIOXIN AND FURAN CONGENERS (NG/KG) IN SEDIMENT COMPOSITES[a] FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND OCEAN REFERENCE SITE

			REACH ID:	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach	C&D Approach	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
			SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Core	Grab	Core	Core	Core	Grab	Grab	Core	Core	Core	Core
			SAMPLE SIZE (N):	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ANALYTE	**UNIT**	**DL (RANGE)**	**TEF**																
2,3,7,8-TCDD	NG/KG	0.09 - 1.97	1	0.1 U	0.46 U	**0.31 EMPC**	1.27 U	0.93 U	0.31 U	0.23 U	0.89 U	1.64 U	1.97 U	0.45 U	1.07 U	0.78 U	**0.89 J**	1.16 U	0.36 U
1,2,3,7,8-PECDD	NG/KG	0.08 - 0.66	0.5	0.06 U	0.43 U	**0.16 J**	0.54 U	0.35 U	0.17 U	**0.12 EMPC**	**0.86 J**	0.43 U	**0.94 J**	0.33 U	**1.07 EMPC**	0.24 U	**1.07 J**	0.29 U	**0.78 J**
1,2,3,4,7,8-HXCDD	NG/KG	0.1 - 1.73	0.1	0.12 U	0.33 U	**0.16 EMPC**	1.18 U	1.05 U	0.42 U	0.17 U	1.27 U	1.64 U	1.6 U	0.54 U	1.73 U	1.1 U	0.89 U	1.03 U	**0.69 J**
1,2,3,6,7,8-HXCDD	NG/KG	0.1 - 1.82	0.1	0.13 U	0.34 U	**0.52 J**	1.24 U	1.11 U	0.44 U	**0.5 J**	**1.59 J**	1.72 U	**1.99 J**	0.57 U	1.82 U	1.15 U	0.94 U	1.09 U	**0.93 J**
1,2,3,7,8,9-HXCDD	NG/KG	0.09 - 1.64	0.1	0.11 U	0.31 U	**0.51 EMPC**	1.12 U	0.99 U	0.4 U	**0.32 J**	**1.85 J**	1.55 U	**2.25 J**	0.51 U	1.64 U	1.04 U	0.84 U	0.97 U	**0.81 EMPC**
1,2,3,4,6,7,8-HPCDD	NG/KG	0.11 - 0.83	0.01	**0.83 J**	**6.95**	**7.15**	**6.77 J**	**6.86 J**	**3.19 J**	**7.72**	**23.8**	**13**	**33.1**	**7.49**	**12.2**	**8.21**	**8.61**	**4.78 J**	**5.8**
OCDD	NG/KG	0.23 - 6.4	0.001	**10.6**	**194**	**153**	**155**	**168**	**85.1**	**108**	**574**	**359**	**1040**	**174**	**279**	**227**	**167**	**143**	**112**
2,3,7,8-TCDF	NG/KG	0.07 - 0.95	0.1	0.1 U	0.49 U	**0.45 J**	0.65 U	0.56 U	0.29 U	**8.93**	0.9 U	0.74 U	**0.75 EMPC**	0.51 U	0.75 U	0.42 U	**1.14 J**	0.61 U	**1.7 J**
1,2,3,7,8-PECDF	NG/KG	0.06 - 0.61	0.05	0.04 U	0.31 U	**0.2 J**	0.4 U	0.26 U	0.16 U	**1.51 J**	**1.18 EMPC**	0.41 U	0.61 U	0.36 U	**1.24 J**	0.19 U	**1.13 J**	0.21 U	**2.32 J**
2,3,4,7,8-PECDF	NG/KG	0.05 - 0.59	0.5	**0.07 J**	0.3 U	**1.77 J**	0.39 U	0.25 U	0.16 U	**9.12**	**1.19 J**	0.4 U	**1.11 J**	0.35 U	**1.02 J**	**1.56 J**	**1.06 J**	0.21 U	**4.45 J**
1,2,3,4,7,8-HXCDF	NG/KG	0.09 - 0.67	0.1	0.08 U	0.32 U	**0.77 J**	**0.48 J**	0.44 U	0.27 U	**3.88**	**1.11 J**	0.52 U	**0.99 J**	**0.32 EMPC**	**1.09 J**	**0.65 J**	**0.8 EMPC**	0.37 U	**3.18 EMPC**
1,2,3,6,7,8-HXCDF	NG/KG	0.09 - 0.64	0.1	0.08 U	0.31 U	**0.37 J**	**0.37 EMPC**	0.42 U	0.25 U	**0.68 J**	**0.84 J**	0.5 U	**0.63 EMPC**	0.29 U	0.64 U	**0.35 J**	**0.73 EMPC**	0.35 U	**2.63 EMPC**
2,3,4,6,7,8-HXCDF	NG/KG	0.1 - 0.71	0.1	0.09 U	0.34 U	**0.51 J**	0.44 U	0.47 U	0.28 U	**1.15 J**	**0.8 J**	0.55 U	0.67 U	0.33 U	0.71 U	0.43 U	0.46 U	0.39 U	**2.78 J**
1,2,3,7,8,9-HXCDF	NG/KG	0.11 - 0.78	0.1	0.1 U	0.38 U	**0.13 J**	0.48 U	0.52 U	0.31 U	**0.19 EMPC**	0.59 U	0.61 U	0.74 U	0.36 U	0.78 U	0.47 U	0.51 U	0.43 U	0.55 U
1,2,3,4,6,7,8-HPCDF	NG/KG	0.07 - 0.58	0.01	**0.17 B**	**0.95 J**	**1.94 J**	**1.02 J**	**1.12 J**	**0.59 J**	**2.3 J**	**2.85 J**	**1.88 J**	**3.61 J**	**1.02 J**	**1.73 J**	**1.67 J**	**1.01 J**	**0.64 J**	**9.02**
1,2,3,4,7,8,9-HPCDF	NG/KG	0.09 - 0.71	0.01	0.08 U	0.42 U	**0.24 J**	0.56 U	0.58 U	0.21 U	**0.87 J**	0.66 U	0.65 U	0.71 U	0.5 U	0.69 U	0.3 U	0.52 U	0.31 U	**0.61 EMPC**
OCDF	NG/KG	0.22 - 1.42	0.001	**0.16 J**	**1.9 B**	**3.35 J**	**3.35 J**	**2.56 J**	**1.14 B**	**5.15 J**	**7.51 J**	**6.18 J**	**8.76 J**	**3.23 J**	**5.62 J**	**3.4 J**	**2.36 J**	**1.7 J**	**3.13 J**
DIOXINS TEQ (ND=0)	NG/KG	-	0	**0.05**	**0.27**	**1.50**	**0.28**	**0.25**	**0.12**	**6.40**	**2.49**	**0.51**	**2.96**	**0.26**	**1.10**	**1.21**	**2.39**	**0.20**	**3.60**
DIOXINS TEQ (ND=1/2DL)	NG/KG	-	0	**0.16**	**0.84**	**1.50**	**1.42**	**1.15**	**0.50**	**6.53**	**3.08**	**1.95**	**4.12**	**0.82**	**2.05**	**1.90**	**2.58**	**1.17**	**3.81**
DIOXINS TEQ (ND=DL)	NG/KG	-	0	**0.27**	**1.40**	**1.50**	**2.56**	**2.06**	**0.87**	**6.65**	**3.66**	**3.38**	**5.27**	**1.39**	**2.99**	**2.58**	**2.76**	**2.15**	**4.02**

U = not detected. J = estimated value; value less than lower method calibration limit. EMPC = estimated maximum possible concentration. B= detected in laboratory blank

(a) = one composite sample from each sampling reach submitted for dioxin/furan testing.

DL = detection limit.

TEF = Toxicity Equivalency Factor.

TEQ = Toxicity Equivalency Quotient.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 6-14 MEAN CONCENTRATIONS OF ANALYTES EXCEEDING TELs (1999)

ANALYTE	UNIT	TEL VALUE	Ocean Reference	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ARSENIC	MG/KG	7.24		32.0	14.33	16.76	10.9	11.1		13.7	16.53	14.53		17.57	12.72	11.3	12.58	14.55
CADMIUM	MG/KG	0.676		1.33				0.77			0.74					0.77		
CHROMIUM	MG/KG	52.3		83.95										59.7				
COPPER	MG/KG	18.7		99.5	38.55	43.18	35.15	35.8		35.23	39.1	38.25		45.9	39.5	38.0	35.93	54.85
LEAD	MG/KG	30.24		118.84	49.83	61.76	36.6	39.2		44.93	52.27	43.83		66.13	47.6	42.43	40.95	48.45
MERCURY	MG/KG	0.13		0.18	0.22	0.28	0.19	0.2		0.18	0.16	0.16		0.23	0.21	0.18	0.17	0.48
NICKEL	MG/KG	15.9		26.45	35.1	54.48	49.03	56.15		38.57	42.1	38.1		46.67	41.82	49.35	47.35	59.95
SILVER	MG/KG	0.73		2.24	0.76													
ZINC	MG/KG	124		273.48	201.75	304.6	197.25	217.5		207.67	248.33	208.5		294.33	207.5	207.33	209.75	238.0
ACENAPHTHENE	UG/KG	6.71		290.38	196.75	52.8	67.75	13.0	19.2	38.0	28.0	64.5	24.75	41.0	48.67	114.67	82.25	265.0
ACENAPHTHYLENE	UG/KG	5.87		28.88	51.75	36.0	38.0	22.0	23.67	32.33	34.33	34.0	20.0	36.67	35.17	54.17	41.5	220.0
ANTHRACENE	UG/KG	46.85		67.58	52.6													155.0
BENZ[A]ANTHRACENE	UG/KG	74.83			98.3													90.5
BENZO[A]PYRENE	UG/KG	88.81			117.43													110.0
CHRYSENE	UG/KG	107.77																
DIBENZ[A,H]ANTHRACENE	UG/KG	6.22		9.63		7.7	6.33											7.55
FLUORANTHENE	UG/KG	112.82		225.0	263.5		124.25									137.83		395.0
FLUORENE	UG/KG	21.17		65.2	39.4	27.82	40.25					25.25			21.37	46.17	33.2	175.0
NAPHTHALENE	UG/KG	34.57		237.63	153.0	106.4	121.0			66.0	70.0	94.75	39.5	76.0	99.17	188.17	134.5	625.0
PHENANTHRENE	UG/KG	86.68		203.15	152.0		105.75									120.0		445.0
PYRENE	UG/KG	152.66		202.58	171.75													335.0
TOTAL PAH (ND=0)	UG/KG	1684.06		1699.90														3294.55
TOTAL PAH (ND=1/2)	UG/KG	1684.06		1714.19														3294.55
TOTAL PAH (ND=DL)	UG/KG	1684.06		1728.49	1699.53													3294.55
4,4'-DDD	UG/KG	1.22																
4,4'-DDE	UG/KG	2.07																
4,4'-DDT	UG/KG	1.19												1.22U				
CHLORDANE	UG/KG	2.26			2.83U	2.94U				2.6U	2.8U	2.78U		3.0U	2.55U			
DIELDRIN	UG/KG	0.715			0.76U	0.78U					0.75U	0.74U		0.80U				
GAMMA-BHC	UG/KG	0.32	0.45U	0.63U	0.79U	0.82U	0.61U	0.50U	0.53U	0.73U	0.78U	0.77U	0.45U	0.84U	0.71U	0.59U	0.62U	0.52U
TOTAL PCB (ND=0)	UG/KG	21.55						22.34										
TOTAL PCB (ND=1/2DL)	UG/KG	21.55						22.44										
TOTAL PCB (ND=DL)	UG/KG	21.55						22.55										
2-METHYLNAPHTHALENE	UG/KG	20.21		346.38	178.25	61.2	86.25			27.33	29.0	59.5	23.25	32.0	54.67	135.67	84.5	490.0
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	182.16																

U = not detected; mean detection limit exceed TEL value

Blank cells indicate that the mean concentration in the sediment was less than the TEL.

TABLE 6-15 MEAN CONCENTRATIONS OF ANALYTES EXCEEDING PELs (1999)

ANALYTE	UNIT	PEL VALUE	Ocean Reference	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Entrance	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ARSENIC	MG/KG	41.6																
CADMIUM	MG/KG	4.21																
CHROMIUM	MG/KG	160.4																
COPPER	MG/KG	108.2																
LEAD	MG/KG	112.18		118.84														
MERCURY	MG/KG	0.696																
NICKEL	MG/KG	42.8				54.48	49.03	56.15						46.67		49.35	47.35	59.95
SILVER	MG/KG	1.7		2.24														
ZINC	MG/KG	271		273.48		304.6								294.33				
ACENAPHTHENE	UG/KG	88.9		290.38	196.75											114.67		265.0
ACENAPHTHYLENE	UG/KG	127.87																220.0
ANTHRACENE	UG/KG	245																
BENZ[A]ANTHRACENE	UG/KG	692.53																
BENZO[A]PYRENE	UG/KG	763.22																
CHRYSENE	UG/KG	845.98																
DIBENZ[A,H]ANTHRACENE	UG/KG	134.61																
FLUORANTHENE	UG/KG	1493.54																
FLUORENE	UG/KG	144.36																175.0
NAPHTHALENE	UG/KG	390.64																625.0
PHENANTHRENE	UG/KG	543.53																
PYRENE	UG/KG	1397.6																
TOTAL PAH (ND=0)	UG/KG	16770.4																
TOTAL PAH (ND=1/2DL)	UG/KG	16770.4																
TOTAL PAH (ND=DL)	UG/KG	16770.4																
4,4'-DDD	UG/KG	7.81																
4,4'-DDE	UG/KG	374.17																
4,4'-DDT	UG/KG	4.77																
CHLORDANE	UG/KG	4.79																
DIELDRIN	UG/KG	4.3																
GAMMA-BHC	UG/KG	0.99																
TOTAL PCB (ND=0)	UG/KG	188.79																
TOTAL PCB (ND=1/2DL)	UG/KG	188.79																
TOTAL PCB (ND=DL)	UG/KG	188.79																
2-METHYLNAPHTHALENE	UG/KG	201.28		346.38														490.0
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2646.551																

Blank cells indicate that the mean concentration in the sediment was less than the PEL.

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TABLE 6-16 FREQUENCY OF DETECTION BY ANALYTICAL FRACTION FOR EACH APPROACH CHANNEL

ANALYTICAL FRACTION	Brewerton Channel Eastern Extension	C&D Approach (grabs)	C&D Approach (cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Staightening
VOCs	5/140	4/140	0/70	4/105	2/105	0/105	0/140	2/105	2/105	2/210	0/210	1/140	1/70
SVOCs	17/135	13/188	8/94	4/141	13/141	13/141	18/188	6/188	6/141	20/282	23/282	14/188	9/94
Pesticides	0/110	0/88	4/44	0/66	0/66	1/66	0/88	0/88	0/66	0/132	2/132	6/88	3/44
Organophosphorus Pesticides	0/25	0/20	0/10	0/15	0/15	0/15	0/20	0/20	0/15	0/30	0/30	0/20	0/10
PCB Aroclors	0/35	0/28	0/14	0/21	0/21	0/21	0/28	0/28	0/21	0/42	0/42	0/28	0/14
PCB Congeners	71/130	38/104	50/52	10/78	42/78	17/78	72/104	48/104	30/78	38/156	119/156	79/104	40/52
PAHs	69/80	63/64	28/32	40/48	42/48	40/48	56/64	57/64	43/48	81/96	88/96	57/64	32/32
Metals	79/80	63/64	31/32	38/48	41/48	46/48	61/64	50/64	44/48	93/96	92/96	63/64	30/32
Butyltins	0/20	0/16	0/8	0/12	1/12	0/12	0/16	2/16	0/12	0/24	0/24	0/16	1/8
Dioxin and Furan Congeners	6/17	4/17	4/17	15/17	12/17	4/17	11/17	5/17	8/17	7/17	11/17	4/17	15/17

TABLE 6-17 FREQUENCY OF DETECTION [a] BY ANALYTICAL FRACTION FOR SEDIMENTS FROM BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND THE OCEAN REFERENCE SITE

	FREQUENCY OF DETECT				PERCENT DETECT			
ANALYTICAL FRACTION	Approach Channels [b]	Inside Site 104	Outside Site 104	Ocean Reference	Approach Channels [b]	Inside Site 104	Outside Site 104	Ocean Reference
VOCs	23/1,540	8/175	5/140	0/35	1.5	4.6	3.6	0.0
SVOCs	164/2,350	23/376	18/188	0/47	7.0	6.1	9.6	0.0
Chlorinated Pesticides	16/1100	8/176	3/88	0/22	1.5	4.5	3.4	0.0
Organophosphorus Pesticides	0/250	0/40	0/20	0/5	0.0	0.0	0.0	0.0
PCB Aroclors	0/350	2/56	0/28	0/7	0.0	3.6	0.0	0.0
PCB Congeners	654/1,350	110/208	33/104	1/26	48.4	53.0	31.7	3.8
PAHs	696/800	116/128	55/64	0/16	87.0	90.6	85.9	0.0
Metals	731/800	118/128	58/64	10/16	91.4	92.2	90.6	62.5
Butyltins	4/200	0/32	0/16	1/4	2.0	0.0	0.0	25.0
Dioxin and Furan Congeners	106/221	17/17	4/17	5/17	48.0	100.0	23.5	29.4

(a) = total number of detected analytes / total number of analytical tests.

(b) = combined total for all approach channels.

TABLE 6-18A THEORETICAL BIOACCUMULATION POTENTIAL* FOR CHLORINATED PESTICIDES, ORGANOPHOSPHORUS PESTICIDES, AND PCB AROCLORS IN TISSUE: COMPARISON TO INSIDE SITE 104

Analyte (UG/KG)	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	7.2	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
4,4'-DDD	ND	ND	ND	**0.7**	ND	ND	**0.6**	ND	ND	ND	ND	ND	**0.8**	**0.3**
4,4'-DDE	1.1	ND	ND	0.9	ND	ND	ND	ND	ND	ND	ND	0.6	0.8	0.3
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALDRIN	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALPHA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BETA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DELTA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN II	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GAMMA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AZINPHOS METHYL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DEMETON	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYL PARATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MALATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHYL PARATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	7.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	12.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Tables 6-6 (Chlorinated Pesticides), 6-7 (Organophosphorus Pesticides), and 6-8 (PCB Aroclors).
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Inside Site 104 value.

TABLE 6-18B THEORETICAL BIOACCUMULATION POTENTIAL* FOR CHLORINATED PESTICIDES, ORGANOPHOSPHORUS PESTICIDES, AND PCB AROCLORS IN TISSUE: COMPARISON TO OUTSIDE SITE 104

Analyte (UG/KG)	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	11.4	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
4,4'-DDD	ND	ND	ND	**0.7**	ND	ND	**0.6**	ND	ND	ND	ND	ND	**0.8**	**0.3**
4,4'-DDE	ND	ND	ND	**0.9**	ND	ND	ND	ND	ND	ND	ND	**0.6**	**0.8**	**0.3**
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALPHA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BETA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DELTA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GAMMA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	2.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AZINPHOS METHYL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DEMETON	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYL PARATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MALATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHYL PARATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Tables 6-6 (Chlorinated Pesticides), 6-7 (Organophosphorus Pesticides), and 6-8 (PCB Aroclors).
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Outside Site 104 value.

TABLE 6-18C THEORETICAL BIOACCUMULATION POTENTIAL* FOR CHLORINATED PESTICIDES, ORGANOPHOSPHORUS PESTICIDES, AND PCB AROCLORS IN TISSUE: COMPARISON TO OCEAN REFERENCE

Analyte (UG/KG)	Ocean	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	0.5	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
4,4'-DDD	ND	ND	ND	**0.7**	ND	ND	**0.6**	ND	ND	ND	ND	ND	**0.8**	**0.3**
4,4'-DDE	ND	ND	ND	**0.9**	ND	ND	ND	ND	ND	ND	ND	**0.6**	**0.8**	**0.3**
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALPHA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BETA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DELTA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GAMMA-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.8**
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AZINPHOS METHYL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DEMETON	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYL PARATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MALATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHYL PARATHION	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Tables 6-6 (Chlorinated Pesticides), 6-7 (Organophosphorus Pesticides), and 6-8 (PCB Aroclors).
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Ocean Reference value.

TABLE 6-19A THEORETICAL BIOACCUMULATION POTENTIAL* FOR PCB CONGENERS IN TISSUE: COMPARISON TO INSIDE SITE 104

Analyte (UG/KG)	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	7.2	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
BZ# 8	0.18	**0.18**	0.13	**0.46**	**0.35**	**0.38**	**0.25**	**0.40**	**0.35**	ND	**0.24**	**0.36**	**0.35**	0.17
BZ# 18	0.26	0.17	0.18	**0.31**	ND	0.23	0.23	**0.41**	ND	ND	0.24	**0.28**	0.24	0.16
BZ# 28	0.20	**0.27**	0.15	**0.50**	ND	**0.27**	0.12	**0.34**	**0.23**	0.15	0.12	**0.30**	**0.36**	0.16
BZ# 44	0.30	0.22	0.18	**0.36**	ND	0.23	ND	0.29	**0.35**	ND	ND	0.24	0.25	0.13
BZ# 49	0.41	0.30	0.23	0.28	ND	0.23	ND	0.34	**0.46**	ND	ND	0.27	0.24	0.14
BZ# 52	0.42	0.39	0.23	**0.45**	ND	0.14	ND	0.26	0.35	ND	ND	0.28	0.20	0.10
BZ# 66	0.26	0.21	0.19	**0.58**	ND	0.15	0.13	**0.29**	**0.29**	0.23	0.09	0.26	**0.31**	0.17
BZ# 77	1.60	0.15	0.46	1.56	0.35	0.12	ND	1.20	1.13	0.48	0.15	0.35	0.73	0.45
BZ# 87	0.23	0.09	0.09	**0.26**	ND	ND	ND	0.14	**0.26**	0.09	ND	0.09	0.10	0.07
BZ# 101	0.72	0.26	0.25	**0.94**	0.29	0.20	0.13	0.67	**0.78**	0.19	0.11	0.39	0.46	0.32
BZ# 105	0.33	ND	0.22	0.26	ND	ND	ND	ND	**0.52**	ND	ND	ND	ND	ND
BZ# 118	0.55	0.21	0.23	**0.66**	0.21	0.12	0.12	0.39	**0.58**	0.22	0.10	0.20	0.35	0.14
BZ# 126	1.13	0.11	0.11	0.37	ND	0.06	0.09	0.17	0.15	0.10	0.08	0.15	0.18	0.05
BZ# 128	0.32	0.07	0.09	0.22	ND	ND	ND	0.18	0.20	ND	ND	0.08	0.10	0.05
BZ# 138	0.99	0.24	0.23	0.89	0.16	0.12	0.08	**1.03**	0.61	0.21	0.10	0.28	0.38	0.35
BZ# 153	1.53	0.30	0.29	1.18	0.19	0.21	0.11	1.50	0.67	0.33	0.08	0.38	0.55	0.39
BZ# 156	0.50	ND	0.13	0.27	ND	ND	ND	0.37	ND	ND	ND	0.11	0.12	0.10
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 170	0.46	0.12	0.14	0.40	ND	0.10	ND	**0.66**	0.23	ND	ND	0.16	0.16	0.15
BZ# 180	1.29	0.25	0.25	0.88	ND	0.15	0.14	**1.48**	0.29	0.19	ND	0.32	0.39	0.29
BZ# 183	0.32	ND	0.08	0.18	ND	ND	ND	**0.43**	ND	ND	ND	ND	0.08	0.07
BZ# 184	0.75	0.35	0.35	**1.33**	0.19	0.22	0.13	**2.14**	0.49	0.39	0.11	0.42	0.65	0.30
BZ# 187	1.05	0.15	0.17	0.57	ND	0.10	0.11	0.83	0.20	0.13	0.09	0.22	0.28	0.17
BZ# 195	0.18	ND	0.11	0.09	ND	ND	ND	**0.25**	ND	ND	ND	ND	ND	ND
BZ# 206	0.70	0.39	0.49	**1.99**	ND	0.23	0.24	0.40	0.46	0.35	0.27	0.60	**0.78**	0.62
BZ# 209	1.05	0.68	0.72	**3.60**	0.56	0.41	0.34	0.70	0.81	0.66	0.43	0.97	**1.28**	0.87
TOTAL PCBs (ND=0)	21.02	5.56	4.92	**21.18**	1.71	4.40	1.89	19.47	10.29	3.88	1.82	8.32	10.17	6.36
TOTAL PCBs (ND=1/2 DL)	22.22	6.46	6.04	21.27	5.46	5.19	3.45	20.33	12.54	5.69	3.32	8.77	10.69	6.62
TOTAL PCBs (ND=DL)	23.43	7.36	7.16	21.37	9.21	5.98	5.00	21.19	14.79	7.50	4.83	9.22	11.22	6.88

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Table 6-9.
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Inside Site 104 value.

TABLE 6-19B THEORETICAL BIOACCUMULATION POTENTIAL* FOR PCB CONGENERS IN TISSUE: COMPARISON TO OUTSIDE SITE 104

Analyte (UG/KG)	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	11.4	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
BZ# 8	0.18	0.18	0.13	0.46	0.35	0.38	0.25	0.40	0.35	ND	0.24	0.36	0.35	0.17
BZ# 18	ND	0.17	0.18	0.31	ND	0.23	0.23	0.41	ND	ND	0.24	0.28	0.24	0.16
BZ# 28	ND	0.27	0.15	0.50	ND	0.27	0.12	0.34	0.23	0.15	0.12	0.30	0.36	0.16
BZ# 44	0.14	0.22	0.18	0.36	ND	0.23	ND	0.29	0.35	ND	ND	0.24	0.25	0.13
BZ# 49	0.21	0.30	0.23	0.28	ND	0.23	ND	0.34	0.46	ND	ND	0.27	0.24	0.14
BZ# 52	0.15	0.39	0.23	0.45	ND	0.14	ND	0.26	0.35	ND	ND	0.28	0.20	0.10
BZ# 66	0.09	0.21	0.19	0.58	ND	0.15	0.13	0.29	0.29	0.23	0.09	0.26	0.31	0.17
BZ# 77	0.13	0.15	0.46	1.56	0.35	0.12	ND	1.20	1.13	0.48	0.15	0.35	0.73	0.45
BZ# 87	ND	0.09	0.09	0.26	ND	ND	ND	0.14	0.26	0.09	ND	0.09	0.10	0.07
BZ# 101	0.13	0.26	0.25	0.94	0.29	0.20	0.13	0.67	0.78	0.19	0.11	0.39	0.46	0.32
BZ# 105	ND	ND	0.22	0.26	ND	ND	ND	ND	0.52	ND	ND	ND	ND	ND
BZ# 118	0.11	0.21	0.23	0.66	0.21	0.12	0.12	0.39	0.58	0.22	0.10	0.20	0.35	0.14
BZ# 126	0.17	0.11	0.11	0.37	ND	0.06	0.09	0.17	0.15	0.10	0.08	0.15	0.18	0.05
BZ# 128	0.06	0.07	0.09	0.22	ND	ND	ND	0.18	0.20	ND	ND	0.08	0.10	0.05
BZ# 138	0.08	0.24	0.23	0.89	0.16	0.12	0.08	1.03	0.61	0.21	0.10	0.28	0.38	0.35
BZ# 153	0.15	0.30	0.29	1.18	0.19	0.21	0.11	1.50	0.67	0.33	0.08	0.38	0.55	0.39
BZ# 156	ND	ND	0.13	0.27	ND	ND	ND	0.37	ND	ND	ND	0.11	0.12	0.10
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 170	0.10	0.12	0.14	0.40	ND	0.10	ND	0.66	0.23	ND	ND	0.16	0.16	0.15
BZ# 180	0.13	0.25	0.25	0.88	ND	0.15	0.14	1.48	0.29	0.19	ND	0.32	0.39	0.29
BZ# 183	ND	ND	0.08	0.18	ND	ND	ND	0.43	ND	ND	ND	ND	0.08	0.07
BZ# 184	0.19	0.35	0.35	1.33	0.19	0.22	0.13	2.14	0.49	0.39	0.11	0.42	0.65	0.30
BZ# 187	0.12	0.15	0.17	0.57	ND	0.10	0.11	0.83	0.20	0.13	0.09	0.22	0.28	0.17
BZ# 195	ND	ND	0.11	0.09	ND	ND	ND	0.25	ND	ND	ND	ND	ND	ND
BZ# 206	0.45	0.39	0.49	1.99	ND	0.23	0.24	0.40	0.46	0.35	0.27	0.60	0.78	0.62
BZ# 209	0.84	0.68	0.72	3.60	0.56	0.41	0.34	0.70	0.81	0.66	0.43	0.97	1.28	0.87
TOTAL PCBs (ND=0)	1.94	5.56	4.92	21.18	1.71	4.40	1.89	19.47	10.29	3.88	1.82	8.32	10.17	6.36
TOTAL PCBs (ND=1/2 DL)	3.19	6.46	6.04	21.27	5.46	5.19	3.45	20.33	12.54	5.69	3.32	8.77	10.69	6.62
TOTAL PCBs (ND=DL)	4.44	7.36	7.16	21.37	9.21	5.98	5.00	21.19	14.79	7.50	4.83	9.22	11.22	6.88

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Table 6-9.
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Outside Site 104 value.

TABLE 6-19C THEORETICAL BIOACCUMULATION POTENTIAL* FOR PCB CONGENERS IN TISSUE: COMPARISON TO OCEAN REFERENCE

Analyte (UG/KG)	Ocean	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	0.5	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
BZ# 8	3.02	0.18	0.13	0.46	0.35	0.38	0.25	0.40	0.35	ND	0.24	0.36	0.35	0.17
BZ# 18	ND	0.17	0.18	0.31	ND	0.23	0.23	0.41	ND	ND	0.24	0.28	0.24	0.16
BZ# 28	ND	0.27	0.15	0.50	ND	0.27	0.12	0.34	0.23	0.15	0.12	0.30	0.36	0.16
BZ# 44	ND	0.22	0.18	0.36	ND	0.23	ND	0.29	0.35	ND	ND	0.24	0.25	0.13
BZ# 49	ND	0.30	0.23	0.28	ND	0.23	ND	0.34	0.46	ND	ND	0.27	0.24	0.14
BZ# 52	ND	0.39	0.23	0.45	ND	0.14	ND	0.26	0.35	ND	ND	0.28	0.20	0.10
BZ# 66	ND	0.21	0.19	0.58	ND	0.15	0.13	0.29	0.29	0.23	0.09	0.26	0.31	0.17
BZ# 77	ND	0.15	0.46	1.56	0.35	0.12	ND	1.20	1.13	0.48	0.15	0.35	0.73	0.45
BZ# 87	ND	0.09	0.09	0.26	ND	ND	ND	0.14	0.26	0.09	ND	0.09	0.10	0.07
BZ# 101	ND	0.26	0.25	0.94	0.29	0.20	0.13	0.67	0.78	0.19	0.11	0.39	0.46	0.32
BZ# 105	ND	ND	0.22	0.26	ND	ND	ND	ND	0.52	ND	ND	ND	ND	ND
BZ# 118	ND	0.21	0.23	0.66	0.21	0.12	0.12	0.39	0.58	0.22	0.10	0.20	0.35	0.14
BZ# 126	ND	0.11	0.11	0.37	ND	0.06	0.09	0.17	0.15	0.10	0.08	0.15	0.18	0.05
BZ# 128	ND	0.07	0.09	0.22	ND	ND	ND	0.18	0.20	ND	ND	0.08	0.10	0.05
BZ# 138	ND	0.24	0.23	0.89	0.16	0.12	0.08	1.03	0.61	0.21	0.10	0.28	0.38	0.35
BZ# 153	ND	0.30	0.29	1.18	0.19	0.21	0.11	1.50	0.67	0.33	0.08	0.38	0.55	0.39
BZ# 156	ND	ND	0.13	0.27	ND	ND	ND	0.37	ND	ND	ND	0.11	0.12	0.10
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 170	ND	0.12	0.14	0.40	ND	0.10	ND	0.66	0.23	ND	ND	0.16	0.16	0.15
BZ# 180	ND	0.25	0.25	0.88	ND	0.15	0.14	1.48	0.29	0.19	ND	0.32	0.39	0.29
BZ# 183	ND	ND	0.08	0.18	ND	ND	ND	0.43	ND	ND	ND	ND	0.08	0.07
BZ# 184	ND	0.35	0.35	1.33	0.19	0.22	0.13	2.14	0.49	0.39	0.11	0.42	0.65	0.30
BZ# 187	ND	0.15	0.17	0.57	ND	0.10	0.11	0.83	0.20	0.13	0.09	0.22	0.28	0.17
BZ# 195	ND	ND	0.11	0.09	ND	ND	ND	0.25	ND	ND	ND	ND	ND	ND
BZ# 206	ND	0.39	0.49	1.99	ND	0.23	0.24	0.40	0.46	0.35	0.27	0.60	0.78	0.62
BZ# 209	ND	0.68	0.72	3.60	0.56	0.41	0.34	0.70	0.81	0.66	0.43	0.97	1.28	0.87
TOTAL PCBs (ND=0)	6.04	5.56	4.92	21.18	1.71	4.40	1.89	19.47	10.29	3.88	1.82	8.32	10.17	6.36
TOTAL PCBs (ND=1/2 DL)	24.30	6.46	6.04	21.27	5.46	5.19	3.45	20.33	12.54	5.69	3.32	8.77	10.69	6.62
TOTAL PCBs (ND=DL)	42.57	7.36	7.16	21.37	9.21	5.98	5.00	21.19	14.79	7.50	4.83	9.22	11.22	6.88

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Table 6-9.
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Ocean Reference value.

TABLE 6-20A THEORETICAL BIOACCUMULATION POTENTIAL* FOR PAHs IN TISSUE: COMPARISON TO INSIDE SITE 104

Analyte (UG/KG)	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	7.2	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
ACENAPHTHENE	321.6	40.10	57.25	12.32	51.20	29.68	23.46	69.73	71.92	41.31	44.84	106.67	73.39	158.60
ACENAPHTHYLENE	32.0	ND	**32.11**	ND	ND	ND	ND	ND	ND	ND	**32.40**	**50.39**	**37.03**	**131.67**
ANTHRACENE	74.9	18.84	26.40	1.90	18.75	10.00	9.22	27.84	29.44	15.28	19.05	39.97	27.44	**92.77**
BENZ[A]ANTHRACENE	68.6	19.46	28.73	5.02	22.94	10.93	10.73	25.38	41.41	22.77	14.05	34.11	23.44	54.16
BENZO[A]PYRENE	88.8	31.85	47.74	6.64	42.22	13.54	14.72	25.41	79.19	46.68	17.63	44.03	31.72	65.84
BENZO[B]FLUORANTHENE	103.2	34.24	71.19	8.44	50.94	24.21	16.28	45.68	77.01	36.27	41.65	102.95	80.57	**137.66**
BENZO[G,H,I]PERYLENE	55.6	23.07	32.32	4.45	32.46	10.78	14.66	22.70	53.76	32.57	12.44	33.33	22.48	41.30
BENZO[K]FLUORANTHENE	46.5	12.35	24.50	2.37	17.87	6.48	6.64	15.68	29.58	16.93	9.69	24.03	16.08	30.82
CHRYSENE	44.9	19.56	31.69	5.59	21.79	9.45	8.86	22.36	35.80	19.82	13.24	33.65	21.88	43.99
DIBENZ[A,H]ANTHRACENE	10.7	5.85	5.34	ND	ND	ND	ND	ND	10.32	6.38	ND	5.40	4.64	4.52
FLUORANTHENE	249.2	71.70	104.99	10.71	64.35	35.93	34.08	94.05	103.16	50.71	56.97	128.21	92.13	236.41
FLUORENE	72.2	21.13	34.01	2.84	21.68	9.71	9.97	27.30	35.16	15.39	19.69	42.95	29.62	**104.74**
INDENO[1,2,3-CD]PYRENE	33.9	17.51	23.02	3.36	11.65	8.49	6.81	16.56	**34.29**	20.12	9.21	23.88	16.77	28.43
NAPHTHALENE	263.2	80.81	102.24	13.74	79.55	51.55	58.65	102.43	114.78	76.57	91.37	175.04	120.01	**374.06**
PHENANTHRENE	225.0	52.91	89.35	6.59	50.14	26.30	25.70	69.46	83.55	38.62	50.51	111.63	75.96	**266.33**
PYRENE	224.4	65.51	98.23	10.90	64.27	29.94	30.44	74.86	111.88	56.09	45.03	108.68	76.51	200.50
TOTAL PAHs (ND=0)	1882.97	506.25	803.61	94.88	540.31	276.99	269.11	639.43	903.81	491.35	449.06	1045.50	729.53	**1971.80**
TOTAL PAHs (ND=1/2 DL)	1898.80	524.24	806.36	107.09	582.00	291.78	286.53	660.97	936.58	511.91	465.89	1055.20	739.61	**1971.80**
TOTAL PAHs (ND=DL)	1914.63	542.23	809.10	119.29	623.70	306.57	303.94	682.51	969.34	532.46	482.72	1064.90	749.68	**1971.80**

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Table 6-10.
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Inside Site 104 value.

TABLE 6-20B THEORETICAL BIOACCUMULATION POTENTIAL* FOR PAHs IN TISSUE: COMPARISON TO OUTSIDE SITE 104

Analyte (UG/KG)	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	11.4	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
ACENAPHTHENE	137.5	40.10	57.25	12.32	51.20	29.68	23.46	69.73	71.92	41.31	44.84	106.67	73.39	**158.60**
ACENAPHTHYLENE	36.2	ND	32.11	ND	ND	ND	ND	ND	ND	ND	32.40	**50.39**	**37.03**	**131.67**
ANTHRACENE	36.8	18.84	26.40	1.90	18.75	10.00	9.22	27.84	29.44	15.28	19.05	**39.97**	27.44	**92.77**
BENZ[A]ANTHRACENE	68.7	19.46	28.73	5.02	22.94	10.93	10.73	25.38	41.41	22.77	14.05	34.11	23.44	54.16
BENZO[A]PYRENE	82.1	31.85	47.74	6.64	42.22	13.54	14.72	25.41	79.19	46.68	17.63	44.03	31.72	65.84
BENZO[B]FLUORANTHENE	87.0	34.24	71.19	8.44	50.94	24.21	16.28	45.68	77.01	36.27	41.65	**102.95**	80.57	**137.66**
BENZO[G,H,I]PERYLENE	57.0	23.07	32.32	4.45	32.46	10.78	14.66	22.70	53.76	32.57	12.44	33.33	22.48	41.30
BENZO[K]FLUORANTHENE	38.1	12.35	24.50	2.37	17.87	6.48	6.64	15.68	29.58	16.93	9.69	24.03	16.08	30.82
CHRYSENE	56.4	19.56	31.69	5.59	21.79	9.45	8.86	22.36	35.80	19.82	13.24	33.65	21.88	43.99
DIBENZ[A,H]ANTHRACENE	ND	**5.85**	**5.34**	ND	ND	ND	ND	ND	**10.32**	**6.38**	ND	**5.40**	**4.64**	**4.52**
FLUORANTHENE	184.1	71.70	104.99	10.71	64.35	35.93	34.08	94.05	103.16	50.71	56.97	128.21	92.13	**236.41**
FLUORENE	27.5	21.13	**34.01**	2.84	21.68	9.71	9.97	27.30	**35.16**	15.39	19.69	**42.95**	**29.62**	**104.74**
INDENO[1,2,3-CD]PYRENE	39.0	17.51	23.02	3.36	11.65	8.49	6.81	16.56	34.29	20.12	9.21	23.88	16.77	28.43
NAPHTHALENE	106.9	80.81	102.24	13.74	79.55	51.55	58.65	102.43	**114.78**	76.57	91.37	**175.04**	**120.01**	**374.06**
PHENANTHRENE	106.2	52.91	89.35	6.59	50.14	26.30	25.70	69.46	83.55	38.62	50.51	**111.63**	75.96	**266.33**
PYRENE	120.0	65.51	98.23	10.90	64.27	29.94	30.44	74.86	111.88	56.09	45.03	108.68	76.51	**200.50**
TOTAL PAHs (ND=0)	1159.91	506.25	803.61	94.88	540.31	276.99	269.11	639.43	903.81	491.35	449.06	1045.50	729.53	**1971.80**
TOTAL PAHs (ND=1/2 DL)	1173.78	524.24	806.36	107.09	582.00	291.78	286.53	660.97	936.58	511.91	465.89	1055.20	739.61	**1971.80**
TOTAL PAHs (ND=DL)	1187.65	542.23	809.10	119.29	623.70	306.57	303.94	682.51	969.34	532.46	482.72	1064.90	749.68	**1971.80**

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Table 6-10.
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Outside Site 104 value.

TABLE 6-20C THEORETICAL BIOACCUMULATION POTENTIAL* FOR PAHs IN TISSUE: COMPARISON TO OCEAN REFERENCE

Analyte (UG/KG)	Ocean	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
Mean % TOC	0.5	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
ACENAPHTHENE	ND	**40.10**	**57.25**	**12.32**	**51.20**	**29.68**	**23.46**	**69.73**	**71.92**	**41.31**	**44.84**	**106.67**	**73.39**	**158.60**
ACENAPHTHYLENE	ND	ND	**32.11**	ND	ND	ND	ND	ND	ND	ND	**32.40**	**50.39**	**37.03**	**131.67**
ANTHRACENE	ND	**18.84**	**26.40**	**1.90**	**18.75**	**10.00**	**9.22**	**27.84**	**29.44**	**15.28**	**19.05**	**39.97**	**27.44**	**92.77**
BENZ[A]ANTHRACENE	ND	**19.46**	**28.73**	**5.02**	**22.94**	**10.93**	**10.73**	**25.38**	**41.41**	**22.77**	**14.05**	**34.11**	**23.44**	**54.16**
BENZO[A]PYRENE	ND	**31.85**	**47.74**	**6.64**	**42.22**	**13.54**	**14.72**	**25.41**	**79.19**	**46.68**	**17.63**	**44.03**	**31.72**	**65.84**
BENZO[B]FLUORANTHENE	ND	**34.24**	**71.19**	**8.44**	**50.94**	**24.21**	**16.28**	**45.68**	**77.01**	**36.27**	**41.65**	**102.95**	**80.57**	**137.66**
BENZO[G,H,I]PERYLENE	ND	**23.07**	**32.32**	**4.45**	**32.46**	**10.78**	**14.66**	**22.70**	**53.76**	**32.57**	**12.44**	**33.33**	**22.48**	**41.30**
BENZO[K]FLUORANTHENE	ND	**12.35**	**24.50**	**2.37**	**17.87**	**6.48**	**6.64**	**15.68**	**29.58**	**16.93**	**9.69**	**24.03**	**16.88**	**30.82**
CHRYSENE	ND	**19.56**	**31.69**	**5.59**	**21.79**	**9.45**	**8.86**	**22.36**	**35.80**	**19.82**	**13.24**	**33.65**	**21.88**	**43.99**
DIBENZ[A,H]ANTHRACENE	ND	**5.85**	**5.34**	ND	ND	ND	ND	ND	**10.32**	**6.38**	ND	**5.40**	**4.64**	**4.52**
FLUORANTHENE	ND	**71.70**	**104.99**	**10.71**	**64.35**	**35.93**	**34.08**	**94.05**	**103.16**	**50.71**	**56.97**	**128.21**	**92.13**	**236.41**
FLUORENE	ND	**21.13**	**34.01**	**2.84**	**21.68**	**9.71**	**9.97**	**27.30**	**35.16**	**15.39**	**19.69**	**42.95**	**29.62**	**104.74**
INDENO[1,2,3-CD]PYRENE	ND	**17.51**	**23.02**	**3.36**	**11.65**	**8.49**	**6.81**	**16.56**	**34.29**	**20.12**	**9.21**	**23.88**	**16.77**	**28.43**
NAPHTHALENE	ND	**80.81**	**102.24**	**13.74**	**79.55**	**51.55**	**58.65**	**102.43**	**114.78**	**76.57**	**91.37**	**175.04**	**120.01**	**374.06**
PHENANTHRENE	ND	**52.91**	**89.35**	**6.59**	**50.14**	**26.30**	**25.70**	**69.46**	**83.55**	**38.62**	**50.51**	**111.63**	**75.96**	**266.33**
PYRENE	ND	**65.51**	**98.23**	**10.90**	**64.27**	**29.94**	**30.44**	**74.86**	**111.88**	**56.09**	**45.03**	**108.68**	**76.51**	**200.50**
TOTAL PAHs (ND=0)	0.00	**506.25**	**803.61**	**94.88**	**540.31**	**276.99**	**269.11**	**639.43**	**903.81**	**491.35**	**449.06**	**1045.50**	**729.53**	**1971.80**
TOTAL PAHs (ND=1/2 DL)	434.11	**524.24**	**806.36**	107.09	**582.00**	291.78	286.53	**660.97**	**936.58**	**511.91**	**465.89**	**1055.20**	**739.61**	**1971.80**
TOTAL PAHs (ND=DL)	868.23	542.23	809.10	119.29	623.70	306.57	303.94	682.51	**969.34**	532.46	482.72	**1064.90**	749.68	**1971.80**

* Values based on mean concentrations detected in the sediment samples (dry weight) as presented in Table 6-10.
For non-detected analytes, the detection limit was used in the mean calculation.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in any sample in a reach.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Ocean Reference value.

TABLE 6-21A THEORETICAL BIOACCUMULATION POTENTIAL* FOR DIOXIN IN TISSUE: COMPARISON TO INSIDE SITE 104

Analyte (NG/KG)	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
% TOC	7.2	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
2,3,7,8-TCDD	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.83**	ND	ND
1,2,3,7,8-PeCDD	0.2	ND	ND	ND	**0.32**	**0.67**	ND	**1.02**	ND	**1.08**	ND	**1.00**	ND	**0.47**
1,2,3,4,7,8-HxCDD	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.41**
1,2,3,6,7,8-HxCDD	0.6	ND	ND	ND	**1.33**	**1.24**	ND	**2.15**	ND	ND	ND	ND	ND	0.56
1,2,3,7,8,9-HxCDD	0.6	ND	ND	ND	**0.85**	**1.44**	ND	**2.43**	ND	ND	ND	ND	ND	0.48
1,2,3,4,6,7,8-HpCDD	7.9	5.14	5.80	3.02	**20.59**	**18.59**	**10.89**	**35.78**	**21.77**	**12.29**	7.56	**8.01**	4.27	3.47
OCDD	169.5	117.72	141.95	80.66	**288.02**	**448.33**	**300.81**	**1124.32**	**505.63**	**281.11**	**209.15**	155.35	127.59	67.03
2,3,7,8-TCDF	0.5	ND	ND	ND	**23.82**	ND	ND	**0.81**	ND	ND	ND	**1.06**	ND	**1.02**
1,2,3,7,8-PeCDF	0.2	ND	ND	ND	**4.03**	**0.92**	ND	ND	ND	**1.25**	ND	**1.05**	ND	**1.39**
2,3,4,7,8-PeCDF	2.0	ND	ND	ND	**24.32**	0.93	ND	1.20	ND	1.03	1.44	0.99	ND	**2.66**
1,2,3,4,7,8-HxCDF	0.9	0.36	ND	ND	**10.35**	**0.87**	ND	**1.07**	**0.93**	**1.10**	0.60	0.74	ND	**1.90**
1,2,3,6,7,8-HXCDF	0.4	0.28	ND	ND	**1.81**	**0.66**	ND	**0.68**	ND	ND	0.32	**0.68**	ND	**1.57**
2,3,4,6,7,8-HxCDF	0.6	ND	ND	ND	**3.07**	**0.62**	ND	ND	ND	ND	ND	ND	ND	**1.66**
1,2,3,7,8,9-HxCDF	0.1	ND	ND	ND	**0.51**	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	2.1	0.77	0.95	0.56	**6.13**	**2.23**	1.58	**3.90**	**2.96**	1.74	1.54	0.94	0.57	**5.40**
1,2,3,4,7,8,9-HpCDF	0.3	ND	ND	ND	**2.32**	ND	ND	ND	ND	ND	ND	ND	ND	**0.37**
OCDF	3.7	2.54	2.16	1.08	**13.73**	**5.87**	**5.18**	**9.47**	**9.39**	**5.66**	3.13	2.20	1.52	1.87
DIOXINS TEQ (ND=0)	1.7	0.22	0.21	0.12	**17.08**	**1.95**	0.43	**3.20**	0.76	1.11	1.11	**2.22**	0.18	**2.16**
DIOXINS TEQ (ND=1/2 DL)	1.7	1.08	0.97	0.47	**17.41**	**2.40**	1.63	**4.45**	**2.40**	**2.06**	**1.75**	**2.40**	1.05	**2.28**
DIOXINS TEQ (ND=DL)	1.7	**1.94**	**1.74**	0.82	**17.73**	**2.86**	**2.83**	**5.70**	**4.04**	**3.01**	**2.38**	**2.57**	**1.92**	**2.41**

* Values based on actual concentrations detected in composited sediment samples (dry weight) as presented in Table 6-13.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in a composite sample.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Inside Site 104 value.

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TABLE 6-21B THEORETICAL BIOACCUMULATION POTENTIAL* FOR DIOXIN IN TISSUE: COMPARISON TO OUTSIDE SITE 104

Analyte (NG/KG)	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
% TOC	11.4	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
2,3,7,8-TCDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.83	ND	ND
1,2,3,7,8-PeCDD	ND	ND	ND	ND	0.32	0.67	ND	1.02	ND	1.08	ND	1.00	ND	0.47
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.41
1,2,3,6,7,8-HxCDD	ND	ND	ND	ND	1.33	1.24	ND	2.15	ND	ND	ND	ND	ND	0.56
1,2,3,7,8,9-HxCDD	ND	ND	ND	ND	0.85	1.44	ND	2.43	ND	ND	ND	ND	ND	0.48
1,2,3,4,6,7,8-HpCDD	4.9	5.14	5.80	3.02	20.59	18.59	10.89	35.78	21.77	12.29	7.56	8.01	4.27	3.47
OCDD	135.6	117.72	141.95	80.66	288.02	448.33	300.81	1124.32	505.63	281.11	209.15	155.35	127.59	67.03
2,3,7,8-TCDF	ND	ND	ND	ND	23.82	ND	ND	0.81	ND	ND	ND	1.06	ND	1.02
1,2,3,7,8-PeCDF	ND	ND	ND	ND	4.03	0.92	ND	ND	ND	1.25	ND	1.05	ND	1.39
2,3,4,7,8-PeCDF	ND	ND	ND	ND	24.32	0.93	ND	1.20	ND	1.03	1.44	0.99	ND	2.66
1,2,3,4,7,8-HxCDF	ND	0.36	ND	ND	10.35	0.87	ND	1.07	0.93	1.10	0.60	0.74	ND	1.90
1,2,3,6,7,8-HXCDF	ND	0.28	ND	ND	1.81	0.66	ND	0.68	ND	ND	0.32	0.68	ND	1.57
2,3,4,6,7,8-HxCDF	ND	ND	ND	ND	3.07	0.62	ND	ND	ND	ND	ND	ND	ND	1.66
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	0.51	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.7	0.77	0.95	0.56	6.13	2.23	1.58	3.90	2.96	1.74	1.54	0.94	0.57	5.40
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	ND	2.32	ND	ND	ND	ND	ND	ND	ND	ND	0.37
OCDF	1.3	2.54	2.16	1.08	13.73	5.87	5.18	9.47	9.39	5.66	3.13	2.20	1.52	1.87
DIOXINS TEQ (ND=0)	0.2	0.22	0.21	0.12	17.08	1.95	0.43	3.20	0.76	1.11	1.11	2.22	0.18	2.16
DIOXINS TEQ (ND=1/2 DL)	0.6	1.08	0.97	0.47	17.41	2.40	1.63	4.45	2.40	2.06	1.75	2.40	1.05	2.28
DIOXINS TEQ (ND=DL)	1.0	1.94	1.74	0.82	17.73	2.86	2.83	5.70	4.04	3.01	2.38	2.57	1.92	2.41

* Values based on actual concentrations detected in composited sediment samples (dry weight) as presented in Table 6-13.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in a composite sample.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Outside Site 104 value.

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TABLE 6-21C THEORETICAL BIOACCUMULATION POTENTIAL* FOR DIOXIN IN TISSUE: COMPARISON TO OCEAN REFERENCE

Analyte (NG/KG)	Ocean	Brewerton Channel Eastern Extension	C&D Approach (Grab)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
% TOC	0.5	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
2,3,7,8-TCDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.83**	ND	ND
1,2,3,7,8-PeCDD	ND	ND	ND	ND	**0.32**	**0.67**	ND	**1.02**	ND	**1.08**	ND	**1.00**	ND	**0.47**
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.41**
1,2,3,6,7,8-HxCDD	ND	ND	ND	ND	**1.33**	**1.24**	ND	**2.15**	ND	ND	ND	ND	ND	**0.56**
1,2,3,7,8,9-HxCDD	ND	ND	ND	ND	**0.85**	**1.44**	ND	**2.43**	ND	ND	ND	ND	ND	**0.48**
1,2,3,4,6,7,8-HpCDD	12.5	5.14	5.80	3.02	**20.59**	**18.59**	10.89	**35.78**	**21.77**	12.29	7.56	8.01	4.27	3.47
OCDD	160.0	117.72	141.95	80.66	**288.02**	**448.33**	**300.81**	**1124.32**	**505.63**	**281.11**	**209.15**	155.35	127.59	67.03
2,3,7,8-TCDF	ND	ND	ND	ND	**23.82**	ND	ND	**0.81**	ND	ND	ND	**1.06**	ND	**1.02**
1,2,3,7,8-PeCDF	ND	ND	ND	ND	**4.03**	**0.92**	ND	ND	ND	**1.25**	ND	**1.05**	ND	**1.39**
2,3,4,7,8-PeCDF	1.1	ND	ND	ND	**24.32**	0.93	ND	**1.20**	ND	1.03	**1.44**	0.99	ND	**2.66**
1,2,3,4,7,8-HxCDF	ND	**0.36**	ND	ND	**10.35**	**0.87**	ND	**1.07**	**0.93**	**1.10**	**0.60**	**0.74**	ND	**1.90**
1,2,3,6,7,8-HXCDF	ND	**0.28**	ND	ND	**1.81**	**0.66**	ND	**0.68**	ND	ND	**0.32**	**0.68**	ND	**1.57**
2,3,4,6,7,8-HxCDF	ND	ND	ND	ND	**3.07**	**0.62**	ND	ND	ND	ND	ND	ND	ND	**1.66**
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	**0.51**	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	2.6	0.77	0.95	0.56	**6.13**	2.23	1.58	**3.90**	**2.96**	1.74	1.54	0.94	0.57	**5.40**
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	ND	**2.32**	ND	ND	ND	ND	ND	ND	ND	ND	**0.37**
OCDF	2.4	**2.54**	2.16	1.08	**13.73**	**5.87**	**5.18**	**9.47**	**9.39**	**5.66**	**3.13**	2.20	1.52	1.87
DIOXINS TEQ (ND=0)	0.8	0.22	0.21	0.12	**17.08**	**1.95**	0.43	**3.20**	0.76	**1.11**	**1.11**	**2.22**	0.18	**2.16**
DIOXINS TEQ (ND=1/2 DL)	2.4	1.08	0.97	0.47	**17.41**	2.40	1.63	**4.45**	2.40	2.06	1.75	2.40	1.05	2.28
DIOXINS TEQ (ND=DL)	4.1	1.94	1.74	0.82	**17.73**	2.86	2.83	**5.70**	4.04	3.01	2.38	2.57	1.92	2.41

* Values based on actual concentrations detected in composited sediment samples (dry weight) as presented in Table 6-13.
Values based on 2% lipid content for either *Macoma* or *Nereis* tissue.

ND = analytes that were not detected in a composite sample.

NOTE: Shaded and bolded values represent TBP values for channels that exceed the Ocean Reference value.

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TABLE 6-22 NUMBER OF MEAN CONCENTRATIONS IN TARGET ANALYTE FRACTIONS THAT EXCEED TELs (1999)

ANALYTE	Ocean Reference	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	0	9	7	6	6	7	0	6	7	6	0	7	6	7	6	6
PAHs	0	10	11	5	7	2	2	3	3	4	3	3	4	6	4	12
PESTICIDES	1	1	3	3	1	1	1	2	3	3	1	4	2	1	1	1
PCBs, TOTAL	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
SEMIVOLATILE ORGANIC COMPOUNDS	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
TOTAL # OF TEL EXCEEDANCES	1	21	22	15	15	13	3	12	14	14	5	15	13	15	12	20

TABLE 6-23 NUMBER OF MEAN CONCENTRATIONS IN TARGET ANALYTE FRACTIONS THAT EXCEED PELs (1999)

ANALYTE	Ocean Reference	Inside Site 104	Outside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	0	3	0	2	1	1	0	0	0	0	0	2	0	1	1	1
PAHs	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	4
PESTICIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCBs, TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEMIVOLATILE ORGANIC COMPOUNDS	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL # OF PEL EXCEEDANCES	0	5	1	2	1	1	0	0	0	0	0	2	0	2	1	6

TABLE 6-24 SUMMARY OF TBP RESULTS: NUMBER OF CHANNEL TBP VALUES THAT EXCEED[a] PLACEMENT SITE/REFERENCE SITE TBP VALUES

				PERCENT EXCEEDANCE		
ANALYTICAL FRACTION	Inside Site 104	Outside Site 104	Ocean Reference	Inside Site 104	Outside Site 104	Ocean Reference
Chlorinated Pesticides	4/286	8/286	9/286	1.4	2.8	3.1
Organophosphorus Pesticides	0/65	0/65	0/65	0.0	0.0	0.0
PCB Aroclors	0/91	0/91	0/91	0.0	0.0	0.0
PCB Congeners	46/338	210/338	253/338	13.6	62.1	74.9
PAHs	11/208	28/208	194/208	5.3	13.5	93.3
Dioxin and Furan Congeners	67/221	95/221	74/221	30.3	4.3	33.5

(a) = total number of channel concentrations (detects only) that exceed reference concentrations/total number of analytes tested in analytical fraction

TABLE 6-25A: MEAN NORMALIZED[(a)] ANALYTE CONCENTRATIONS IN SEDIMENTS FROM UPPER CHESAPEAKE BAY APPROACH CHANNELS TO THE PORT OF BALTIMORE COMPARED TO UPPER CHESAPEAKE BAY SEDIMENT DATA IN ESKIN ET AL. 1996

ANALYTE [(b)]	Units	Upper Cheasapeake Bay-Segment 3*	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
GRAIN SIZE [(c)]	N/A	mud	mud	mud	mud	muddy sand	mud	mud	mud	mud	mud	mud	mud	mud	mud
TOC	%	3.2	10.5	9.5	8.4	3.0	10.2	9.5	7.4	2.8	7.9	8.7	8.6	9.0	13.4
ARSENIC	mg/kg	17.4	17.1	11.5	11.2	44.6	13.9	18.3	15.8	4.1	22.4	13.6	11.4	12.9	14.6
CADMIUM	mg/kg	1.01	0.3	0.3	0.8	0.4	0.3	0.8	0.5	0.0	0.4	0.4	0.8	0.3	0.3
CHROMIUM	mg/kg	49.2	45.1	26.6	27.9	105.6	42.1	51.7	46.7	13.8	75.9	38.7	28.1	33.0	29.3
COPPER	mg/kg	42.5	44.1	37.0	36.0	69.6	35.8	43.2	41.6	13.5	58.3	42.3	38.4	36.8	55.1
LEAD	mg/kg	39	62.9	38.5	39.4	73.4	45.7	57.8	47.6	14.0	83.9	50.9	42.9	42.0	48.7
MERCURY	mg/kg	0.19	0.3	0.2	0.2	0.7	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.2	0.5
NICKEL	mg/kg	52.9	55.7	51.7	56.5	65.3	39.2	46.5	41.4	11.0	59.2	44.8	49.9	48.6	60.2
ZINC	mg/kg	360	310.6	207.7	218.7	373.7	211.2	274.5	226.6	60.8	374.4	222.2	209.5	215.3	239.1
ANTHRACENE	ug/kg	1630	230.5	316.9	30.7	691.6	134.0	107.7	345.8	808.3	167.1	521.1	478.9	349.5	1139.9
BENZ(A)ANTHRACENE	ug/kg	2033	236.5	362.6	78.1	671.9	143.5	125.7	318.3	1106.9	243.7	398.7	417.2	299.2	664.6
BENZO(G,H,I)PERYLENE	ug/kg	2827	277.6	417.2	70.4	952.5	141.1	172.3	335.0	2135.3	503.9	456.5	540.9	404.0	807.2
BENZO(A)PYRENE	ug/kg	3711	385.7	602.9	103.7	1291.0	178.1	171.2	289.7	1474.2	362.5	247.7	409.9	286.9	507.0
CHRYSENE	ug/kg	5933	228.7	398.7	86.4	598.6	121.9	100.4	278.6	963.5	219.8	371.1	412.1	278.6	539.7
DIBENZ(A,H)ANTHRACENE	ug/kg	286	70.3	67.3	53.4	601.7	52.8	60.2	84.1	302.6	79.7	157.0	66.2	58.3	55.8
FLUORANTHENE	ug/kg	10267	875.7	1284.2	167.1	1979.6	473.7	397.7	1206.4	2732.3	550.7	1629.0	1561.0	1171.5	2907.0
IDENO(1,2,3-cd)PYRENE	ug/kg	3075	212.2	287.4	52.5	380.5	110.4	77.8	211.0	930.6	214.6	200.3	293.6	213.5	349.1
NAPHTHALENE	ug/kg	3107	979.6	1234.0	206.7	2096.8	671.3	690.7	1272.0	3274.2	828.7	3051.2	2114.4	1523.5	4578.8
PHENANTHRENE	ug/kg	10266	646.4	1080.2	102.2	1535.3	346.3	299.5	877.9	2279.8	412.4	1468.4	1340.9	965.3	3272.4
PYRENE	ug/kg	11680	798.9	1216.4	166.5	1850.6	388.0	353.5	940.4	3044.8	599.0	1223.8	1323.2	972.7	2467.9
TOTAL PAHs (ND=0)	ug/kg	121854	6588.7	9986.8	1832.9	20988.7	4004.4	3566.9	8660.2	26544.0	5861.5	13870.7	12932.4	9523.0	24202.2
TOTAL PCBs (ND=0)	ug/kg	313.7	87.8	109.4	323.6	513.8	76.5	59.9	246.7	387.6	89.4	161.2	115.9	142.2	86.1
4,4'-DDD	ug/kg	57.2	6.9	6.2	10.5	74.3	6.5	7.7	10.3	36.6	9.8	19.4	6.4	9.8	3.8
4,4'-DDE	ug/kg	55.2	6.5	5.9	14.2	70.8	6.1	7.1	9.8	34.8	9.4	18.3	7.7	10.1	3.6
4,4'-DDT	ug/kg	25	10.7	9.7	10.3	116.7	10.2	11.6	15.8	57.5	15.4	30.8	10.0	10.2	5.5
DIELDRIN	ug/kg	9.1**	7.1	6.4	6.8	76.1	6.6	7.6	10.6	37.5	10.0	19.9	6.5	6.6	3.6
DIOXIN (OCDD)***	ng/kg	11406	1938	1830	788	6316	6239	4141	20635	2086	9426	2799	2122	1561	868

*based on mean of normalized concentrations (Eskin et al 1996)

**detected in only one sediment bay sample (MCB3.3C)

***OCDD was the only dioxin detected at concentrations above the detection limit of 0.01 ppb in Eskin et al. 1996.

(a) Metal concentrations are normalized to % silt-clay fraction of the bulk sediment; PAHs, pesticide, PCB and dioxin concentrations are normalized to % TOC of the bulk sediment.

(b) Number of samples per analyte provided in Table 2.

(c) Grain size classification from Scott et al. 1988. Mud = >85% silt/clay fraction; sandy mud = >50% silt/clay fraction; muddy sand = <50% silt/clay fraction.

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TABLE 6-25B: SAMPLE SIZES FOR SEDIMENT DATA PRESENTED IN TABLE 6-25a AND TABLES 6-7 THROUGH 6-32

ANALYTE	Upper Cheasapeake Bay-Segment 3*	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
GRAIN SIZE	24	5	4	2	3	3	3	4	4	3	6	6	4	2
TOC	17	5	4	2	3	3	3	4	4	3	6	6	4	2
ARSENIC	12	5	4	2	3	3	3	4	4	3	6	6	4	2
CADMIM	12	5	4	2	3	3	3	4	4	3	6	6	4	2
CHROMIUM	12	5	4	2	3	3	3	4	4	3	6	6	4	2
COPPER	12	5	4	2	3	3	3	4	4	3	6	6	4	2
LEAD	5	5	4	2	3	3	3	4	4	3	6	6	4	2
MERCURY	5	5	4	2	3	3	3	4	4	3	6	6	4	2
NICKEL	12	5	4	2	3	3	3	4	4	3	6	6	4	2
ZINC	5	5	4	2	3	3	3	4	4	3	6	6	4	2
ANTHRACENE	1	5	4	2	3	3	3	4	4	3	6	6	4	2
BENZ(A)ANTHRACENE	6	5	4	2	3	3	3	4	4	3	6	6	4	2
BENZO(G,H,I)PERYLENE	5	5	4	2	3	3	3	4	4	3	6	6	4	2
BENZO(A)PYRENE	6	5	4	2	3	3	3	4	4	3	6	6	4	2
CHRYSENE	6	5	4	2	3	3	3	4	4	3	6	6	4	2
DIBENZ(A,H)ANTHRACENE	1	5	4	2	3	3	3	4	4	3	6	6	4	2
FLUORANTHENE	6	5	4	2	3	3	3	4	4	3	6	6	4	2
IDENO(1,2,3)PYRENE	5	5	4	2	3	3	3	4	4	3	6	6	4	2
NAPHTHALENE	2	5	4	2	3	3	3	4	4	3	6	6	4	2
PHENANTHRENE	5	5	4	2	3	3	3	4	4	3	6	6	4	2
PYRENE	5	5	4	2	3	3	3	4	4	3	6	6	4	2
TOTAL PAHs (ND=0)	2	5	4	2	3	3	3	4	4	3	6	6	4	2
TOTAL PCBs (ND=0)	3	5	4	2	3	3	3	4	4	3	6	6	4	2
4,4'-DDD	3	5	4	2	3	3	3	4	4	3	6	6	4	2
4,4'-DDE	3	5	4	2	3	3	3	4	4	3	6	6	4	2
4,4'-DDT	3	5	4	2	3	3	3	4	4	3	6	6	4	2
DIELDRIN	1	5	4	2	3	3	3	4	4	3	6	6	4	2
DIOXIN (OCDD)	2	5	4	2	3	3	3	4	4	3	6	6	4	2

*data from Eskin et al. 1996

CHAPTER 7 -
RECEIVING WATER / ELUTRIATES

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7. RECEIVING WATER AND ELUTRIATE CHEMISTRY

This chapter presents receiving water and elutriate chemistry data that were collected in 1999-2000 specifically for a Tier II evaluation of water column impacts. These data are similar to the 1997-1998 data that are presented in Chapter 3. Site water (Inside Site 104), and reference site water (Outside Site 104 and Ocean Reference) were submitted for analytical testing. These waters are referred to as "receiving waters" because the dredged material would be received into these waters when placed. Elutriate preparation water was collected from each channel proposed for dredging [as specified in the ITM (USEPA/USACE 1998)] for preparation of the individual elutriates in the analytical and toxicology laboratories. Water collection and preservation techniques are described in Chapter 4. A summary of site water and elutriate samples that were submitted for analytical testing is provided in Table 5-1B. Results of water column toxicological studies are addressed in Chapter 8.

7.1 SAMPLE RECEIPT

The elutriate preparation water was transported with the sediment cores from the project staging areas to EA's Ecotoxiocology Laboratory facility in Sparks, Maryland. Samples were chilled with ice during the transport period. Upon receipt, the water samples were visually inspected and the water containers were compared against the chain-of-custody record. Elutriate preparation water for the water column toxicity tests was stored in a walk-in refrigeration unit until testing, and the remaining elutriate preparation water was hand-delivered to STL–Baltimore for elutriate preparation and subsequent chemical analysis. Receiving water samples targeted for chemical analysis (sampling stations KI-3, KI-7, and KI-14 and equipment blanks) were collected in the field and hand-delivered on the day of collection to STL–Baltimore. The holding time for the receiving water samples and equipment blanks was initiated at the time of sample collection. The holding time for elutriates was initiated at the completion of the elutriate preparation process (Section 7.2). Copies of chain-of-custody forms for the site water, equipment blanks, and elutriate samples are provided in Attachment III.

7.2 ELUTRIATE PREPARATION

Elutriates were created by mixing dredging site water and sediment, allowing the mixture to settle, filtering, and testing the overlying water for dissolved constituents as per USEPA/USACE (1998) guidance. The purpose of elutriate testing is to simulate the potential mixing and release of dissolved organic or inorganic constituents into the water column during hydraulic placement of dredged material in open-water sites.

Elutriates were prepared following the Standard Elutriate Preparation specified in the ITM (USEPA/USACE 1998). A sediment/water mixture, at a 1:4 ratio of sediment-to-site water, was thoroughly mixed for 30 minutes. The mixture was then allowed to settle, and the supernatant was siphoned off and filtered to remove particulates. Elutriates were prepared using site water from each channel reach and a composite sediment sample collected from each sampling reach. In addition, although these sediments were not proposed for dredging, elutriates were prepared from Inside Site 104, Outside Site 104, and the Ocean Reference. While these elutriates are not required by the ITM, they were prepared and analyzed for comparative purposes only. Results of the placement/reference site elutriate tests were numerically compared to channel elutriate data. Elutriate samples that were created and tested for the upper Chesapeake Bay approach channels to the Port of Baltimore and Site 104 study are summarized in Table 7-1.

7.3 ANALYTICAL METHODS AND DETECTION LIMITS

Site waters, equipment blanks, and elutriates were analyzed for the target analytes identified in the Analytical Quality Assurance Project Plan (QAPP) (EA and STL–Baltimore 2000) which was approved by USACE and USEPA. Project-specific analytes, analytical methods, and detection limits for aqueous samples are provided in Tables 5-2 and 5-5, respectively.

7.4 DATA ANALYSIS

7.4.1 Calculation of Mean Concentrations

Two sets of elutriates were prepared for each channel reach, three sets of elutriates were prepared for Inside Site 104, and a single elutriate was prepared for both Outside Site 104 and the Ocean Reference area. Mean elutriate concentrations were determined after substituting the analytical detection limit for non-detected analytes (ND = DL). Use of the detection limit is overly conservative. If an analyte was not detected in any of the elutriates, the mean detection limit was reported and qualified with a "U" in the summary tables (following the approach discussed in section 7.4.2 below).

7.4.2 Concentrations of Total PCBs, Total PAHs, and Dioxin TEQs

For each individual sample, the total PCB concentration was determined by summing the 18 summation congeners listed in Table 9-3 of the ITM, and then multiplying this sum by a factor of 2 as described in the NOAA (1993) standard approach for Total PCB determinations. Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. For both the total PCB and total PAH concentrations, three values are reported, each representing the following methods for treating concentrations below the analytical detection limit:

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

Substituting the detection limit for all non-detects (ND = DL) provides the most conservative estimate of the non-detected concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are non-detects.

The Toxicity Equivalency Quotients (TEQs) for dioxin were calculated following the approach in USEPA 1989. Each congener was multiplied by the Toxicity Equivalency Factor (TEF) and then the congener concentrations were summed. Concentrations that were flagged with a "B"

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(detected in blank) or "EMPC" (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA Region III dioxin validation guidance (USEPA Region III 1999). The TEQs were calculated using ND=0, ND=1/2DL, and ND=DL.

7.4.3 Comparisons to Receiving Water and WQC

Chemical results of the elutriate analyses were compared with the results of the receiving water samples (KI-3WAT, KI-7WAT), the Outside Site 104 reference water sample (KI-14WAT), and the Ocean Reference water sample. Analytes detected in the elutriates and receiving/reference waters were compared to acute and chronic aquatic life water quality criteria and to criteria for the protection of human health from consumption of aquatic organisms. Criteria were extracted from the U.S. EPA's National Recommended Water Quality Criteria (63 Fed. Reg. 68354-68364; 10 December 1998); and MDE's *proposed* water quality criteria (Maryland Register 27(17): 1628-1636; dated 25 August 2000) (Table 7-2). MDE's proposed criteria are much more extensive than the State's current listing, and the proposed criteria for the listed compounds are identical to the USEPA's criteria. Human health criteria are based on MDE's 10^{-5} risk-level. A 10^{-5} risk is defined as a potential for one additional case of cancer in 100,000 people. Elutriate metal concentrations, which were measured as *total* values, are (conservatively) compared to *dissolved* aquatic life criteria. Consistent with the technical basis of these criteria, maximum concentrations of detected constituents were compared to the acute criteria and mean concentrations were compared to chronic and human health criteria (conservatively assuming that ND=DL). USEPA's criteria values (for detected analytes only) are provided in Table 7-2.

7.5 RECEIVING WATER AND ELUTRIATE RESULTS

Results of the receiving water and elutriate analyses conducted in 1999-2000 are presented in the following subsections. Both maximum and mean results for elutriates are presented for each channel reach (Tables 7-3 through 7-27). Comparison to water quality criteria are provided in Tables 7-33A, 7-34A, and 7-35A. Results of equipment blank analyses are provided in Attachment III. Definitions of inorganic, organic, and dioxin/furan data qualifiers are presented in Tables 3-4, 3-5, and 6-1, respectively. Raw data are provided in Appendix D. Analytical narratives that include an evaluation of laboratory quality assurance/quality control results are provided in Attachment III. STL–Baltimore will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

7.5.1 Inorganic Non-Metals/Nutrients

Results of the cyanide, ammonia, nitrogen, TKN, total phosphorus, sulfide, BOD, COD, and TOC analyses for receiving water are provided in Table 7-3. Maximum and mean elutriate concentrations are presented in Tables 7-4 and 7-5, respectively.

Cyanide was detected at the detection limit in one channel elutriate (0.005 mg/L), Tolchester Channel North. Cyanide was not detected in the receiving waters or in any of the other channel elutriates. Concentrations of TOC in receiving water ranged from 1 to 4.3 mg/L. Mean TOC concentrations in channel elutriates ranged from 4.1 mg/L (Craighill Angle East) to 257 mg/L (Tolchester South). With the exception of Tolchester South, TOC concentrations in channel elutriates were generally less than the concentrations reported in the elutriates from the placement/reference areas (Inside Site 104, Outside 104, and Ocean Reference).

Total sulfide in receiving water was below detection (0.35 mg/L) at Inside Site 104. Total sulfide concentrations in receiving water at Outside Site 104 and the Ocean Reference area were 0.76 and 0.93 mg/L, respectively. Tolchester Channel - South was the only channel elutriate with a detectable maximum concentration of total sulfide (0.44 mg/L); however, total sulfide was also reported in the laboratory method blank, indicating that the sulfide concentration may be biased high in the sample.

In the receiving waters, total phosphorus (TP) was only detected at the Ocean Reference area at a concentration of 0.09 mg/L (Table 7-3). Mean total phosphorus in channel elutriates ranged from 0.02 mg/L [C&D Approach (cores)] to 0.41 mg/L (Swan Point Channel). Elutriates created with the Ocean Reference sediment had the highest TP concentration (1.30 mg/L) (Table 7-5).

Ammonia-nitrogen was detected in both receiving waters collected from within Inside Site 104 (KI-3 and KI-7) with an average concentration of 0.28 mg/L as NH_3. Ammonia-nitrogen was also detected in receiving waters from Outside Site 104 and the Ocean Reference at concentrations of 0.15 and 0.13 mg/L, respectively. Ammonia-nitrogen concentrations in the receiving waters were below both the USEPA acute and chronic saltwater criteria for aquatic life of 43 and 6.4 mg/L as NH_3, respectively (assuming 10 ppt salinity, 10°C and pH of 7.4). Ammonia-nitrogen was detected in all channel elutriate samples with maximum concentrations ranging from 1.2 to 18.1 mg/L, and mean concentrations ranging from 1.2 – 10.2 mg/L. Ammonia-nitrogen mean concentrations exceeded the chronic saltwater criteria for aquatic life (6.4 mg/L) in the Craighill Angle–East elutriate (10.2 mg/L) and Craighill Entrance (6.45 mg/L) (Table 7-34A).

Total Kjeldahl nitrogen (TKN) (organic nitrogen + ammonia-nitrogen) in receiving water ranged from 0.55 mg/L at Outside Site 104 to 0.87 mg/L at Inside Site 104. Mean TKN in elutriates from the channel sites ranged from 0.65 mg/L (Craighill Channel) to 7.25 mg/L (Craighill Angle East). Mean TKN in elutriates from the placement/reference sites fell within the range measured in the channel elutriates, with Outside Site 104 having the highest TKN concentration (4.00 mg/L) and the Ocean Reference having the lowest TKN concentration (0.80 mg/L).

7.5.2 Volatile Organic Compounds

Results of the volatile organic compound (VOC) analysis in receiving water are presented in Table 7-6. Results for elutriates are provided in Table 7-7. VOCs were not detected in any of the tested receiving water samples. Of the 35 tested VOCs, dichloromethane (a commonly used laboratory chemical) was the only VOC detected in the channel elutriates. Dichloromethane concentrations (ranging from 16 to 680 µg/L) did not exceed the human health criterion of 16,000 µg/L (Table 7-35A).

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7.5.3 Semivolatile Organic Compounds

Concentrations of the SVOC analyses in receiving waters are presented in Table 7-8. Maximum and mean concentrations of SVOCs in channel elutriates appear in Tables 7-9 and 7-10, respectively. Of the 44 SVOCs analyzed, bis(2-ethylyhexyl)phthalate was the only SVOC detected in receiving water and the channel elutriates (ranging from 2 to 28 μg/L). There are no WQC for bis(2-ethylyhexyl)phthalate.

7.5.4 Chlorinated Pesticides, Organophosphorus Pesticides, and PCB Aroclors

Maximum concentrations of chlorinated pesticides, organophosphate pesticides, and PCB aroclors in receiving waters are presented in Table 7-11. Maximum and mean concentrations detected in the channel elutriates are presented in Tables 7-12 and 7-13, respectively. Three of 22 tested chlorinated pesticides were detected in the receiving water from Inside Site 104 – beta-BHC, gamma-BHC, and heptachlor epoxide. Heptachlor epoxide was detected below the recommended TDL of 0.1 μg/L (USEPA/USACE 1995). There are no published TDLs for beta-BHC and gamma-BHC.

Four of the 22 tested chlorinated pesticides were detected in the channel elutriates (beta-BHC, gamma-BHC, heptachlor, and heptachlor epoxide). Beta-BHC was detected in elutriates from each channel with the exception of C&D Approach (surficial sediments) and C&D Approach (core sediments). Maximum concentrations of beta-BHC ranged from 0.01 to 0.03 μg/L, and were qualified as estimated. Beta-BHC was not detected in the elutriates from the placement/reference area sediments.

Gamma-BHC was detected in elutriates from all channels with the exception of Brewerton Channel Eastern Extension, C&D Approach (core), and Craighill Channel. The maximum concentrations of gamma-BHC ranged from 0.0092 to 0.02 μg/L. Gamma-BHC was detected in the elutriate from Inside Site 104 reference sediments (0.01 μg/L).

Heptachlor was detected in all channel elutriates with the exception of Craighill Upper Range. Maximum concentrations ranged from 0.03 to 0.19 μg/L. All detected concentrations in the channels were below the USEPA/USACE (1995) TDL of 0.1 μg/L, with the exception of Craighill Angle–West (0.19 μg/L). Heptachlor was also detected in elutriates created with sediments from Outside Site 104 and Inside Site 104.

Heptachlor epoxide was detected in 11 of the 13 channel elutriates with a concentration range of 0.02 to 0.04 μg/L. All detected concentrations were below the recommended TDL of 0.1 μg/L (USEPA/USACE 1995).

PCB aroclors were not detected in receiving water samples from the placement/reference sites (Table 7-11), or in channel elutriates (Table 7-12).

7.5.5 PCB Congeners

Results of the PCB congener analysis in receiving water are presented in Table 7-14. Results for maximum and mean concentrations in channel elutriates are provided in Tables 7-15 and 7-16, respectively. Only 1 of 26 tested PCB congeners was detected in receiving water, and 5 out of 26 tested PCB congeners were detected in channel elutriates. Note that the Total PCB values are affected substantially by the method used to handle non-detected analytes. As shown in Table 7-15 for example, no PCBs were detected in the elutriates for Tolchester Channel–South, but the Total PCB values assuming ND=0, ND=1/2DL, and ND=DL are 0.0, 0.0525 and 0.105 µg/L, respectively.

PCB congener #8 was the only congener detected from receiving waters from Inside Site 104 and this congener was also detected in the method blank. Total PCB (assuming ND = DL) ranged from 0.105 to 0.159 µg/L in receiving waters (Table 7-14).

PCB congeners #8 and #18 were the most commonly detected congeners in the channel elutriates. Mean total PCBs in channel elutriates (assuming ND = ½DL) ranged from 0.0525 µg/L (Craighill Channel, Tolchester Channel–South) to 0.0716 µg/L (Tolchester Channel–North), compared to a range of 0.105 to 0.118 µg/L for mean Total PCB (assuming ND = DL). Mean Total PCBs for ND=0 ranged from 0 (zero) to 0.0253 µg/L. All detected congeners were measured at or below the recommended TDL of 0.01 µg/L for individual congeners (USEPA/USACE 1995). Total PCB concentrations exceeded the criteria for human health consumption of aquatic organisms in all channel and placement/reference site elutriates, even in reaches where no congeners were detected (if ND=1/2DL and ND=DL were used in the Total PCB calculations) (Table 7-35A). These exceedances are largely driven by the substitution of the detection limits for non-detected congeners.

7.5.6 Polynuclear Aromatic Hydrocarbons

Results of the PAH analysis in receiving water are presented in Table 7-17. Results for elutriate maximum and mean concentrations in the channel elutriates are presented in Tables 7-18 and 7-19, respectively.

No PAHs were detected in any of the receiving water samples. Fluorene was the only PAH detected in channel elutriates [Craighill Angle East (0.08 µg/L)]. Fluorene and pyrene were detected in the Inside Site 104 elutriate, both at a concentration of 0.07 µg/L. The flourene concentration in the Craighill Angle elutriate did not exceed the human health criterion of 14,000 µg/L (Table 7-35A). There are no WQC for pyrene.

7.5.7 Metals

Results of the metal analyses in receiving water are provided in Table 7-20. Six of 16 tested metals were detected in the receiving waters. Aluminum and iron were detected in all four receiving water samples with concentrations ranging from 159 to 296 μg/L and 28.4 to 289 μg/L for aluminum and iron, respectively. Copper and manganese were detected in 3 out of 4 receiving water samples (75%) ranging from 0.93 to 6.7 μg/L and 2.4 to 12.4 μg/L, respectively. Arsenic and nickel were detected in receiving water from Outside Site 104 with concentrations of 2.5 and 2.1 μg/L, respectively.

Maximum and mean concentrations for the metal analyses in channel elutriates are presented in Tables 7-21 and 7-22, respectively. Thirteen of the sixteen target metals were detected in the channel elutriate samples. Aluminum, arsenic, manganese, and nickel were detected in elutriates water from all 13 channels. Beryllium, lead, and silver were detected in the elutriate from Tolchester Straightening only.

Copper in the C&D Approach (surficial) was the only metal that exceeded acute (4.8 μg/L) and chronic (3.1 μg/L) water quality criterion (Table 7-33A). Two metals (arsenic and manganese) exceeded the human health criterion (Table 7-35A) in every channel elutriate.

7.5.8 Butyltins

Results of the butyltin analyses in receiving water are provided in Table 7-23. Tributyltin was detected in the Ocean Reference water with a estimated concentration of 80 ng/L. Maximum and mean concentrations of butyltins in channel elutriates are presented in Tables 7-24 and 7-25, respectively. Tributyltin was also detected in elutriate at the Ocean Reference (100 ng/L). Monobutyltin was detected in one channel elutriate water (Craighill Entrance) with a maximum concentration of 130 ng/L.

7.5.9 Dioxin and Furan Congeners

Results of the dioxin and furan congener analyses in receiving waters are provided in Table 7-26. Five of the 17 tested dioxin/furan congeners were detected in the receiving water samples (1,2,3,4,6,7,8-HpCDD, 1,2,3,7,8-PeCDD, OCDD, 1,2,3,7,8-PeCDF, and OCDF). The detected congeners are those with the lowest toxicity. The dioxin TEQ (at ND = 0) in receiving water ranged from 0 to 0.00059 ng/L, while the dioxin TEQ (at ND = 1/2DL) in receiving water ranged from 0.00184 to 0.00279 ng/L. The dioxin TEQ (ND=DL) ranged from 0.00364 to 0.00499 ng/kg. It is important to note that 2,3,7,8-TCDD, the most toxic congener which is specifically regulated by U.S. EPA's ambient water quality criteria (O'Hanian 2000), was not detected in receiving water samples from the placement/reference areas (Table 7-26).

Results of the dioxin and furan congener analyses in elutriates are provided in Table 7-27. Four out of 17 tested dioxin and furan congeners were detected in channel elutriates and two of the four detected congenerss were detected in the laboratory method blank ("B-qualified"). OCDD, the least toxic congener, was the most frequently detected congener in the channel elutriates and it was also detected in the laboratory method blank. Only 2 channel elutriates had detectable concentrations of dioxin congeners (Brewerton Channel Eastern Externsion and the Cutoff Angle). Although sediments will not be dredged from Inside Site 104, Outside Site 104, or the Ocean Reference site, elutriate testing was conducted for comparative purposes.

Dioxin TEQ (ND = 0) in channel elutriates ranged from 0.0 to 0.00014 ng/L, the dioxin TEQ (ND = 1/2DL) in channel elutriates ranged from 0.00219 to 0.00412 ng/L, and the dioxin TEQ (ND=DL) ranged from 0.0045 to 0.0082 ng/kg. It is important to note that 2,3,7,8-TCDD, which is the congener specifically regulated by USEPA's ambient water quality criteria (O'Hanian 2000), was not detected in elutriates prepared from the placement/reference areas or from the channel elutriates (Table 7-27). Dioxins are hydrophobic, not easily dissolved in water, and elevated concentrations would not be expected in receiving water or elutriate samples.

7.5.10 Summary of Elutriate Chemistry

Overall, 16 of 192 (8.3%) of the tested organic and inorganic constituents were detected in the receiving water samples (Table 7-28). Twenty-nine of 192 (15.1%) of the tested organic and inorganic constituents were detected in the channel elutriates. Twenty-three of 192 (12%) of the tested organic and inorganic constituents were detected in elutriates created with sediments from the placement/reference areas. Metals were the most frequently detected constituents in both the receiving water and channel elutriates.

7.6 WATER QUALITY MODELING

7.6.1 Description of the STFATE Model

The dispersion of elutriate into the ambient water following the release of dredged material from a barge was modeled to evaluate compliance of the elutriate with applicable water quality criteria. The elutriate simulates the pore water within the dredged material. The modeling of the elutriate fraction of the dredged material was performed for a release from a split hull barge at both Site 104 and the Norfolk Ocean Disposal Site (NODS), and for the hydraulic pumping out of a barge, and subsequent near bottom release, at Site 104.

The elutriate was modeled using STFATE, which is a standard USACE model used for computing the fate of material placed from either a split-hull barge or a hopper dredge (Johnson and Fong 1995). The model computes the movement of the material from the moment it is injected into the water column until the material is either deposited on the seafloor or transported out of the numerical grid. The model simulates both the solid fractions (e.g., clumps, sand, silt, and clay) and the elutriate that is present in the barge. The computations consist of three phases. The first phase is the convective descent of the dredged material cloud through the water column; during this time the cloud grows as a result of the entrainment of ambient water. Phase 2 occurs when the descending cloud of dredged material strikes the seafloor with a dynamic bottom collapse resulting in a radially expanding bottom surge. The bottom collapse phase continues until the estimated rate of spreading resulting from turbulent diffusion exceeds the rate of spreading of the cloud collapse. Phase 3 occurs at the end of the collapse phase when all remaining material is subjected to the passive transport, diffusion, and settling of the suspended material. Passive transport occurs as the material is carried by the natural current following the dissipation of the initial momentum associated with the release. This passive transport phase continues until the suspended material deposits on the seafloor or is transported out of the numerical grid. Basic output from the model consists of information on the amount of material in suspension and the footprint of the deposited material on the seafloor.

Results of the STFATE modeling described in the following sections were used to develop tables of dilution factors as a function of distance and time following the placement event. An examination of the compliance with water quality criteria, taking into account available site dilution, is provided in Section 7.7. The solids fraction of the dredged material (sand, silt, and clay) was included in the model to provide an appropriate composition in the barge. The material fractions used in the model are discussed in Section 7.6.2. STFATE models both the elutriate and its chemical constituents as a conservative tracer that remains in the water column. During an actual barge placement, a fraction of the elutriate remains as pore water trapped in clumps, which fall to the bottom, and therefore does not become available to the water column. Therefore the STFATE model over-estimates (by an unknown degree) the actual concentration of constituents in the water column. An additional fraction of the elutriate is buried along with the solid materials and is not available to the water column. The availability of elutriate in the water column is discussed in Section 7.6.3 along with other modeling procedures. STFATE modeling results for both a split hull barge and for the hydraulic pumping out of a barge are presented in Section 7.6.4

7.6.2 Site and Material Parameters

The STFATE model requires a number of site parameters including current velocities, vertical water column density gradients, barge dimensions, and material fractions in the barge. The dimensions used for a standard barge were a 170-ft length, 53-ft width, 18-ft loaded draft and 3,000 cubic yard (cu yd) capacity. The capacity was reduced from a maximum of 4,000 cu yd to ensure no spillage during clamshell dredging operations.

7.6.2.1 Site 104

Mean lower low water (MLLW) depths within Site 104 vary between 42 and 78 ft. Dredged material placement was not proposed in the northern one-third of the site where depths are less than 45 feet. A buffer zone was also proposed for the southern 1,200 ft of the site where depths exceed 70 ft. The remaining site lies mainly within the 48-ft to 52-ft MLLW depth contours. A 50-ft depth was used for the STFATE model simulations. This is conservative since deeper depths provide greater mixing potential and consequently result in reduced ambient concentrations.

Allowed dispersion areas for dredged material placement sites typically have dimensions associated with travel times on the order of several hours. For example, the allowed dispersion area for ocean placement is defined as a 4-hour travel time following discharge [40 CFR 227.29(a)] and USEPA/USACE 1991). In addition, USEPA's ambient water quality criteria to protect against chronic effects are based on 4-day average exposure concentrations. Because of the time scales associated with attaining water quality criteria, a tidally averaged current velocity was selected for use in the STFATE model.

Site-specific data on current velocities were obtained during a monitoring program conducted by SAIC during summer 1999 [Science Applications International Corporation (SAIC) 1999, Appendix C]. The field program included the deployment of bottom mounted instrumentation at four stations in Site 104 during both June and July. During the monitoring program, SAIC encountered a problem with the calibration between the raw instrument readings and engineering units. SAIC received a notice from the current sensor manufacturer, Aanderaa, stating that the coefficients were low by a factor of 2. The current velocities published in the SAIC report were therefore increased by a factor of 2. Subsequent to the publication of the report, SAIC received a second notice stating that the factor of 2 error did not apply to the instrument serial numbers used during the Site 104 deployment. Therefore, the SAIC velocity data presented in the following section were decreased by one-half from their reported values.

During June and July 1999, current meters were deployed at four stations in Site 104. Of these four stations, Station 1 was at the northern end of the site in an area where placement was not to take place, and the data retrieval at Stations 2 and 3 was only for a several day period. The average ebb and flood tide velocities for Station 4 at a 1.5-m height from the bottom are presented in the following table during three deployment periods (SAIC 1999, Appendix C).

Date	Average Velocity (cm/sec)	
	Ebb Tide	Flood Tide
14-18 June	21.3	34.7
13-15 July	19.5	30.6
20-27-July	14.2	20.6
Weighted Average	17.1	26.4

An average velocity is also included in the above table that was calculated by weighting the velocities by the number of observations in each deployment period. The resulting average flood tide velocity of 26.4 cm/sec (0.866 ft/sec) measured 1.5 m above the bottom exceeds the 17.1 cm/sec (0.560 ft/sec) ebb tide velocity. These velocities are consistent with the known net upstream bottom flow in the Chesapeake Bay that is induced by density driven circulation. Near the surface of the water column, the ebb tide velocity would exceed the flood tide velocity.

At Site 104, water density increases with depth because of the more saline bottom water. The vertical density difference is typically 0.007 gm/cc (SAIC 1999, Figure 5-1.1). In the STFATE model the surface density was assumed to be 1.005 gm/cc and the bottom density 1.012 gm/cc. The density of the elutriate in the dredged material, collected from a bottom depth shallower than Site 104, was assumed to be 1.011 gm/cc.

7.6.2.2 Norfolk Ocean Disposal Site

Conditions at the NODS were based on information contained in the Environmental Impact Statement (EIS) that was prepared by the USEPA Region III (1992). The site has a radius of 4 nautical miles and depths vary from 43 to 85 ft. Depths near the center of the site vary between 65 and 80 ft. A representative depth of 70 ft was used in the STFATE analysis.

The EIS reported near bottom current velocities to be typically 10 cm/sec (0.33 ft/sec) during the winter. During summer, surface velocities are lower and near bottom velocities approach 2 cm/sec (0.07 ft/sec). The 0.33-ft/sec winter current velocity was used in STFATE, appropriate for the proposed October to March dredging /placement period.

The water density at the NODS was calculated from salinity and temperature. The EIS indicated that the ocean site is at the offshore edge of the lower salinity outflow that discharges from the mouth of the Chesapeake Bay with surface salinity values of approximately 25 ppt. Density profiles were calculated as a function of temperature assuming that salinity varies from 25 ppt at the surface to 30 ppt at the bottom.

Water Density (gm/cc)

Depth	Salinity (ppt)	5° C	10° C	20° C
Surface	25	1.0205	1.0199	1.0179
Bottom	30	1.0247	1.0240	1.0219

The elutriate density of the dredged material in STFATE was assumed to be 1.011 gm/cc. The above table indicates that the water density variation between the dredging site and the ocean placement area is controlled more by the general freshwater/ocean salinity difference than by vertical salinity variation or seasonal changes in temperature. For STFATE, the density profile at the NODS was assumed to increase from 1.020 gm/cc at the surface to 1.024 gm/cc at the bottom.

7.6.2.3 Material Properties

The material fractions used in the STFATE model for both Site 104 and the NODS were based on the physical characteristics data provided in Chapter 6. Table 6-2 provides physical data at 13 proposed dredging locations within the Baltimore Harbor approach channels. Sediment characteristics based on an average of the 13 locations are summarized below.

Material	Sediment Fraction (% dry weight)	Sediment Fraction (% volume)
Sand	12.3	2.21
Silt	47.1	8.48
Clay	40.6	7.31
Water	- -	82.0

The average sediment sample had a moisture content of 61.7% and a specific gravity of 1.33. The moisture content and the specific gravity indicate that the average sediment sample was 82% water (1.33 × 0.617) and 18% solids by volume.

7.6.3 Modeling Procedures

A numerical grid consisting of 45 rows and 29 columns was used for the STFATE model calculations. At Site 104, a 400-ft spacing was used in the longitudinal direction (between rows) and a 200-ft spacing in the transverse direction (between columns). The discharge location was placed in row 3, which provided 40 active cells (16,000 ft) in the longitudinal direction. Model calculations are not performed along the outer two rows and columns. The active width of the model grid was 4,800 ft. The model grid used at Site 104 is illustrated in Figure 7-1. The actual location of the model grid relative to the site varies for each barge release location. For the average ebb tide scenario (0.56 ft/sec), a 5-hour model simulation could be accommodated. However, for the higher velocity flood tide scenario (0.866 ft/sec), only a 4.5-hour simulation was possible before a portion of the released material was lost from the model grid.

At the NODS, the lower 0.33 ft/sec tidal velocity allowed a smaller 250-ft by 150 ft grid spacing to be used, while still accommodating a 5-hour model simulation.

STFATE predicts concentrations throughout the water column at each location on the model grid. In addition to the user-specified depths, the model also provides the maximum water column concentration at each grid location. A composite of the maximum water column concentrations at each time-step in the model simulation was used to develop summary tables of dilution as a function of distance. Within the modeled plume, the maximum concentration occurs along the plume centerline and concentrations decrease in the transverse direction away from the centerline following a Gaussian distribution. For compliance with water quality criteria, a plume average concentration has been allowed under Maryland regulations. An appropriate plume width to use with STFATE was determined by comparison with other MDE approved models. USEPA's CORMIX model is commonly used for National Pollutant Discharge Elimination System (NPDES) permitting and it also assumes a Gaussian distribution. In CORMIX, a plume width is defined as 1.414 standard deviations. This definition of plume width was adopted for application with the STFATE model. Integration under a Gaussian curve for 1.414 standard deviations on either side of the plume centerline indicates that a plume average concentration is 74.7 percent of the centerline value. Plume average concentrations are used in Section 7.6.4 when presenting results of the STFATE model.

The STFATE model was used to evaluate the release from both a split hull barge (Site 104, Norfolk Ocean Disposal Site) and the hydraulic pumping out of a barge (Site 104 only). For the split hull release, the 3,000 cu yd barge capacity was divided into two layers with a total release time of 60 seconds. The hydraulic emptying of the barge is performed by pumping approximately 3-4 parts water to 1 part dredged material. The pumped material is released near bottom, within approximately six pipe diameters. A deflector plate is placed at the end of the pipe to disperse the material and prevent bottom scour. The hydraulic placement of the dredged material from a barge was assumed to take 45 minutes. The 3,000 cu yd barge load was divided into six 500 cu yd layers and released at uniform intervals during the 45-minute period. In STFATE, the material released from a barge quickly falls to the bottom with very little water column interaction. The elutriate then mixes up into the water column from a near-bottom location. The initial placement of the dredged material at a near bottom location by hydraulic pumping is, therefore, very similar to what takes place in STFATE.

Section 7.6.2 indicated that 82 percent of the barge volume consists of water. STFATE models the elutriate fraction as a conservative tracer with a non-varying mass in the water column. There are two potential mechanisms that reduce the available elutriate: (1) a portion of the dredged material in the barge consists of clumps that fall to the bottom without releasing the trapped pore water to the water column, and (2) a portion of the elutriate will be buried along with the dredged material as pore water as it settles to the bottom.

To examine what fraction of the dredged material may exist as clumps, the moisture content of sediment samples was compared to the liquid limit. The liquid limit corresponds to the moisture content at which a material will no longer maintain a fixed shape and begins to flow. The moisture content and liquid limit were available for 48 sediment samples collected in Baltimore Harbor approach channels (EA 2000c, Table 4-12). A procedure for estimating the occurrence of clumps was provided by USACE–WES (Paul Schroeder, 2000, personal communication). Using the WES method, the occurrence of clumps is assumed to be 100% if the moisture content is less than the liquid limit. The occurrence of clumps is assumed to be 0% if the moisture content is greater than 180% of the liquid limit. Between the liquid limit and the 180% value, the clumping fraction is linearly interpolated between 100% and 0%. Applying this technique to the 48 sediment samples resulted in a 52% occurrence of 0% clumps and a 29% occurrence of 20-40% clumps. The average occurrence of clumps in the sediment samples was 18%. If 18% of the dredged material formed into clumps, only 82% of the elutriate contained in the barge would be available to the water column.

An estimation of what portion of the elutriate from the barge is buried along with the dredged material as it settles to the bottom is illustrated in Table 7-29. The STFATE model output indicates that within 30 minutes, 472.7 cu yd of material, 87.5 percent of solids originally in the barge, was deposited on the seafloor. If this material settled at the same compactness (moisture content) as the original dredged material, 2,154 cu yd of water would be required to fill the voids between particles. The average (bulk) dilution of the elutriate from the barge was estimated by examining the dimensions of the elutriate cloud 10, 20, and 30 minutes after placement. For example, after 10 minutes the near bottom cloud had a diameter of 211.4 ft and a thickness of 6.27 ft, resulting is a volume of 8,151 cu yd. This represents an average bulk dilution of 3.3 from the original 2,460 cu yd elutriate volume in the barge. Applying bulk dilution factors 10, 20, and 30 minutes after placement allowed the determination of the fraction of the pore water in the settled material that was obtained from the original elutriate. Table 7-29 indicates that between 10 and 30 minutes the fraction of elutriate from the barge that is buried along with the dredged material increases from 17.1 to 22.0 percent.

The settling of suspended material to the seafloor occurs with a larger void space than was present in the originally dredged sediments. Modeling performed by USACE to examine placement of dredged material at Site 104 used a bulking factor of 1.49, determined from material properties, for placed dredged material immediately after placement (Johnson et al. 1999, Chapter 9). This means that the amount of water buried with the dredged material exceeds the amount originally present in the sediment by approximately 49 percent. The estimation of the amount of original elutriate buried with the dredged material in the previous paragraph assumed that the void space remains unchanged (bulking factor = 1.0). The use of a lower bulking factor is conservative because it results in less elutriate being buried in the sediment and more elutriate available to the water column. The following table provides the percent of original elutriate buried during the first 30 minutes for bulking factors of 1.0, 1.2, and 1.4, a range from very conservative to near a reasonable value.

Original Elutriate (%) Buried with Dredged Material

Minutes	Bulking Factor		
	1.0	1.2	1.4
10	17.1	20.5	28.7
20	20.9	25.1	35.1
30	22.0	26.4	37.0

This analysis indicates that typically 20 to 30% of the elutriate will be buried with the dredged material, and will not be available to the water column. In summary, approximately 18% of the dredged material may be present as clumps, and 20-30% of the remaining 82% of the elutriate is buried along with the dredged material. In combination, these two mechanism remove 34-43% of the elutriate from the water column. Therefore, only 57-66% of the original elutriate will be present in the water column and subject to dispersive processes. The STFATE model was executed for three cases assuming that 50, 75, and 100% of the elutriate was available to the water column. To represent these cases in the model, the volume fraction of clumps was increased to offset the decrease in the elutriate fraction. The elutriate volume fraction was assumed to be 41.0%, 61.5% and 82.0% for the 50%, 75%, and 100% elutriate availability cases.

7.6.4 Discussion of Model Results

STFATE modeling results for the mixing of elutriate into the water column are provided in Tables 7-30 and 7-31 for Site 104 and Table 7-32 for the NODS. At Site 104, Table 7-30 provides for dredged material placement from a split hull barge, and Table 7-31 for the emptying of a barge by hydraulic pumping. Each Site 104 table contains results for an average ebb tide (0.56 ft/sec) and for an average flood tide (0.866 ft/sec) near-bottom current velocity. For the NODS, Table 7-32 provides results for the placement of material from a split hull barge at an average 0.33 ft/sec tidal velocity. The STFATE model result tables provide the distances and times following placement for the elutriate plume to achieve dilution factors ranging from 50 to 500, and for the dilution achieved 1.0 hour and 4.0 hours following the initial release. For each tidal velocity scenario, the STFATE model was executed for three cases corresponding to 50%, 75%, and 100% elutriate availability to the water column. In Section 7.3.3, the fraction of elutriate bound within clumps and reburied as the solid material settled to the seafloor was examined within the initial 30 minutes after release. Based on this discussion, the 75% elutriate availability scenario was considered the most appropriate for use in determinations of compliance with ambient water quality criteria in Section 7.7.

Site 104 – Split Hull Barge

The longitudinal distribution of the elutriate plume for an average ebb tide scenario at Site 104 is illustrated in Figure 7-2. The figure displays the sequence of maximum water column concentration (as well as the concentration and distance distribution) within the elutriate plume at 1-hour intervals after release of dredged material from a barge. In the figure, the y-axis displays the ratio of the water column concentration to the elutriate concentration in the barge (C_o), and the x-axis displays the spatial distribution of the modeled plume at 1-, 2-, 3- and 4-hour intervals.

An examination of the Site 104 ebb and flood tide scenarios in Table 7-30 indicates that a similar dilution is obtained at a similar time following release. However, since the average flood tide velocity of 0.866 ft/sec is approximately 50% greater than the 0.56 ft/sec ebb tide velocity, the dilutions on a flood tide are obtained at an approximately 50% greater distance. For example, a dilution factor of 50 is achieved at a 2,443-ft distance for the ebb tide scenario (75% elutriate availability) and at a 3,477-ft distance for the flood tide scenario. The times associated with a dilution factor of 50 were very similar, 1.21 hours during ebb tide, and 1.12 hours during flood tide. The predominate ebb-flood current direction is aligned with the longer north-south dimension of Site 104. Therefore, the northern one-third of the site, which will not be used for placement because MLLW depths are less than 45 ft, will act to contain the longer flood tide plume dimensions.

A comparison of dilution results between the three elutriate availability scenarios at Site 104 can be made by examining the ebb tide results in Table 7-30. For a dilution factor of 100, the water column distance increases from 2,863 ft to 3,312 ft, and to 3,712 ft for elutriate availability of 50%, 75%, and 100%, respectively.

Site 104 – Hydraulic Pumping

STFATE modeling results for emptying a barge by hydraulic pumping at Site 104 are provided in Table 7-31. By increasing the placement time from 60 seconds to 45 minutes, the instantaneous source strength is reduced, resulting in lower near-field concentrations and increased dilution factors at a given distance. For the ebb tide scenario (75% elutriate availability), the distance to the 100 fold dilution decreased from 3,312 ft using a split hull barge to 2,140 ft for hydraulic pumping. With hydraulic pumping, the distance to achieve similar dilutions did not increase as much between the ebb and flood tide scenarios as was observed with the split hull barge. At a dilution factor of 100, the flood tide scenario had an 11% longer distance, and at a dilution factor of 300, the flood tide scenario had a 20 percent longer distance than the ebb tide scenario.

Norfolk Ocean Disposal Site

STFATE modeling results of the mixing of elutriate into the water column at the NODS due to the placement of dredged material from a split hull barge are provided in Table 7-32. Because of the lower 0.33 ft/sec tidal velocity at the ocean site, a given dilution factor occurs at shorter distance than at Site 104. At the ocean site (75% elutriate availability) dilution factors of 50 and

500 occur at distances of 1,296 and 3,707 ft, while at Site 104 these dilution factors occur at distances of 2,443 and 6,588 ft (75% elutriate availability, ebb tide). At the ocean site, dilution factors occurring 1-hour and 4-hours following the placement are 43 and 1,000, respectively, slightly greater than at Site 104.

7.7 DISCUSSION AND TIER II WATER QUALITY EVALUATION

7.7.1 Evaluation Approach

As discussed in Section 7.5 above, extensive analytical characterizations of elutriate samples from 13 different approach channels (plus 3 placement/reference areas) were conducted. The general approach used to evaluate these data is as follows:

- The analytical data for each of the approach channels and reference areas were tabulated.
- Elutriate analytes which were "detected" are compared to applicable ambient water quality criteria for the protection of saltwater aquatic life and human health from the consumption of contaminated organisms.
- Where detected concentrations exceeded applicable criteria, STFATE modeling results are used to estimate the time and distance required to reduce these 100% elutriate concentrations to comply with ambient water quality criteria values.

This is a complex evaluation because of the large number of analytes, the different tidal conditions, alternate approaches to address concentrations which are less than the analytical detection limit (U-qualified), different release scenarios (hydraulic placement vs. split hull barge release), etc. For this reason, the discussion below is focused on the following assumptions and scenarios, that are believed to be reasonably conservative (i.e., overestimate any potential environmental effects):

- STFATE modeling results are based on a split hull barge release using average ebb tide velocities and 75% elutriate availability (Section 7.6).
- The highest detected concentration in the data set for each channel reach is compared to the saltwater acute (1-hour average) ambient water quality criteria; and the mean concentration is used to compare to the saltwater chronic (4-day average) ambient water quality criteria values.
- The ambient water quality criteria used for this assessment are USEPA's National Recommended Water Quality Criteria (63 Fed. Reg. 68354-68364; 10 December 1998); and MDE's *proposed* water quality criteria (Maryland Register 27(17): 1628-1636; dated 25 August 2000) (Table 7-2). MDE's proposed criteria are much more extensive than the State's current listing, and the criteria for the listed compounds are identical the USEPA's criteria. Human health criteria are based on MDE's 10^{-5} risk-level. Elutriate metal concentrations, which were measured as *total* values, are (conservatively) compared to *dissolved* aquatic life criteria.

- Tables 7-33B, 7-34B and 7-35B calculate mixing factors and compliance distances assuming that analytes reported to be not detected (ND) are equal the detection limit (ND = DL). This is a very conservative assumption, since it assumes that all undetected analytes are actually present in concentrations just barely under their detection limits, which is highly unlikely. Note that the values for Total PCBs (which were rarely detected) are presented as ND=DL, ND= ½ DL and ND=0 to put these measurements in perspective.

7.7.2 Discussion of the Elutriate Data

Few of the more than 150 target analytes evaluated as part of the approved QAPP were detected in the elutriate samples. The results from these analyses are presented in Tables 7-33 through 7-35. When these detected analytes are compared to applicable ambient water quality criteria for the protection of saltwater aquatic life and human health, a much smaller list of chemicals results (Tables 7-36 and 7-37).

The Code of Federal Regulations [40 CFR 227.29(a)] and the USEPA/USACE (1991, Section 5) Ocean Testing Manual for dredged material allow a dispersion area defined by the placement site boundary, or within the site after the 4-hour initial mixing period. Compliance with ambient water quality criteria is evaluated at the edge of that mixing zone area. Similar guidance is not presented in the USEPA/USACE (1998) Inland Testing Manual, although it does state clearly that *"the discharge of dredged material cannot cause the water quality standards to be exceeded outside the mixing zone..."* (p. 55, emphasis added).

7.7.2.1 Placement at Site 104

For discussion purposes, the 13 approach channels, 2 proposed placement areas (Site 104 and the Ocean), and one reference area (Outside 104) are divided into two groups: (1) channel eaches where all ambient water quality criteria are predicted to be met within approximately one hour of release, and (2) channel reaches which have at least one constituent that would require more than approximately one hour to comply with criteria. The discussion below assumes placement using a split hull dredge which is conservative compared to hydraulic placement techniques (based on a review of the STFATE modeling).

Channel Reaches Meeting Ambient Criteria Within One Approximately Hour

There were only 12 constituents detected in the full strength (undiluted) channel elutriate that exceeded aquatic life or human health criteria based simply on numerical comparisons (ignoring critical evaluation factors such as exposure duration and dilution). These constituents were: ammonia, arsenic, beryllium, copper, cyanide, heptachlor, heptachlor epoxide, manganese, total PCBs, silver, sulfide, and tributyltin. As shown in Table 7-36, elutriates from the following channel reaches would be in compliance with all ambient acute, chronic, and human health criteria within approximately one hour of release from a split hull barge (assuming ND=0 or ND=½DL for PCBs):

- C&D Approach Channels (cores)
- Craighill Channel
- Craighill Angle East
- Craighill Entrance
- Craighill Upper Range
- Outside Site 104
- Swan Point Channel
- Tolchester Channel–North
- Tolchester–Straightening

Because (1) releases at the placement site will not be on a continuous basis at a single location; (2) the exposure assumptions that are the basis of USEPA's ambient water quality criteria for the protection of aquatic life and human health are not met; and (3) that all of the elutriate analytes will be in compliance with ambient water quality criteria for the protection of aquatic life and human health within approximately one hour of release from a split hull barge, no unacceptable adverse effects to the water column would be expected from proper management of the materials.

Channel Reaches Requiring Greater Than Approximately One Hour to Meet Criteria

Only three analytes detected in elutriates would require *more* than one hour to achieve compliance with ambient water quality criteria Based on release from a split hull barge (Table 7-36):

- USEPA's chronic aquatic life criterion for hydrogen sulfide,
- USEPA's human health criterion for manganese, and
- USEPA's and MDE's proposed human health criterion for heptachlor.

As shown in Table 7-36, elutriates from five channel reaches (and two reference areas) would require more than one hour to be in compliance with all ambient water quality criteria. It is also noteworthy that only one chemical in each reach requires more than one hour for compliance.

Manganese in Elutriate Samples From Brewerton Channel Eastern Extension, C&D Approach Channels (surficial), and Cutoff Angle

Elutriates from these three channel reaches require more than one hour to comply with USEPA's human health criterion for manganese. STFATE modeling indicates that the time for compliance is 1.39, 1.12 and 1.28 hours, respectively, for these three reaches with a maximum distance of 2,799 ft under ebb flow conditions (Table 7-36). There are several important points regarding the manganese criterion, and whether these concentrations could have any potential effect on receiving waters.

- Manganese is a naturally occurring trace element, "*is a vital micronutrient for both plants and animals,*" and causes health problems if not present in sufficient quantities (USEPA 1993a, p. 157). Manganese was detected in elutriates from every channel reach and control area evaluated in this program, as would be expected based on USEPA's determination that the mean natural "background concentration" in U.S. soils (from which sediments are derived) was 348,000 µg/kg dry weight (USEPA 2000b, Exhibit 5-1).

- USEPA's human health criterion for manganese is 100 µg/L, was published in the Agency's (1976) Red Book, and was intended "*to protect against a possible human health hazard to humans by manganese accumulation in shellfish*" (USEPA 1993a, p. 158). USEPA's criteria document states that the [normal] average human intake is approximately 10 mg per day, but that "*very large doses of manganese can cause some diseases and liver damage, but these are not known to occur in the United States. Only a few manganese toxicity problems have been found throughout the world, and these have occurred under unique circumstances (i.e., a [drinking] well in Japan near a deposit of buried batteries)*" (USEPA 1993a, p. 157).

- The transient and short duration of manganese in the water column will not allow mollusks to achieve a steady-state bioaccumulation factor, and therefore they will not accumulate manganese to high concentrations in their edible tissues. Within less than two hours of release, manganese concentrations are expected to be below USEPA's 100 µg/L criterion, and the site can be managed such that frequent exposures are unlikely.

- The manganese human health criterion is based on humans consuming contaminated aquatic life on a regular basis for a long duration (e.g., 6.5 grams per day for a 70-year lifetime). Because there will not be a continuous release at a given location, and the proposed site will not be operational for more than 10 years, it is clear that no one could consume shellfish collected from the site on a daily basis throughout their lifetime.

In conclusion, the assumptions upon which USEPA's manganese criterion is based are not consistent with the water column exposure that will occur at the proposed dredged material placement site. Furthermore, manganese is not currently regulated by MDE, nor is it contained in MDE's proposed criteria changes [Maryland Register 27(17): 1628-1636; dated 25 August 2000].

Sulfide in Elutriate Samples From Inside Site 104, Tolchester Channel–South, and the Ocean Reference Site

Total sulfide was only detected in elutriates at three locations, and there is some question about the accuracy of the analytical results. More specifically at Inside Site 104, sulfide was only determined in 1 of 3 samples and that sample was J-qualified; at Tolchester Channel–South, it was detected in only 1 of 2 samples (B-qualified); and at the Ocean Reference Site sulfide was determined in the one sample (B-qualified).

Assuming the total sulfide data are accurate, elutriates from each of these locations (one channel reach and two placement/reference areas) would require more than one hour to comply with USEPA's chronic aquatic life criterion for hydrogen sulfide. STFATE modeling indicates that the time for compliance would be 3.65 hours for Inside Site 104, 2.26 hours for Tolchester

South, and 2.5 hours for the Ocean Reference (Table 7-36). There are several important points regarding the chemistry of hydrogen sulfide that influence its potential effect on saltwater aquatic life.

- USEPA's (1998) aquatic life chronic criterion of 2.0 µg/L is based upon the concentration of "*undissociated hydrogen sulfide (H_2S)*," whereas the analytical parameter measured in this program was <u>total sulfide</u>.

- Hydrogen sulfide is a naturally occurring compound that is commonly found in anaerobic aquatic sediments as an anaerobic degradation product of both inorganic and organic sulfur compounds. Under normal environmental conditions, only a small portion of the total sulfide would be expected to be in the form of H_2S. Further, when sediments are disturbed during dredging and release operations, H_2S will be quickly oxidized to yield sulfate compounds (SO_4). As noted by USEPA (1993a), "*the fact that H_2S is oxidized in well-aerated water by natural biological systems to sulfates or is biologically oxidized to elemental sulfur has caused investigators to minimize the toxic effects of H_2S on fish and other aquatic life.*"

- Two of the three stations where elutriate concentrations exceed USEPA chronic criteria are placement or reference areas (Inside Site 104 and the Ocean Reference Site), as opposed to areas that are planned to be dredged.

- USEPA's chronic aquatic life criterion is based on a 4-day average exposure period which is inconsistent with the environmental chemistry of hydrogen sulfide under the dredged material release and organism exposure scenarios expected at Site 104.

In conclusion, the assumptions embedded within USEPA's hydrogen sulfide criterion are not consistent with the water column exposure that will occur at the proposed placement site. Further, hydrogen sulfide is not currently regulated by MDE, nor is it contained in MDE's proposed criteria changes [Maryland Register 27(17): 1628-1636; dated 25 August 2000].

<u>Heptachlor in Elutriate Samples From Craighill Angle West</u>
Heptachlor was the only analyte in elutriate samples from Craighill Angle West that would require more than one hour to comply with USEPA's criteria. STFATE modeling indicates that the time for compliance with the heptachlor criterion is 1.21 hours and would be achieved within 2,279 feet during the average ebb tide (Table 7-36).

Heptachlor (and heptachlor epoxide) are man-made pesticides that were used to control termites and other insects. In late 1978, most uses were phased out, and the chemical is no longer available to the general public. It is, however, strongly adsorbed to soil and extremely resistant to biodegradation (USEPA's Website; www.epa.gov/OGWDW/dwh/t-soc/heptachlor.html). Thus, the heptachlor measured in elutriates from Craighill Angle West, and other Bay channel reaches has probably been in place for a long time without any significant increases from new sources.

USEPA's (1998) ambient criterion for the protection of human health from the consumption of contaminated aquatic life is 0.0021 µg/L (at MDE's 10^{-5} risk level), approximately three times lower than the instrument detection limit. As discussed in USEPA water quality criteria documents (e.g., USEPA 1993a, Appendix C), the Agency's criterion is based upon the following *assumptions*:

- the consumed organisms are exposed to the chemical for a sufficient duration that they reach a maximum steady state tissue concentration,
- a continuously exposed population of edible contaminated organisms from the site that is sufficient to feed a human population on a daily basis for 70 years.
- the criterion is the exposure concentration that is estimated to cause a lifetime carcinogenic risk of 10^{-5} (i.e., causing one additional cancer out of one hundred thousand exposed persons), and
- "*continuous exposure to the compound*" throughout a 70-year human lifespan, e.g., daily consumption of contaminated organisms collected from the site for 70 years.

The assumptions upon which USEPA's heptachlor criterion is based are not consistent with the water column exposure that will occur at the proposed dredged material placement site. These data suggest that no adverse effect would be expected from exposure to heptachlor based upon the properly managed and temporary use of the site.

7.7.2.2 Ocean Placement

Based on the results of the STFATE modeling at the NODS, all constituents detected in the channel elutriates for which WQC exist would be expected to comply with applicable ambient WQC within the 4-hour mixing period allowed by USEPA/USACE (1991) inside the placement site boundaries (Table 7-37).

7.8 CONCLUSIONS AND OBSERVATIONS

The discussion and tables presented above indicate that ambient water quality criteria for the protection of aquatic life and human health criteria are exceeded for a small number of chemicals in full strength (undiluted) elutriate samples. However, given (1) the releases at the site will not be on a continuous basis at a given location; (2) the exposure assumptions that are the basis of USEPA's ambient water quality criteria for the protection of aquatic life and human health are not met; and (3) that all of the elutriate analytes will be in compliance with ambient water quality criteria for the protection of aquatic life and human health within several hours of release from a split hull barge (conservative), unacceptable adverse effects to the water column would not be expected from proper management of the discharges at either Site 104 or NODS. Further, alternate release scenarios (e.g., hydraulic placement under specific tidal conditions) could further reduce water column exposure from elutriate conditions.

Other observations from the elutriate data set include:

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- None of the elutriates prepared from the three placement/reference areas complies with all USEPA criteria. In fact, each of the three reference areas have undiluted elutriate concentrations that exceed USEPA criteria for at least two analytes.

- Out of more than 150 tested analytes, only three constituents (manganese, sulfide, and heptachlor) would require more than 1 hour to achieve compliance with applicable ambient criteria. Two of these (manganese and sulfide) are naturally occurring chemicals which are present in all waterbodies, and the third (heptachlor) has not been commercially available since 1978.

- As shown in Table 7-36, <u>acute</u> criteria were rarely exceeded in the elutriate data set. In every instance except one, compliance with acute criteria would be attained within 3 minutes of release (less than 100 ft). The largest exceedance was for heptachlor at Craighill Angle West, where compliance with criteria would occur within 11 minutes at a distance of approximately 371 ft. USEPA's acute ambient water quality criteria are based upon a 1-hour average exposure concentration.

The ITM (USEPA/USACE 1998) states that after consideration of the Tier II water quality data, one of two possible conclusions is reached regarding the potential water column impact of the proposed dredged material:

1) The available water quality requirements are met. Further information on water column toxicity must be evaluated in Tier III when there are contaminants of concern for which applicable water quality criteria or standards are not available or where interactive effects are of concern.

2) Concentrations of one or more of the dissolved contaminants of concern, after allowance for mixing, exceeds applicable water quality criteria or standards beyond the boundaries of the mixing zone. In this case, the proposed discharge of dredged material does not comply with the water quality criteria or standards.

Although a mixing zone will not be issued for open-water placement, the preceding discussion supports the conclusion that adverse effects in the water column are not expected based upon the extensive set of data collected to date.

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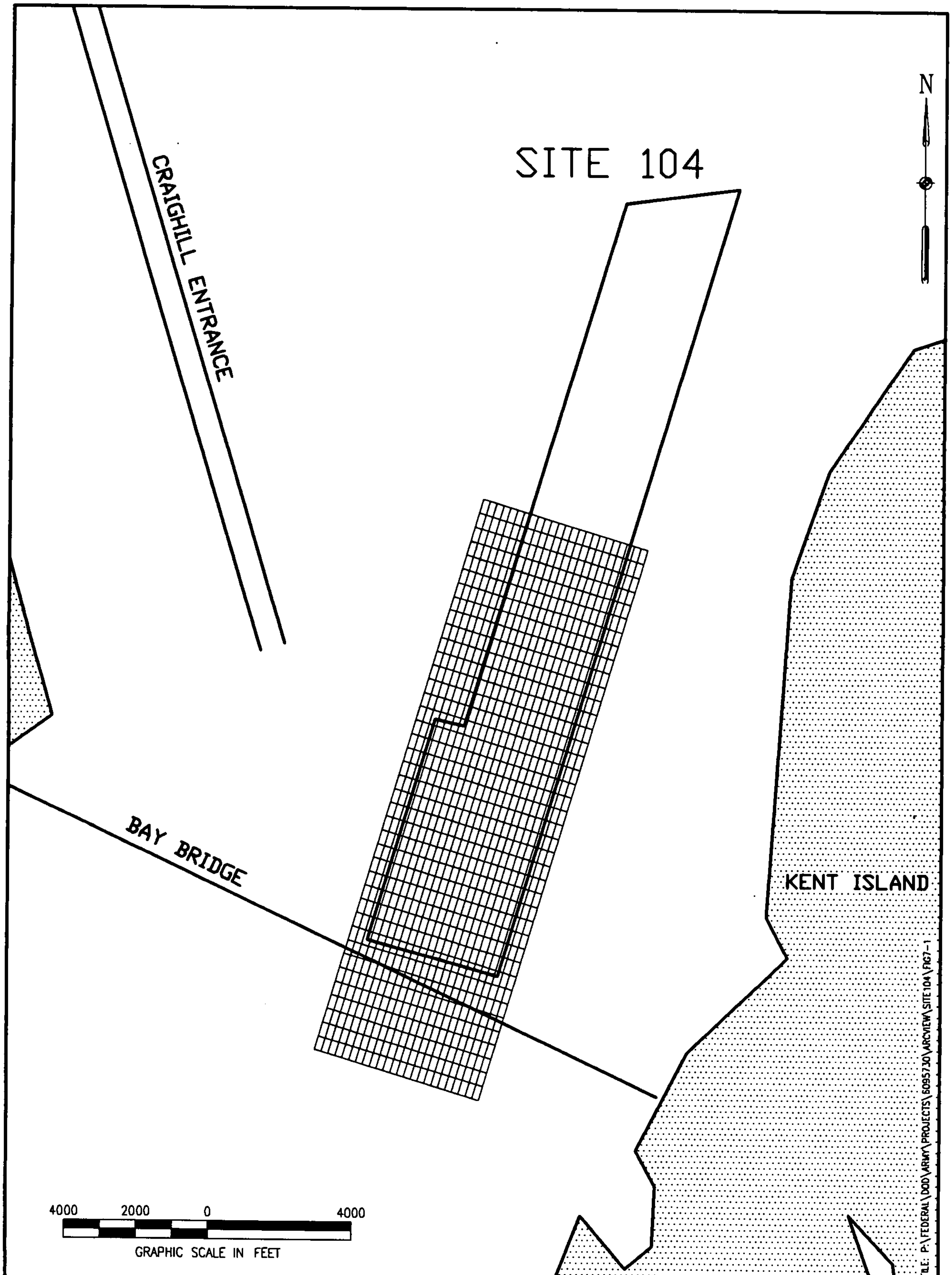

Figure 7-1 STFATE Model Grid at Site 104.

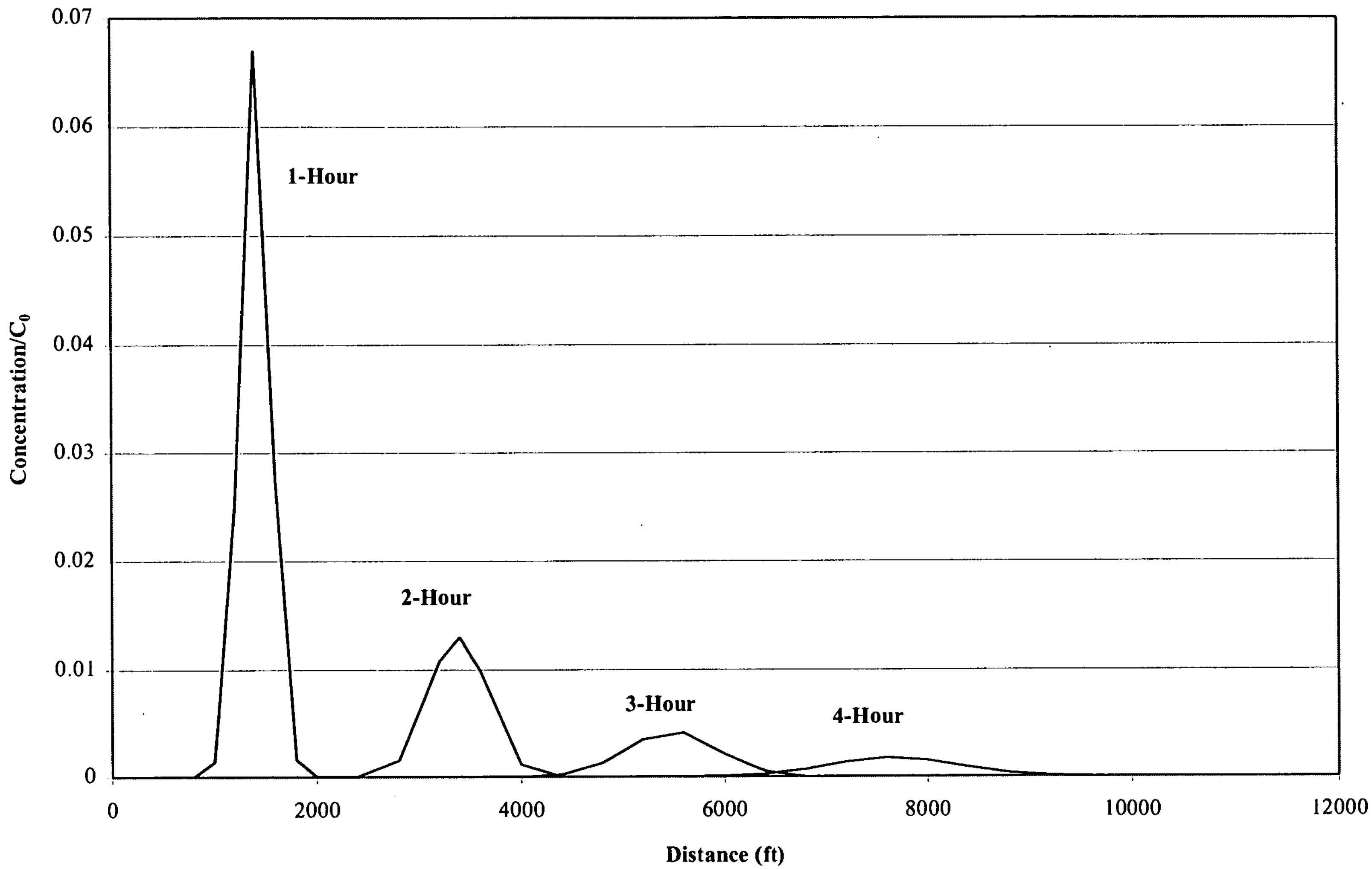

Figure 7-2 STFATE Prediction of Maximum Elutriate Concentration at 1-Hour Intervals after Release (Average Ebb Tide Scenario, 75% Elutriate Availability)

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TABLE 7-1 SEDIMENT COMPOSITES FOR ELUTRIATE TESTING

Sampling Reach	Station	Sediment Aliquot (ml)	Site Water ID and Volume (L)	Elutriate Sample ID
Craighill Entrance	CRE-001VC	500	CRE-SW 8	CRE-VC-EL
	CRE-002VC	500		
	CRE-003VC	500		
	CRE-004VC	500		
Craighill Channel	CR1	666	CR-SW 8	CR-EL
	CR2	666		
	CR3	666		
Craighill Angle-East	CRA-E-001VC	666	CRA-E-SW 8	CRA-E-VC-EL
	CRA-E-002VC	666		
	CRA-E-003VC	666		
Craighill Angle-West	CRA-W-001VC	666	CRA-W-SW 8	CRA-W-VC-EL
	CRA-W-002VC	666		
	CRA-W-003VC	666		
Craighill Upper Range	CRU1	666	CRU-SW 8	CRU-EL
	CRU2	666		
	CRU3	666		
Cutoff Angle	CUT1	666	CUT-SW 8	CUT-EL
	CUT2	666		
	CUT3	666		
Tolchester Channel - South	TLC-S-001VC	500	TLC-S-SW 8	TLC-S-VC-EL
	TLC-S-002VC	500		
	TLC-S-003VC	500		
	TLC-S-004VC	500		
Tolchester Channel - North	TLC-N-005VC	333	TLC-N-SW 8	TLC-N-VC-EL
	TLC-N-006VC	333		
	TLC-N-007VC	333		
	TLC-N-008VC	333		
	TLC-N-009VC	333		
	TLC-N-010VC	333		
Tolchester Straightening	TLS-001VC	1000	TLS-SW 8	TLS-VC-EL
	TLS-002VC	1000		
Brewerton Channel Eastern Extension	BE1	500	BE-SW 8	BE-EL
	BE2	500		
	BE3	500		
	BE4	500		
Swan Point Channel	SWP-001VC	333	SWP-SW 8	SWP-VC-EL
	SWP-002VC	333		
	SWP-003VC	333		
	SWP-004VC	333		
	SWP-005VC	333		
	SWP-006VC	333		
C&D Approach Channels	CD-001VC	1000	CD-VC-SW 8	CD-VC-EL
	CD-002VC	1000		
	CD003	500	CD-SW 8	CD-EL
	CD004	500		
	CD005	500		
	CD006	500		
Inside Site 104	KI-3	400	KI-SW	KI-EL
	KI-5	400		
	KI-7-REF	400		
	KI-S-1	400		
	KI-S-2	400		
	KI-7-REF	1000	KI-SW	KI-7-EL
	KI-7-REFFD	1000		
Outside Site 104	KI-11	500	KI-OUT-SW	KI-OUT
	KI-14	500		
	KI-15	500		
	KI-16	500		

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TABLE 7-2 APPLICABLE FEDERAL AND PROPOSED MDE WATER QUALITY CRITERIA

Analyte	Units	SALTWATER CRITERIA		
		ACUTE [a]	CHRONIC [b]	HUMAN HEALTH [c]
NON-METALS				
CYANIDE	UG/L	1 [d]	1 [d]	
NITROGEN, AMMONIA	MG/L	43 [p]	6.4 [p]	
SULFIDE, TOTAL	UG/L		2 [s]	
VOCs				
DICHLOROMETHANE	UG/L			16000 [u]
SVOCs				
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L			59 [u]
PESTICIDES				
ALPHA-BHC	UG/L			0.13 [u]
BETA-BHC	UG/L			0.46 [u]
ENDOSULFAN I	UG/L	0.034 [k]	0.0087 [k]	240
GAMMA-BHC	UG/L	0.16		0.63 [u]
HEPTACHLOR	UG/L	0.053	0.0036	0.0021 [u]
HEPTACHLOR EPOXIDE	UG/L	0.053	0.0036	0.0011 [u]
PCBs				
TOTAL PCB	UG/L			0.0017 eu
PAHs				
FLUORENE	UG/L			14,000
PYRENE	UG/L			11000
METALS				
ANTIMONY	UG/L			4300
ARSENIC	UG/L	69 [f]	36 [f]	0.14 [g]
BERYLLIUM	UG/L			0.117 [h]
CHROMIUM	UG/L	1100 [i]	50 [i]	
COPPER	UG/L	4.8 [j]	3.1 [j]	
LEAD	UG/L	210 [l]	8.1 [l]	
MANGANESE	UG/L			100
MERCURY	UG/L	1.8 [m]	0.94 [m]	0.051
NICKEL	UG/L	74 [o]	8.2 [o]	4600
SELENIUM	UG/L	290 [q]	71 [q]	
SILVER	UG/L	1.9 [r]		
ZINC	UG/L	90 [t]	81 [t]	
TRIBUTYLTIN	UG/L	0.37 [n]	0.01 [n]	

Superscripts:

a = acute aquatic life criteria based on 1-hr average exposure concentrations.
b = chronic aquatic life criteria based on 4-day average exposure concentrations.
c = USEPA human health criteria based on daily lifetime (70-year) average consumption of aquatic organisms; criteria based on 10^{-5} risk for carcinogens.
d = free cyanide as µg CN/L
e = applies to Total PCBs (sum of all congeners or isomer analyses).
f = total dissolved arsenic.
g = inorganic arsenic only.
h = from EPA 1986 Gold Book; no EPA 1998 number.
i = dissolved chromium; hexavalent.
j = dissolved copper.
k = most appropriately applied to sum of alpha (I) and beta (II) endosulfan.
l = dissolved lead.
m = dissolved total mercury.
n = proposed criteria.
o = dissolved nickel.
p = total ammonia as nitrogen; assumes cold weather conditions: salinity = 10 ppt, water temperature = 10 C, and pH=7.4
q = dissolved selenium.
r = dissolved silver.
s = undissociated hydrogen sulfide (H_2S).
t = dissolved zinc.
u = carcinogen

TABLE 7-3 CONCENTRATIONS OF INORGANIC NON-METALS (MG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
CYANIDE	MG/L	0.003	0.005U	0.005U	0.005U	0.003U
NITROGEN, AMMONIA	MG/L	0.02	**0.32**	**0.23**	**0.15**	**0.13**
NITROGEN, NITRATE AND NITRITE	MG/L	0.003	0.02U	0.02U	**0.11**	0.004U
NITROGEN, TOTAL KJELDAHL	MG/L	0.19	**0.63**	**0.87**	**0.55**	**0.63**
OXYGEN DEMAND, BIOCHEMICAL	MG/L	1	**3**	**2.6**	**3.23**	2U
OXYGEN DEMAND, CHEMICAL	MG/L	4.4	**415**	**441**	**404**	**221**
PHOSPHORUS, TOTAL	MG/L	0.01	0.01U	0.01U	0.05U	**0.09**
SULFIDE, TOTAL	MG/L	0.35	0.35U	0.35U	**0.76B**	**0.93B**
TOTAL ORGANIC CARBON	MG/L	0.08	**1.2**	**1**	2U	**4.3**

U = not detected. **B** = found in blank.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-4 MAXIMUM CONCENTRATIONS OF INORGANIC NON-METALS (MG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
ANALYTE	**UNIT**	**MIN DL**																
CYANIDE	MG/L	0.0031	0.0031U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.06U	0.005U	0.06U	0.005U	**0.005**	0.005U	0.005U
NITROGEN, AMMONIA	MG/L	0.02	**0.38**	**2.8**	**1.7**	**2.3**	**1.3**	**2.2**	**1.2**	**18.1**	**8.6**	**9.8**	**2.5**	**4.2**	**4.1**	**11.2**	**4.42**	**2.9**
NITRITE	MG/L	0.005	**0.88**	0.02U	0.02U	0.02U	**0.02**	**0.1**	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
NITROGEN, TOTAL KJELDAHL	MG/L	0.19	**0.8**	**4**	**3.8**	**4.3**	**1.3**	**1.1**	**1**	**10.1**	**7.8**	**8.6**	**3.3**	**5.1**	**7.1**	**4.6**	**9.8**	**4.29**
OXYGEN DEMAND, BIOCHEMICAL	MG/L	0.37	2U	1U	**22.7<**	**1**	1U	**1.2**	**2.1**	1U	**22.1>**	**21.3>**	**1**	**1.08**	**2U**	**2.4**	**22.9<**	**2.8**
OXYGEN DEMAND, CHEMICAL	MG/L	4.4	**291**	**657**	**433**	**606**	**307**	**227**	**444**	**417**	**575**	**691**	**638**	**535**	**459**	**452**	**393**	**466**
pH	pH	-	NM	**7.89**	**7.92**	**7.9**	**8**	**8.08**	**7.6**	**7.65**	**7.63**	**7.45**	**7.73**	**7.8**	**8.07**	**8.17**	**8.06**	**8**
PHOSPHORUS, TOTAL	MG/L	0.01	**1.3**	**0.24**	**0.76**	**0.2**	**0.16B**	**0.02**	**0.06**	**0.1**	**0.15**	**0.05**	**0.12**	**0.15**	**0.76**	**0.05**	**0.21**	**0.05**
SULFIDE, TOTAL	MG/L	0.35	**0.49B**	0.35U	**3.5J**	0.35U	0.35U	0.35U	0.35U	0.35U	0.35U	0.35U	0.35U	0.35U	0.35U	0.35U	**0.44B**	0.35U
TOTAL ORGANIC CARBON	MG/L	0.08	**31.5**	**28**	**65.9**	**8**	**8**	**8**	**8**	**8**	8U	**10.3**	8U	**8**	**8**	**8**	**506**	**8**

U = not detected. **B** = found in blank. **J** = estimated value.

NM = not measured.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-5 MEAN CONCENTRATIONS OF INORGANIC NON-METALS (MG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East
# ELUTRIATES TESTED:			1[a]	1[a]	3	2	2	2	2	2
CYANIDE	MG/L	0.0031	0.0031U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NITROGEN, AMMONIA	MG/L	0.02	0.38	2.8	1.250	2.2	1.15	2.1	0.705	10.2
NITROGEN, NITRATE AND NITRITE	MG/L	0.005	0.88	0.02 U	0.02 U	0.02 U	0.02	0.06	0.02 U	0.02 U
NITROGEN, TOTAL KJELDAHL	MG/L	0.19	0.8	4	2.7	2.8	1.3	1.03	0.65	7.25
OXYGEN DEMAND, BIOCHEMICAL	MG/L	0.37	2U	1.0 U	9.2	0.815	0.685 U	0.93	1.55	0.685 U
OXYGEN DEMAND, CHEMICAL	MG/L	4.4	291	657	355	522	186	134	419	266
pH	pH	-	NM	7.89	7.31	7.72	7.69	7.79	7.53	7.48
PHOSPHORUS, TOTAL	MG/L	0.01	1.3	0.24	0.313	0.135	0.095	0.015	0.035	0.07
SULFIDE, TOTAL	MG/L	0.35	0.49B	0.35 U	1.4	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
TOTAL ORGANIC CARBON	MG/L	0.08	31.5	28	24.7	6.3	5.05	6.9	4.7	4.13

ANALYTE	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:	2	2	2	2	2	2	2	2
CYANIDE	0.005 U	0.0325 U	0.005 U	0.0325 U	0.005 U	0.005	0.005 U	0.005 U
NITROGEN, AMMONIA	5.56	6.45	2.25	3.7	3	5.96	4.41	2.54
NITROGEN, NITRATE AND NITRITE	0.0125 U	0.02 U	0.02 U	0.02 U	0.0125 U	0.02 U	0.0125 U	0.0125 U
NITROGEN, TOTAL KJELDAHL	5.02	8.2	2.04	4.85	5.95	3.95	7.07	4.25
OXYGEN DEMAND, BIOCHEMICAL	11.6	11.2	0.785	1.04	1.7 U	1.42	13.2	2.25
OXYGEN DEMAND, CHEMICAL	498	566	536	484	317	339	321	337
pH	7.62	7.43	7.72	7.73	7.51	7.84	7.81	7.68
PHOSPHORUS, TOTAL	0.085	0.045	0.075	0.08	0.41	0.035	0.18	0.045
SULFIDE, TOTAL	0.35 U	0.195	0.35 U	0.35 U	0.35 U	0.35 U	0.395	0.35 U
TOTAL ORGANIC CARBON	4.04 U	9.15	4.04 U	4.28	5.55	4.13	257	6.07

U = not detected. B = found in blank.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NM = not measured.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-6 CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
1,1,1-TRICHLOROETHANE	UG/L	1	NT	NT	1U	1U
1,1,2,2-TETRACHLOROETHANE	UG/L	1	NT	NT	1U	1U
1,1,2-TRICHLOROETHANE	UG/L	0.7	NT	NT	0.7U	1U
1,1-DICHLOROETHANE	UG/L	0.6	NT	NT	0.6U	1U
1,1-DICHLOROETHYLENE	UG/L	1	NT	NT	1U	1U
1,2-DICHLOROETHANE	UG/L	0.8	NT	NT	0.8U	1U
1,2-DICHLOROPROPANE	UG/L	0.7	NT	NT	0.7U	1U
2-CHLOROETHYL VINYL ETHER	UG/L	2	NT	NT	2U	2U
ACROLEIN	UG/L	6	NT	NT	6U	6U
ACRYLONITRILE	UG/L	6	NT	NT	6U	6U
BENZENE	UG/L	0.6	NT	NT	0.6U	1U
BROMODICHLOROMETHANE	UG/L	0.6	NT	NT	0.6U	1U
BROMOMETHANE	UG/L	1	NT	NT	1U	1U
CARBON DISULFIDE	UG/L	0.7	NT	NT	0.7U	1U
CARBON TETRACHLORIDE	UG/L	1	NT	NT	1U	1U
CFC-11	UG/L	1	NT	NT	1U	1U
CFC-12	UG/L	2	NT	NT	2U	1U
CHLOROBENZENE	UG/L	0.8	NT	NT	0.8U	1U
CHLORODIBROMOMETHANE	UG/L	0.5	NT	NT	0.5U	1U
CHLOROETHANE	UG/L	0.8	NT	NT	0.8U	1U
CHLOROFORM	UG/L	0.6	NT	NT	0.6U	1U
CHLOROMETHANE	UG/L	0.5	NT	NT	0.5U	2U
CIS-1,3-DICHLOROPROPENE	UG/L	0.7	NT	NT	0.7U	1U
DICHLOROMETHANE	UG/L	1	NT	NT	1U	1U
ETHYLBENZENE	UG/L	0.7	NT	NT	0.7U	1U
METHYLBENZENE	UG/L	0.7	NT	NT	0.7U	1U
TETRACHLOROETHENE	UG/L	1	NT	NT	1U	1U
TRANS-1,2-DICHLOROETHENE	UG/L	1	NT	NT	1U	1U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.7	NT	NT	0.7U	1U
TRIBOMOMETHANE	UG/L	1	NT	NT	1U	1U
TRICHLOROETHYLENE	UG/L	1	NT	NT	1U	1U
VINYL CHLORIDE	UG/L	0.9	NT	NT	0.9U	1U

U = not detected.

DL = detection limit.

NT = not tested

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TABLE 7-7 CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
REACH ID:																		
# ELUTRIATES TESTED:			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1,1,1-TRICHLOROETHANE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1,2,2-TETRACHLOROETHANE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1,2-TRICHLOROETHANE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
1,1-DICHLOROETHANE	UG/L	0.6	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U
1,1-DICHLOROETHYLENE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,2-DICHLOROBENZENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
1,2-DICHLOROETHANE	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
1,2-DICHLOROPROPANE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
1,4-DICHLOROBENZENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2-CHLOROETHYL VINYL ETHER	UG/L	2	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
ACROLEIN	UG/L	6	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U
ACRYLONITRILE	UG/L	6	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U	6U
BENZENE	UG/L	0.6	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U
BROMODICHLOROMETHANE	UG/L	0.6	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U
BROMOMETHANE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
CARBON DISULFIDE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
CARBON TETRACHLORIDE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
CFC-11	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
CFC-12	UG/L	2	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
CHLOROBENZENE	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
CHLORODIBROMOMETHANE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
CHLOROETHANE	UG/L	0.8	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U	0.8U
CHLOROFORM	UG/L	0.6	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U	0.6U
CHLOROMETHANE	UG/L	0.5	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
CIS-1,3-DICHLOROPROPENE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
DICHLOROMETHANE	UG/L	1	1U	**130**	**110**	**160**	**22**	**120**	**110**	**110**	**110**	**170**	**160**	**34**	**680E**	**16**	**30**	**140**
ETHYLBENZENE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
M-DICHLOROBENZENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
METHYLBENZENE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
TETRACHLOROETHENE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TRANS-1,2-DICHLOROETHENE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.7	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U	0.7U
TRIBOMOMETHANE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
TRICHLOROETHYLENE	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
VINYL CHLORIDE	UG/L	0.9	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U	0.9U

U = not detected. E = exceeds calibration range of the instrument.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

TABLE 7-8 CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
1,2,4-TRICHLOROBENZENE	UG/L	2	2U	2U	2U	2U
1,2-DICHLOROBENZENE	UG/L		2U	2U	2U	
1,2-DIPHENYLHYDRAZINE	UG/L	3	3U	3U	3U	3U
1,4-DICHLOROBENZENE	UG/L	2	2U	2U	2U	2U
1-METHYLNAPHTHALENE	UG/L	0.31	0.31U	0.31U	0.31U	0.31U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/L	1	1U	1U	1U	1U
2,4,6-TRICHLOROPHENOL	UG/L	2	2U	2U	2U	2U
2,4-DICHLOROPHENOL	UG/L	2	2U	2U	2U	2U
2,4-DIMETHYLPHENOL	UG/L	4	4U	4U	4U	4U
2,4-DINITROPHENOL	UG/L	23	23U	23U	23U	23U
2,4-DINITROTOLUENE	UG/L	2	2U	2U	2U	2U
2,6-DINITROTOLUENE	UG/L	2	2U	2U	2U	2U
2-CHLORONAPHTHALENE	UG/L	2	2U	2U	2U	2U
2-CHLOROPHENOL	UG/L	1	1U	1U	1U	1U
2-METHYL-4,6-DINITROPHENOL	UG/L	5	5U	5U	5U	5U
2-METHYLNAPHTHALENE	UG/L	0.21	0.21U	0.21U	0.21U	0.21U
2-METHYLPHENOL	UG/L	2	2U	2U	2U	2U
2-NITROPHENOL	UG/L	3	3U	3U	3U	3U
3,3'-DICHLOROBENZIDINE	UG/L	7	7U	7U	7U	7U
3,4-METHYLPHENOL	UG/L	2	2U	2U	2U	2U
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	UG/L	2	2U	2U	2U	2U
4-BROMOPHENYL PHENYL ETHER	UG/L	3	3U	3U	3U	3U
4-CHLORO-3-METHYLPHENOL	UG/L	1	1U	1U	1U	1U
4-CHLOROPHENYL PHENYL ETHER	UG/L	2	2U	2U	2U	2U
4-NITROPHENOL	UG/L	4	4U	4U	4U	4U
BENZOIC ACID	UG/L	34	34U	34U	34U	34U
BENZYL ALCOHOL	UG/L	2	2U	2U	2U	2U
BENZYL BUTYL PHTHALATE	UG/L	2	2U	2U	2U	2U
BIS(2-CHLOROETHOXY)METHANE	UG/L	2	2U	2U	2U	2U
BIS(2-CHLOROETHYL) ETHER	UG/L	2	2U	2U	2U	2U

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TABLE 7-8 (CONTINUED)

ANALYTE	UNIT	MIN DL	KI-03	KI-07	KI-14	
Sample ID:			**KI-03**	**KI-07**	**KI-14**	
Reach ID:			**Inside Site 104**	**Inside Site 104**	**Outside Site 104**	**Ocean Reference**
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	2	2U	2U	2U	**3B**
DIBENZOFURAN	UG/L	2	2U	2U	2U	2U
DIETHYL PHTHALATE	UG/L	3	3U	3U	3U	3U
DIMETHYL PHTHALATE	UG/L	3	3U	3U	3U	3U
DI-N-BUTYL PHTHALATE	UG/L	4	4U	4U	4U	4U
DI-N-OCTYL PHTHALATE	UG/L	3	3U	3U	3U	3U
HEXACHLORO-1,3-BUTADIENE	UG/L	2	2U	2U	2U	2U
HEXACHLOROBENZENE	UG/L	3	3U	3U	3U	3U
HEXACHLOROCYCLOPENTADIENE	UG/L	4	4U	4U	4U	4U
HEXACHLOROETHANE	UG/L	2	2U	2U	2U	2U
M-DICHLOROBENZENE	UG/L	2	2U	2U	2U	2U
METHANAMINE, N-METHYL-N-NITROSO	UG/L	3	3U	3U	3U	3U
NITROBENZENE	UG/L	3	3U	3U	3U	3U
N-NITROSODI-N-PROPYLAMINE	UG/L	4	4U	4U	4U	4U
N-NITROSODIPHENYLAMINE	UG/L	4	4U	4U	4U	4U
PENTACHLOROPHENOL	UG/L	2	2U	2U	2U	2U
PHENOL	UG/L	2	2U	2U	2U	2U

U = not detected. **B** = found in blank.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-9 MAXIMUM CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1[(a)]	1[(a)]	3	2	2	2	2	2	2	2	2	2	2	2	2	2
1,2,4-TRICHLOROBENZENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
1,2-DIPHENYLHYDRAZINE	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
1-METHYLNAPHTHALENE	UG/L	0.31	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U	0.31U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/L	1	1U	1U	1U	1U	1.1U	1U	1U	1U	1U	1.2U	1U	1U	1.1U	1U	1U	1.1U
2,4,6-TRICHLOROPHENOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2,4-DICHLOROPHENOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2,4-DIMETHYLPHENOL	UG/L	4	4U	4U	4U	4U	4.3U	4U	4U	4U	4U	4.9U	4U	4U	4.3U	4U	4U	4.3U
2,4-DINITROPHENOL	UG/L	23	23U	23U	23U	23U	24U	23U	23U	23U	23U	28U	23U	23U	25U	23U	23U	25U
2,4-DINITROTOLUENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2,6-DINITROTOLUENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2-CHLORONAPHTHALENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2-CHLOROPHENOL	UG/L	1	1U	1U	1U	1U	1.1U	1U	1U	1U	1U	1.2U	1U	1U	1.1U	1U	1U	1.1U
2-METHYL-4,6-DINITROPHENOL	UG/L	5	5U	5U	5U	5U	5.3U	5U	5U	5U	5U	6.1U	5U	5U	5.4U	5U	5U	5.4U
2-METHYLNAPHTHALENE	UG/L	0.21	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U	0.21U
2-METHYLPHENOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
2-NITROPHENOL	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
3,3'-DICHLOROBENZIDINE	UG/L	7	7U	7U	7U	7U	7.4U	7U	7U	7U	7U	8.5U	7U	7U	7.6U	7U	7U	7.5U
3,4-METHYLPHENOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
ONE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
4-BROMOPHENYL PHENYL ETHER	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
4-CHLORO-3-METHYLPHENOL	UG/L	1	1U	1U	1U	1U	1.1U	1U	1U	1U	1U	1.2U	1U	1U	1.1U	1U	1U	1.1U
4-CHLOROPHENYL PHENYL ETHER	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
4-NITROPHENOL	UG/L	4	4U	4U	4U	4U	4.3U	4U	4U	4U	4U	4.9U	4U	4U	4.3U	4U	4U	4.3U
BENZOIC ACID	UG/L	34	34U	34U	34U	34U	36U	34U	34U	34U	34U	41U	34U	34U	37U	34U	34U	37U
BENZYL ALCOHOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
BENZYL BUTYL PHTHALATE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
BIS(2-CHLOROETHOXY)METHANE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
BIS(2-CHLOROETHYL) ETHER	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	2	2U	2U	**2.9**	2U	2.1U	**11**	2U	**3.2**	2U	2.4U	2U	**2**	2.2U	**15**	**28**	**2.2**
DIBENZOFURAN	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
DIETHYL PHTHALATE	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
DIMETHYL PHTHALATE	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
DI-N-BUTYL PHTHALATE	UG/L	4	4U	4U	4U	4U	4.3U	4U	4U	4U	4U	4.9U	4U	4U	4.3U	4U	4U	4.3U
DI-N-OCTYL PHTHALATE	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
HEXACHLORO-1,3-BUTADIENE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
HEXACHLOROBENZENE	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
HEXACHLOROCYCLOPENTADIENE	UG/L	4	4U	4U	4U	4U	4.3U	4U	4U	4U	4U	4.9U	4U	4U	4.3U	4U	4U	4.3U
HEXACHLOROETHANE	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
METHANAMINE, N-METHYL-N-NITROSO	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
NITROBENZENE	UG/L	3	3U	3U	3U	3U	3.2U	3U	3U	3U	3U	3.7U	3U	3U	3.3U	3U	3U	3.2U
N-NITROSODI-N-PROPYLAMINE	UG/L	4	4U	4U	4U	4U	4.3U	4U	4U	4U	4U	4.9U	4U	4U	4.3U	4U	4U	4.3U
N-NITROSODIPHENYLAMINE	UG/L	4	4U	4U	4U	4U	4.3U	4U	4U	4U	4U	4.9U	4U	4U	4.3U	4U	4U	4.3U
PENTACHLOROPHENOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U
PHENOL	UG/L	2	2U	2U	2U	2U	2.1U	2U	2U	2U	2U	2.4U	2U	2U	2.2U	2U	2U	2.2U

U = not detected.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-10 MEAN CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1[a]	1[a]	3	2	2	2	2	2	2	2	2	2	2	2	2	2
1,2,4-TRICHLOROBENZENE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
1,2-DIPHENYLHYDRAZINE	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
1-METHYLNAPHTHALENE	UG/L	0.31	0.31U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/L	1	1U	1.0 U	1.0 U	1.0 U	1.05 U	1.0 U	1.0 U	1.0 U	1.0 U	1.1 U	1.0 U	1.0 U	1.05 U	1.0 U	1.0 U	1.05 U
2,4,6-TRICHLOROPHENOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
2,4-DICHLOROPHENOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
2,4-DIMETHYLPHENOL	UG/L	4	4U	4.0 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.0 U	4.0 U	4.45 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.15 U
2,4-DINITROPHENOL	UG/L	23	23U	23.0 U	23.0 U	23.0 U	23.5 U	23.0 U	23.0 U	23.0 U	23.0 U	25.5 U	23.0 U	23.0 U	24.0 U	23.0 U	23.0 U	24.0 U
2,4-DINITROTOLUENE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
2,6-DINITROTOLUENE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
2-CHLORONAPHTHALENE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
2-CHLOROPHENOL	UG/L	1	1U	1.0 U	1.0 U	1.0 U	1.05 U	1.0 U	1.0 U	1.0 U	1.0 U	1.1 U	1.0 U	1.0 U	1.05 U	1.0 U	1.0 U	1.05 U
2-METHYL-4,6-DINITROPHENOL	UG/L	5	5U	5.0 U	5.0 U	5.0 U	5.15 U	5.0 U	5.0 U	5.0 U	5.0 U	5.55 U	5.0 U	5.0 U	5.2 U	5.0 U	5.0 U	5.2 U
2-METHYLNAPHTHALENE	UG/L	0.21	0.21U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
2-METHYLPHENOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
2-NITROPHENOL	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
3,3'-DICHLOROBENZIDINE	UG/L	7	7U	7.0 U	7.0 U	7.0 U	7.2 U	7.0 U	7.0 U	7.0 U	7.0 U	7.75 U	7.0 U	7.0 U	7.3 U	7.0 U	7.0 U	7.25 U
3,4-METHYLPHENOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
4-BROMOPHENYL PHENYL ETHER	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
4-CHLORO-3-METHYLPHENOL	UG/L	1	1U	1.0 U	1.0 U	1.0 U	1.05 U	1.0 U	1.0 U	1.0 U	1.0 U	1.1 U	1.0 U	1.0 U	1.05 U	1.0 U	1.0 U	1.05 U
4-CHLOROPHENYL PHENYL ETHER	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
4-NITROPHENOL	UG/L	4	4U	4.0 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.0 U	4.0 U	4.45 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.15 U
BENZOIC ACID	UG/L	34	34U	34.0 U	34.0 U	34.0 U	35.0 U	34.0 U	34.0 U	34.0 U	34.0 U	37.5 U	34.0 U	34.0 U	35.5 U	34.0 U	34.0 U	35.5 U
BENZYL ALCOHOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
BENZYL BUTYL PHTHALATE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
BIS(2-CHLOROETHOXY)METHANE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
BIS(2-CHLOROETHYL) ETHER	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	2	2U	2.0 U	**2.17**	2.0 U	2.05 U	**6.5**	2.0 U	**2.2**	2.0 U	2.2 U	2.0 U	**1.75**	2.1 U	**8.5**	**15**	**2**
DI-N-BUTYL PHTHALATE	UG/L	4	2U	4.0 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.0 U	4.0 U	4.45 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.15 U
DI-N-OCTYL PHTHALATE	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
DIBENZOFURAN	UG/L	2	3U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
DIETHYL PHTHALATE	UG/L	3	4U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
DIMETHYL PHTHALATE	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
HEXACHLORO-1,3-BUTADIENE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
HEXACHLOROBENZENE	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
HEXACHLOROCYCLOPENTADIENE	UG/L	4	4U	4.0 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.0 U	4.0 U	4.45 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.15 U
HEXACHLOROETHANE	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
METHANAMINE, N-METHYL-N-NITROSO	UG/L	3	3U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
N-NITROSODI-N-PROPYLAMINE	UG/L	4	3U	4.0 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.0 U	4.0 U	4.45 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.15 U
N-NITROSODIPHENYLAMINE	UG/L	4	4U	4.0 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.0 U	4.0 U	4.45 U	4.0 U	4.0 U	4.15 U	4.0 U	4.0 U	4.15 U
NITROBENZENE	UG/L	3	4U	3.0 U	3.0 U	3.0 U	3.1 U	3.0 U	3.0 U	3.0 U	3.0 U	3.35 U	3.0 U	3.0 U	3.15 U	3.0 U	3.0 U	3.1 U
PENTACHLOROPHENOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U
PHENOL	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.05 U	2.0 U	2.0 U	2.0 U	2.0 U	2.2 U	2.0 U	2.0 U	2.1 U	2.0 U	2.0 U	2.1 U

U = not detected.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-11 CONCENTRATIONS OF CHLORINATED PESTICIDES, ORGANOPHOSPORUS PESTICIDES, AND PCB AROCLORS (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
4,4'-DDD	UG/L	0.01	0.01U	0.01UJ	0.01U	0.01U
4,4'-DDE	UG/L	0.02	0.02U	0.02UJ	0.02U	0.02U
4,4'-DDT	UG/L	0.02	0.02U	0.02UJ	0.02U	0.02U
ALDRIN	UG/L	0.02	0.02U	0.02UJ	0.02U	0.02U
ALPHA-BHC	UG/L	0.01	0.01U	0.01UJ	0.01U	0.01U
BETA-BHC	UG/L	0.01	0.01U	**0.02J**	0.01U	0.01U
CHLORBENSIDE	UG/L	0.1	0.1UJ	0.1UJ	0.1U	0.1U
CHLORDANE	UG/L	0.1	0.1U	0.1UJ	0.1U	0.1U
DACTHAL	UG/L	0.1	0.1U	0.1UJ	0.3U	0.1U
DELTA-BHC	UG/L	0.01	0.01U	0.01UJ	0.01U	0.01U
DIELDRIN	UG/L	0.01	0.01U	0.01UJ	0.01U	0.01U
ENDOSULFAN I	UG/L	0.01	0.01U	0.01UJ	0.01U	0.01U
ENDOSULFAN II	UG/L	0.02	0.02U	0.02UJ	0.02U	0.02U
ENDOSULFAN SULFATE	UG/L	0.02	0.02U	0.02UJ	0.02U	0.02U
ENDRIN	UG/L	0.03	0.03U	0.03UJ	0.03U	0.03U
ENDRIN ALDEHYDE	UG/L	0.03	0.03U	0.03UJ	0.03U	0.03U
GAMMA-BHC	UG/L	0.0081	0.0081U	**0.0097J**	0.0081U	0.0081U
HEPTACHLOR	UG/L	0.02	0.02U	0.02UJ	0.02U	0.02U
HEPTACHLOR EPOXIDE	UG/L	0.01	0.01U	**0.03J**	0.01U	0.01U
METHOXYCHLOR	UG/L	0.08	0.08U	0.08UJ	0.08U	0.08U
MIREX	UG/L	0.1	0.1U	0.1UJ	0.1U	0.1U
TOXAPHENE	UG/L	0.49	0.49U	0.49UJ	0.49U	0.49U
AZINPHOS METHYL	UG/L	0.58	0.58U	0.58U	0.58U	0.58U
DEMETON	UG/L	2	2U	2U	2U	2U
ETHYL PARATHION	UG/L	1	1U	1U	1U	1U
MALATHION	UG/L	0.22	0.22U	0.22U	0.22U	0.22U
METHYL PARATHION	UG/L	0.24	0.24U	0.24U	0.24U	0.24U
AROCLOR 1016	UG/L	0.33	0.33U	0.33UJ	0.33U	0.33U
AROCLOR 1221	UG/L	0.32	0.32U	0.32UJ	0.32U	0.32U
AROCLOR 1232	UG/L	0.29	0.29U	0.29UJ	0.29U	0.29U
AROCLOR 1242	UG/L	0.3	0.3U	0.3UJ	0.3U	0.3U
AROCLOR 1248	UG/L	0.09	0.09U	0.09UJ	0.09U	0.09U
AROCLOR 1254	UG/L	0.44	0.44U	0.44UJ	0.44U	0.44U
AROCLOR 1260	UG/L	0.41	0.41U	0.41UJ	0.41U	0.41U

U = not detected J = estimated value

MIN DL = minimum detection limit

NOTE: [illegible] concentrations

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TABLE 7-12 MAXIMUM CONCENTRATIONS OF CHLORINATED PESTICIDES, ORGANOPHOSPHORUS PESTICIDES, AND PCB AROCLORS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
4,4'-DDD	UG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
4,4'-DDE	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDT	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
ALDRIN	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
ALPHA-BHC	UG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
AROCLOR 1016	UG/L	0.33	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U	0.33U
AROCLOR 1221	UG/L	0.32	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U
AROCLOR 1232	UG/L	0.29	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U	0.29U
AROCLOR 1242	UG/L	0.3	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U
AROCLOR 1248	UG/L	0.09	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U	0.09U
AROCLOR 1254	UG/L	0.44	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U	0.44U
AROCLOR 1260	UG/L	0.41	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U	0.41U
BETA-BHC	UG/L	0.01	0.01U	0.01U	0.01U	**0.03J**	0.01U	0.01U	**0.01J**	**0.01J**	**0.01J**	**0.01J**	**0.02J**	**0.03J**	**0.03J**	**0.02J**	**0.02J**	**0.02J**
CHLORDANE	UG/L	0.1	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
CHLORBENSIDE	UG/L	0.1	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
DACTHAL	UG/L	0.1	0.3U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
DELTA-BHC	UG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
DIELDRIN	UG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
ENDOSULFAN I	UG/L	0.01	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
ENDOSULFAN II	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
ENDOSULFAN SULFATE	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
ENDRIN	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
ENDRIN ALDEHYDE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
GAMMA-BHC	UG/L	0.0081	0.0081U	0.0081U	**0.01**	0.0081U	**0.01**	0.0081U	0.0081U	**0.01**	**0.01J**	**0.01J**	**0.01J**	**0.02**	**0.01J**	**0.02**	**0.0092J**	**0.02**
HEPTACHLOR	UG/L	0.02	0.02U	**0.03**	**0.05**	**0.04**	**0.07**	**0.07**	**0.04**	**0.07**	**0.19**	**0.08**	0.02U	**0.06**	**0.06**	**0.05**	**0.04**	**0.03**
HEPTACHLOR EPOXIDE	UG/L	0.01	0.01U	0.01U	**0.03J**	**0.02J**	**0.02**	0.01U	0.01U	**0.02J**	**0.03**	**0.02J**	**0.03J**	**0.03J**	**0.04J**	**0.03**	**0.03J**	**0.03J**
METHOXYCHLOR	UG/L	0.08	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U	0.08U
MIREX	UG/L	0.1	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
TOXAPHENE	UG/L	0.49	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U	0.49U
AZINPHOS METHYL	UG/L	0.58	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U
DEMETON	UG/L	2	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
ETHYL PARATHION	UG/L	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
MALATHION	UG/L	0.22	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U	0.22U
METHYL PARATHION	UG/L	0.24	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U

U = not detected. **J** = estimated value.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-13 MEAN CONCENTRATIONS OF CHLORINATED PESTICIDES, ORGANOPHOSPHORUS PESTICIDES, AND PCB AROCLORS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1[(a)]	1[(a)]	3	2	2	2	2	2	2	2	2	2	2	2	2	2
4,4'-DDD	UG/L	0.01	0.05	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4'-DDE	UG/L	0.02	0.01U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDT	UG/L	0.02	0.02U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ALDRIN	UG/L	0.02	0.02U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ALPHA-BHC	UG/L	0.01	0.02U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
AROCLOR 1016	UG/L	0.33	0.01U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
AROCLOR 1221	UG/L	0.32	0.33U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
AROCLOR 1232	UG/L	0.29	0.32U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U
AROCLOR 1242	UG/L	0.3	0.29U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
AROCLOR 1248	UG/L	0.09	0.3U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U
AROCLOR 1254	UG/L	0.44	0.09U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U
AROCLOR 1260	UG/L	0.41	0.44U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
BETA-BHC	UG/L	0.01	0.41U	0.01 U	0.01 U	**0.02**	0.01 U	0.01 U	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
CHLORDANE	UG/L	0.1	0.1U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
CHLOROBENSIDE	UG/L	0.1	0.1U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
DACTHAL	UG/L	0.1	0.3U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
DELTA-BHC	UG/L	0.01	0.01U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
DIELDRIN	UG/L	0.01	0.01U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN I	UG/L	0.01	0.01U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN II	UG/L	0.02	0.02U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDOSULFAN SULFATE	UG/L	0.02	0.02U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDRIN	UG/L	0.03	0.03U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
ENDRIN ALDEHYDE	UG/L	0.03	0.03U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
GAMMA-BHC	UG/L	0.0081	0.0081U	0.0081 U	**0.01**	0.0081 U	**0.01**	0.0081 U	0.0081 U	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
HEPTACHLOR	UG/L	0.02	0.02U	**0.03**	**0.03**	**0.03**	**0.05**	**0.05**	**0.03**	**0.05**	**0.105**	**0.05**	0.02 U	**0.04**	**0.04**	**0.04**	**0.03**	**0.03**
HEPTACHLOR EPOXIDE	UG/L	0.01	0.01U	0.01 U	**0.017**	**0.015**	**0.02**	0.01 U	0.01 U	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.02**	**0.02**	**0.02**
METHOXYCHLOR	UG/L	0.08	0.0026U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
MIREX	UG/L	0.1	0.08U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
TOXAPHENE	UG/L	0.49	0.01U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U
AZINPHOS METHYL	UG/L	0.58	0.58U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U
DEMETON	UG/L	2	2U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
ETHYL PARATHION	UG/L	1	1U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MALATHION	UG/L	0.22	0.22U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
METHYL PARATHION	UG/L	0.24	0.24U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U

U = not detected.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-14 CONCENTRATIONS OF PCB CONGENERS (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

ANALYTE	UNIT	MIN DL	KI-03	KI-07	KI-14	
			Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
BZ# 8*	UG/L	0.003	**0.01B**	**0.03B**	0.003U	0.003U
BZ# 18*	UG/L	0.0064	0.0064UJ	0.0064UJ	0.0064U	0.0064U
BZ# 28*	UG/L	0.0065	0.0065UJ	0.0065UJ	0.0065U	0.0065U
BZ# 44*	UG/L	0.0055	0.0055U	0.0055U	0.0055U	0.0055U
BZ# 49	UG/L	0.003	0.003U	0.003U	0.003U	0.003U
BZ# 52*	UG/L	0.0022	0.0022U	0.0022U	0.0022U	0.0022U
BZ# 66*	UG/L	0.0004	0.0004U	0.0004U	0.0004U	0.0004U
BZ# 77*	UG/L	0.0025	0.0025U	0.0025U	0.0025U	0.0025U
BZ# 87	UG/L	0.0012	0.0012U	0.0012U	0.0012U	0.0012U
BZ# 101*	UG/L	0.0026	0.0026U	0.0026U	0.0026U	0.0026U
BZ# 105*	UG/L	0.0034	0.0034U	0.0034U	0.0034U	0.0034U
BZ# 118*	UG/L	0.0018	0.0018U	0.0018U	0.0018U	0.0018U
BZ# 126*	UG/L	0.0013	0.0022U	0.0022U	0.0022U	0.0013U
BZ# 128*	UG/L	0.0022	0.0013U	0.0013U	0.0013U	0.0022U
BZ# 138*	UG/L	0.0013	0.0013U	0.0013U	0.0013U	0.0013U
BZ# 153*	UG/L	0.003	0.003U	0.003U	0.003U	0.003U
BZ# 156	UG/L	0.0012	0.0012U	0.0012U	0.0012U	0.0012U
BZ# 169*	UG/L	0.0022	0.0022U	0.0022U	0.0022U	0.0022U
BZ# 170*	UG/L	0.0014	0.0014U	0.0014U	0.0014U	0.0014U
BZ# 180*	UG/L	0.0015	0.0015U	0.0015U	0.0015U	0.0015U
BZ# 183	UG/L	0.0017	0.0017U	0.0017U	0.0017U	0.0017U
BZ# 184	UG/L	0.001	0.001U	0.001U	0.001U	0.001U
BZ# 187*	UG/L	0.0053	0.0053U	0.0053U	0.0053U	0.0053U
BZ# 195	UG/L	0.0017	0.0017U	0.0017U	0.0017U	0.0017U
BZ# 206	UG/L	0.0024	0.0024U	0.0024U	0.0024U	0.0024U
BZ# 209	UG/L	0.0026	0.0026UJ	0.0026UJ	0.0026U	0.0026U
TOTAL PCB (ND=0)**	UG/L	-	0.02	0.06	0	0
TOTAL PCB (ND=1/2DL)**	UG/L	-	0.0695	0.110	0.0525	0.0525
TOTAL PCB (ND=DL)	UG/L	-	0.119	0.159	0.105	0.105

U = not detected. **B** = found in blank. **J** = estimated value..

* = PCB congeners used for total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998). Sum multiplied by a factor of 2 as per NOAA (1993)

MIN DL = minimum detection limit

Note: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

**Note that the mean of the total PCBs for individual samples is not equivalent to the sum of mean individual PCBs for ND=0 and ND=1/2DL.

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TABLE 7-15 MAXIMUM CONCENTRATIONS OF PCB CONGENERS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
BZ# 8*	UG/L	0.003	0.003U	**0.0077J**	0.003U	**0.01**	**0.0052J**	**0.01**	0.003U	**0.0066J**	**0.01J**	**0.0067J**	0.003U	0.003U	0.003U	**0.01J**	0.003U	**0.0031J**
BZ# 18*	UG/L	0.0064	0.0012U	0.0064U	0.0064U	0.0064U	**0.0068J**	**0.01**	0.0064U	**0.01J**	0.0064U	0.01J	0.0064U	**0.01J**	**0.0078J**	**0.01**	0.0064U	**0.01J**
BZ# 28*	UG/L	0.0065	0.0022U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U	0.0065U
BZ# 44*	UG/L	0.005	0.003U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U	0.0055U
BZ# 49	UG/L	0.003	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U
BZ# 52*	UG/L	0.0022	0.0064U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U
BZ# 66*	UG/L	0.0004	0.0018U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U	0.0004U
BZ# 77*	UG/L	0.0025	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U
BZ# 87	UG/L	0.0012	0.0055U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U
BZ# 101*	UG/L	0.0026	0.0022U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U
BZ# 105*	UG/L	0.0034	0.0065U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U	0.0034U
BZ# 118*	UG/L	0.0018	0.0034U	0.0018U	0.0018U	**0.0019J**	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U	0.0018U
BZ# 126*	UG/L	0.0022	0.0025U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U
BZ# 128*	UG/L	0.0013	0.0015U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U
BZ# 138*	UG/L	0.0013	0.001U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	0.0013U	**0.0016J**	0.0013U	0.0013U	0.0013U	0.0013U	**0.0017J**
BZ# 153*	UG/L	0.003	0.0026U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U	0.003U
BZ# 156	UG/L	0.0012	0.0004U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U	0.0012U
BZ# 169*	UG/L	0.0022	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U	0.0022U
BZ# 170*	UG/L	0.0014	0.0013U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	0.0014U	**0.0033J**
BZ# 180*	UG/L	0.0015	0.0053U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U	0.0015U
BZ# 183	UG/L	0.0017	0.0013U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U
BZ# 184	UG/L	0.001	0.0012U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U
BZ# 187*	UG/L	0.0053	0.0017U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U	0.0053U
BZ# 195	UG/L	0.0017	0.0014U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U	0.0017U
BZ# 206	UG/L	0.0024	0.0017U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U	0.0024U
BZ# 209	UG/L	0.0026	0.0024U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U	0.0026U
TOTAL PCB (ND=0)**	UG/L	-	0	0.0154	0	0.0238	0.0136	0.04	0	0.0332	0.02	0.0334	0.0032	0.02	0.0156	0.04	0	0.0328
TOTAL PCB (ND=1/2DL)**	UG/L	-	0.0525	0.0649	0.0525	0.0715	0.0599	0.0831	0.0525	0.0763	0.0695	0.0765	0.0544	0.0661	0.0617	0.0831	0.0525	0.0745
TOTAL PCB (ND=DL)	UG/L	-	0.105	0.114	0.105	0.119	0.109	0.126	0.105	0.119	0.119	0.12	0.106	0.112	0.108	0.126	0.105	0.116

U = not detected. J = estimated value.

* = PCB congeners used for total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998). Sum multiplied by a factor of 2 as per NOAA 1993.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

**Note that the mean of the total PCBs for individual samples is not equivalent to the sum of mean individual PCBs for ND=0 and ND=1/2DL.

TABLE 7-16 MEAN CONCENTRATIONS OF PCB CONGENERS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1(a)	1(a)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
ANALYTE	UNIT	MIN DL																
BZ# 8*	UG/L	0.003	0.003U	**0.0077**	0.003 U	**0.0065**	**0.0041**	**0.0065**	0.003 U	**0.0048**	**0.0065**	**0.0049**	0.003 U	0.003 U	0.003 U	**0.00765**	0.003 U	**0.0031**
BZ# 18*	UG/L	0.0064	0.0012U	0.0064 U	0.0064 U	0.0064 U	**0.0066**	**0.0082**	0.0064 U	**0.0082**	0.0064 U	**0.0082**	0.0064 U	**0.0082**	**0.0071**	**0.0082**	0.0064 U	**0.0082**
BZ# 28*	UG/L	0.0065	0.0022U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U
BZ# 44*	UG/L	0.005	0.003U	0.0055 U	0.0055 U	0.00525 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
BZ# 49	UG/L	0.003	0.003U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
BZ# 52*	UG/L	0.0022	0.0064U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U
BZ# 66*	UG/L	0.0004	0.0018 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
BZ# 77*	UG/L	0.0025	0.0025U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U
BZ# 87	UG/L	0.0012	0.0055U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
BZ# 101*	UG/L	0.0026	0.0022U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U
BZ# 105*	UG/L	0.0034	0.0065U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U
BZ# 118*	UG/L	0.0018	0.0034U	0.0018 U	0.0018 U	**0.00185**	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U
BZ# 126*	UG/L	0.0022	0.0025U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U
BZ# 128*	UG/L	0.0013	0.0015U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U
BZ# 138*	UG/L	0.0013	0.001U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	**0.00145**	0.0013 U	0.0013 U	0.0013 U	0.0013 U	**0.0015**
BZ# 153*	UG/L	0.003	0.0026U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
BZ# 156	UG/L	0.0012	0.0004U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
BZ# 169*	UG/L	0.0022	0.0022U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U
BZ# 170*	UG/L	0.0014	0.0013U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	**0.0024**
BZ# 180*	UG/L	0.0015	0.0053U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
BZ# 183	UG/L	0.0017	0.0013U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U
BZ# 184	UG/L	0.001	0.0012U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
BZ# 187*	UG/L	0.0053	0.0017U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U
BZ# 195	UG/L	0.0017	0.0014U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U
BZ# 206	UG/L	0.0024	0.0017U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
BZ# 209	UG/L	0.0026	0.0024U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0026 U
TOTAL PCB (ND=0)**	UG/L	-	0	0.0154	0	0.0119	0.012	0.02	0	0.0166	0.01	0.0167	0.0016	0.01	0.0078	0.0253	0	0.0181
TOTAL PCB (ND=1/2DL)**	UG/L	-	0.0525	0.0649	0.0525	0.0617	0.0598	0.0678	0.0525	0.0644	0.061	0.0645	0.0535	0.0593	0.0571	0.0716	0.0525	0.0645
TOTAL PCB (ND=DL)	UG/L	-	0.105	0.114	0.105	0.112	0.108	0.116	0.105	0.112	0.112	0.112	0.105	0.109	0.106	0.118	0.105	0.111

U = not detected.

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

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

Note: Shaded and bolded values represent mean concentrations for analytes detected in at least one sample. Means calculated with ND=DL.

**Note that the mean of the total PCBs for individual samples is not equivalent to the sum of mean individual PCBs for ND=0 and ND=1/2DL.

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TABLE 7-17 CONCENTRATIONS OF PAHs (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
ACENAPHTHENE	UG/L	0.39	0.39U	0.39U	0.39U	0.39U
ACENAPHTHYLENE	UG/L	0.38	0.38U	0.38U	0.38U	0.38U
ANTHRACENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U
BENZ[A]ANTHRACENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U
BENZO[A]PYRENE	UG/L	0.04	0.04U	0.04U	0.04U	0.04U
BENZO[B]FLUORANTHENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U
BENZO[G,H,I]PERYLENE	UG/L	0.06	0.06U	0.06U	0.06U	0.06U
BENZO[K]FLUORANTHENE	UG/L	0.05	0.05U	0.05U	0.05U	0.05U
CHRYSENE	UG/L	0.02	0.02U	0.02U	0.02U	0.02U
DIBENZ[A,H]ANTHRACENE	UG/L	0.06	0.06U	0.06U	0.06U	0.06U
FLUORANTHENE	UG/L	0.04	0.04U	0.04U	0.04U	0.04U
FLUORENE	UG/L	0.06	0.06U	0.06U	0.06U	0.06U
INDENO[1,2,3-CD]PYRENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U
NAPHTHALENE	UG/L	0.32	0.32U	0.32U	0.32U	0.32U
PHENANTHRENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U
PYRENE	UG/L	0.06	0.06U	0.06U	0.06U	0.06U
TOTAL PAH (ND=0)	UG/L	-	0	0	0	0
TOTAL PAH (ND=1/2DL)	UG/L	-	0.82	0.82	0.82	0.82
TOTAL PAH (ND=DL)	UG/L	-	1.63	1.63	1.63	0.81

U = not detected.

MIN DL = minimum detection limit.

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TABLE 7-18 MAXIMUM CONCENTRATIONS OF PAHs (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
ACENAPHTHENE	UG/L	0.39	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U	0.39U
ACENAPHTHYLENE	UG/L	0.38	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U	0.38U
ANTHRACENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
BENZ[A]ANTHRACENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
BENZO[A]PYRENE	UG/L	0.04	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U
BENZO[B]FLUORANTHENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
BENZO[G,H,I]PERYLENE	UG/L	0.06	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U
BENZO[K]FLUORANTHENE	UG/L	0.05	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
CHRYSENE	UG/L	0.02	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
DIBENZ[A,H]ANTHRACENE	UG/L	0.06	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U
FLUORANTHENE	UG/L	0.04	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U	0.04U
FLUORENE	UG/L	0.06	0.06U	0.06U	**0.07P**	0.06U	0.06U	0.06U	0.06U	**0.08P**	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U
INDENO[1,2,3-CD]PYRENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
NAPHTHALENE	UG/L	0.32	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U	0.32U
PHENANTHRENE	UG/L	0.03	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
PYRENE	UG/L	0.06	0.06U	0.06U	**0.07**	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U	0.06U
TOTAL PAH (ND=0)	UG/L	-	0	0	0.07	0	0	0	0	0.08	0	0	0	0	0	0	0	0
TOTAL PAH (ND=1/2DL)	UG/L	-	0.81	0.81	0.85	0.81	0.81	0.81	0.81	0.86	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
TOTAL PAH (ND=DL)	UG/L	-	1.63	1.63	1.64	1.63	1.63	1.63	1.63	1.65	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63

U = not detected. **P** = >25% between two GC columns.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

TABLE 7-19 MEAN CONCENTRATIONS OF PAHs (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1[a]	1[a]	3	2	2	2	2	2	2	2	2	2	2	2	2	2
ANALYTE	UNIT	MIN DL																
ACENAPHTHENE	UG/L	0.39	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
ACENAPHTHYLENE	UG/L	0.38	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
ANTHRACENE	UG/L	0.03	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
BENZ[A]ANTHRACENE	UG/L	0.03	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
BENZO[A]PYRENE	UG/L	0.04	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BENZO[B]FLUORANTHENE	UG/L	0.03	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
BENZO[G,H,I]PERYLENE	UG/L	0.06	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
BENZO[K]FLUORANTHENE	UG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
CHRYSENE	UG/L	0.02	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
DIBENZ[A,H]ANTHRACENE	UG/L	0.06	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
FLUORANTHENE	UG/L	0.04	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
FLUORENE	UG/L	0.06	0.06 U	0.06 U	**0.06**	0.06 U	0.06 U	0.06 U	0.06 U	**0.07**	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
INDENO[1,2,3-CD]PYRENE	UG/L	0.03	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
NAPHTHALENE	UG/L	0.32	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
PHENANTHRENE	UG/L	0.03	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
PYRENE	UG/L	0.06	0.06 U	0.06 U	**0.06**	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
TOTAL PAH (ND=0)	UG/L	-	0	0	0.06	0	0	0	0	0.07	0	0	0	0	0	0	0	0
TOTAL PAHS (ND=1/2DL)	UG/L	-	0.82	0.82	0.84	0.82	0.82	0.82	0.82	0.84	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
TOTAL PAH (ND=DL)	UG/L	-	1.63	1.63	1.64	1.63	1.63	1.63	1.63	1.64	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63

U = not detected.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-20 CONCENTRATIONS OF METALS (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
ALUMINUM	UG/L	37.9	**169J**	**159J**	**296**	**255**
ANTIMONY	UG/L	1	1U	1U	1U	1U
ARSENIC	UG/L	1.7	1.7U	1.7U	**2.5B**	1.7U
BERYLLIUM	UG/L	0.1	0.1U	0.1U	0.1U	0.1U
CADMIUM	UG/L	0.2	0.2U	0.2U	0.2UJ	0.2UN
CHROMIUM	UG/L	0.7	0.7U	0.7U	0.7U	0.7UN
COPPER	UG/L	0.7	**0.98B**	**1B**	**0.93B**	0.7U
IRON	UG/L	5.5	**45J**	**55.1J**	**289**	**28.4B**
LEAD	UG/L	1.1	1.1UJ	1.1UJ	1U	2.2UN
MANGANESE	UG/L	2.4	**7.5J**	**12.4J**	**6.7J**	2.4U
MERCURY	UG/L	0.1	0.1U	0.1U	0.1U	0.1UN
NICKEL	UG/L	2.4	2.4U	2.4U	**2.1J**	2.4UN
SELENIUM	UG/L	1.8	1.8U	1.8U	1.8U	1.8U
SILVER	UG/L	2.2	2.2U	2.2U	3.2U	2.2U
THALLIUM	UG/L	10	10UJ	10UJ	8.5UJ	17UNW
ZINC	UG/L	1.7	1.7U	1.7U	2.3U	1.7U

U = not detected. **B** = value is <RL but >IDL/MDL. **J** = estimated value.

N = spiked sample not within control limits. **W** = AAS out of control limits.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-21 MAXIMUM CONCENTRATIONS OF METALS (UG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1 [(a)]	1 [(a)]	3	2	2	2	2	2	2	2	2	2	2	2	2	2
ALUMINUM	UG/L	37.9	**236**	**174B**	**173B**	**158B**	**428**	**91.5B**	**154B**	**203B**	**155J**	**170J**	**140B**	**119B**	**152B**	**179J**	**133B**	**176B**
ANTIMONY	UG/L	1	1U	**3.7B**	**3.7B**	**2.9B**	**4.1B**	**3.3B**	**1.8B**	**2.3B**	**2.4B**	**2.5B**	1U	**3.6B**	**3.2B**	**2.5B**	**1.2B**	**6.1B**
ARSENIC	UG/L	1.7	1.7U	**8.5B**	**6B**	**4.4B**	**4.1B**	**2.9B**	**2.3B**	**11B**	**4.8J**	**6.7B**	**3.9B**	**7.2B**	**7.2B**	**5.2B**	**4.4B**	**33.2**
BERYLLIUM	UG/L	0.1	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	**0.53J**
CADMIUM	UG/L	0.2	0.2UN	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
CHROMIUM	UG/L	0.7	0.7UN	**0.91B**	0.7U	**1.1B**	**1.3B**	**1B**	0.7U	**1.9B**	**1.8B**	**1.8B**	**1B**	0.7U	**1.2B**	0.7U	**1.1B**	**4.4B**
COPPER	UG/L	0.7	0.7U	0.7U	0.7U	**1.3B**	**5.8B**	**1.4B**	0.7U	**2.2B**	**0.8B**	0.7U	0.7U	**1.1B**	0.7U	**1.3B**	0.7U	**2.9B**
IRON	UG/L	5.5	**10.9B**	5.5U	**230B**	**19.3B**	5.5U	5.5U	**14B**	**1920**	**143**	**486**	5.5U	**9.4B**	**208**	**1940**	**1020**	**7.3B**
LEAD	UG/L	1.1	2.2UN	1.1U	2.2U	1.1U	1.1U	1.1U	2.2U	1.1U	1.1U	2.2U	2.2U	1.1U	2.2U	1.1U	1.1U	**3.1**
MANGANESE	UG/L	2.4	2.4U	**3420**	**1680**	**7830**	**4690**	**3310**	**892**	**4250**	**3360**	**1610**	**2210**	**7020**	**3950**	**4980**	**3540**	**2470**
MERCURY	UG/L	0.1	0.1UN	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
NICKEL	UG/L	0.8	2.4UN	**2.4B**	**2.5B**	**3.9B**	**4.3B**	**5B**	**2.6B**	**4.7J**	**5.5B**	**5.5B**	**4.1B**	**4.6B**	**3.8B**	**5.9J**	**6.2B**	**11.4B**
SELENIUM	UG/L	1.8	1.8U	1.8U	1.8U	**1.9B**	**1.9B**	1.8U	1.8U	1.8U	1.8U	1.8U	1.8U	**2.2B**	1.8U	1.8U	1.8U	**29.2**
SILVER	UG/L	2.2	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	2.2U	**2.3B**
THALLIUM	UG/L	1	17UNW	5U	10U	10U	5U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
ZINC	UG/L	1.7	1.7U	1.7U	1.7U	1.7U	**4.1B**	1.7U	1.7U	1.7U	1.7U	1.7U	1.7U	1.7U	**1.8J**	1.7U	1.7U	1.7U

U = not detected. **B** = value is <RL but >IDL/MDL. **J** = estimated value. **N** = spiked sample not within control limits. **W** = AAS out of control limits.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-22 MEAN CONCENTRATIONS OF METALS (MG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
REACH ID:			Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1[(a)]	1[(a)]	3	2	2	2	2	2	2	2	2	2	2	2	2	2
ALUMINUM	UG/L	37.9	**236**	**174**	**154.67**	**142**	**257.85**	**82.85**	**142.5**	**153.5**	**134.5**	**169**	**125**	**108.8**	**145**	**141**	**128.5**	**170**
ANTIMONY	UG/L	1	1U	**3.7**	**2**	**1.95**	**2.55**	**2.2**	**1.4**	**1.65**	**1.7**	**1.75**	1.0 U	**2.3**	**2.1**	**1.75**	**1.1**	**3.6**
ARSENIC	UG/L	1.7	1.7U	**8.5**	**5.07**	**4.1**	**3.2**	**2.45**	**2**	**8.8**	**3.95**	**5.05**	**3.55**	**6.05**	**4.6**	**5.2**	**3.05**	**18.2**
BERYLLIUM	UG/L	0.1	0.1U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	**0.315**
CADMIUM	UG/L	0.2	0.2UN	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CHROMIUM	UG/L	0.7	0.7UN	**0.91**	0.7 U	**0.9**	**1**	**0.85**	0.7 U	**1.3**	**1.25**	**1.25**	**0.85**	0.7 U	**0.95**	0.7 U	**0.9**	**2.55**
COPPER	UG/L	0.7	0.7U	0.7 U	0.7 U	**1**	**3.25**	**1.35**	0.7 U	**1.95**	**0.75**	0.7 U	0.7 U	**0.9**	0.7 U	**1**	0.7 U	**2.05**
IRON	UG/L	5.5	**10.9B**	5.5 U	**80.83**	**12.4**	5.5 U	5.5 U	**9.75**	**976.9**	**79.85**	**245.75**	5.5 U	**7.45**	**123.65**	**972.75**	**670**	**6.4**
LEAD	UG/L	1.1	2.2UN	1.1 U	1.83 U	1.1 U	1.1 U	1.1 U	1.65 U	1.1 U	1.1 U	1.65 U	1.65 U	1.1 U	2.2 U	1.1 U	1.1 U	**2.1**
MANGANESE	UG/L	2.4	2.4U	**3420**	**961.67**	**6625**	**4465**	**2245**	**847**	**3280**	**2750**	**1565**	**1960**	**5520**	**2620**	**3830**	**2210.5**	**1850**
MERCURY	UG/L	0.1	0.1UN	0.1 U	0.1 U	0.1 U	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**0.1 U**	**. 0.1 U**	**0.1 U**
NICKEL	UG/L	0.8	2.4UN	**2.4**	**2.43**	**3.3**	**3.45**	**4.75**	**2.5**	**4.35**	**4.05**	**3.95**	**3.25**	**3.5**	**3.3**	**5.2**	**4.75**	**7.25**
SELENIUM	UG/L	1.8	1.8U	1.8 U	1.8 U	**1.85**	**1.85**	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	**2**	1.8 U	1.8 U	1.8 U	**15.5**
SILVER	UG/L	2.2	2.2U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	**2.25**
THALLIUM	UG/L	1	17UNW	5.0 U	8.33 U	7.5 U	3.0 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U	7.5 U
ZINC	UG/L	1.7	1.7U	1.7 U	1.7 U	1.7 U	**2.9**	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	**1.75**	1.7 U	1.7 U	1.7 U

U = not detected. **B** = value is <RL but >IDL/MDL. N = spiked sample not within control limits. **W** = AAS out of control limits.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

TABLE 7-23 CONCENTRATIONS OF BUTYLTINS (UG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

		Sample ID:	KI-03	KI-07	KI-14	
		Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	MIN DL				
MONOBUTYLTIN	NG/L	32	32U	32U	31U	310U
DIBUTYLTIN	NG/L	39	39U	40U	39U	280U
TRIBUTYLTIN	NG/L	45	45U	46U	45U	**80J**
TETRABUTLYTIN	NG/L	51	51U	52U	50U	220U

U = not detected. **J** = estimated value; value below lowest calibration

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-24 MAXIMUM CONCENTRATIONS OF BUTYLTINS (NG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1 (a)	1 (a)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
MONOBUTYLTIN	NG/L	32	310U	33U	34U	32U	33U	34U	34U	33U	34U	**130**	34U	34U	35U	33U	35U	34U
DIBUTYLTIN	NG/L	40	280U	41U	42U	40U	41U	42U	43U	41U	42U	41U	42U	42U	43U	41U	43U	43U
TRIBUTYLTIN	NG/L	46	**100J**	47U	48U	46U	47U	49U	49U	48U	48U	47U	49U	48U	50U	47U	50U	49U
TETRABUTLYTIN	NG/L	52	220U	53U	54U	52U	53U	55U	56U	54U	54U	53U	55U	54U	56U	53U	56U	56U

U = not detected. **J** =estimated value below lowest calibrator.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

TABLE 7-25 MEAN CONCENTRATIONS OF BUTYLTINS (NG/L) IN ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:			1 (a)	1 (a)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
MONOBUTYLTIN	NG/L	32	310 U	33.0 U	33.33 U	32.0 U	33.0 U	33.5 U	34.0 U	33.0 U	33.5 U	**81.5**	33.5 U	33.5 U	34.0 U	33.0 U	34.0 U	33.0 U
DIBUTYLTIN	NG/L	40	280 U	41.0 U	41.33 U	40.0 U	41.0 U	41.5 U	43.0 U	41.0 U	41.5 U	40.5 U	41.5 U	41.5 U	42.0 U	40.5 U	42.0 U	41.5 U
TRIBUTYLTIN	NG/L	46	**100 J**	47.0 U	47.67 U	46.0 U	47.0 U	48.5 U	49.0 U	48.0 U	47.5 U	47.0 U	48.0 U	48.0 U	49.0 U	47.0 U	49.0 U	47.5 U
TETRABUTLYTIN	NG/L	52	220 U	53.0 U	53.67 U	52.0 U	53.0 U	54.5 U	56.0 U	53.5 U	53.5 U	53.0 U	54.0 U	54.0 U	55.0 U	53.0 U	54.5 U	54.0 U

U = not detected. J = estimated value below lowest calibrator.

(a) = actual concentrations for one elutriate sample reported for Outside Site 104 and Ocean Reference.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

TABLE 7-26 CONCENTRATIONS OF DIOXIN AND FURAN CONGENERS (NG/L) IN RECEIVING WATER INSIDE SITE 104, OUTSIDE SITE 104, AND AT THE OCEAN REFERENCE SITE

			Sample ID:	KI-03	KI-07	KI-14	
			Reach ID:	Inside Site 104	Inside Site 104	Outside Site 104	Ocean Reference
ANALYTE	UNIT	TEF	MIN DL				
2,3,7,8-TCDD	NG/L	1	0.00154	NT	0.00161 U	0.00154 U	0.00257 U
1,2,3,7,8-PECDD	NG/L	0.5	0.00104	NT	0.00107 U	0.00104 U	**0.00118 J**
1,2,3,4,7,8-HXCDD	NG/L	0.1	0.00127	NT	0.00127 U	0.00172 U	0.00235 U
1,2,3,6,7,8-HXCDD	NG/L	0.1	0.00133	NT	0.00133 U	0.0018 U	0.00247 U
1,2,3,7,8,9-HXCDD	NG/L	0.1	0.0012	NT	0.0012 U	0.00163 U	0.00223 U
1,2,3,4,6,7,8-HPCDD	NG/L	0.01	0.00152	NT	**0.0042 J**	**0.00454 EMPC**	0.00287 U
OCDD	NG/L	0.001	0.00387	NT	**0.04 B**	**0.03 B**	**0.01 B**
2,3,7,8-TCDF	NG/L	0.1	0.00109	NT	0.00137 U	0.00109 U	0.00167 U
1,2,3,7,8-PECDF	NG/L	0.05	0.00073	NT	0.00092 U	0.00083 U	**0.00096 EMPC**
2,3,4,7,8-PECDF	NG/L	0.5	0.00072	NT	0.0009 U	0.00081 U	0.00072 U
1,2,3,4,7,8-HXCDF	NG/L	0.1	0.00098	NT	0.00098 U	0.00122 U	0.00125 U
1,2,3,6,7,8-HXCDF	NG/L	0.1	0.00094	NT	0.00094 U	0.00116 U	0.00119 U
2,3,4,6,7,8-HXCDF	NG/L	0.1	0.00105	NT	0.00105 U	0.00129 U	0.00133 U
1,2,3,7,8,9-HXCDF	NG/L	0.1	0.00115	NT	0.00115 U	0.00142 U	0.00146 U
1,2,3,4,6,7,8-HPCDF	NG/L	0.01	0.00105	NT	0.00118 U	0.00105 U	0.0018 U
1,2,3,4,7,8,9-HPCDF	NG/L	0.01	0.00128	NT	0.00144 U	0.00128 U	0.0022 U
OCDF	NG/L	0.001	0.00269	NT	**0.00464 EMPC**	**0.00364 EMPC**	0.00459 U
DIOXINS TEQ (ND=0)	NG/L			NT	**0.000042**	0	**0.00059**
DIOXINS TEQ (ND=1/2DL)	NG/L			NT	**0.00184**	0.00183	**0.00279**
DIOXINS TEQ (ND=DL)	NG/L			NT	**0.00364**	0.00366	**0.00499**

U = not detected. **J** = estimated value. **B** = detected in laboratory blank. **EMPC** = estimated maximum possible concentration.

MIN DL = minimum detection limit.

NT = not tested in K1-03 water.

TABLE 7-27 CONCENTRATIONS OF DIOXIN AND FURAN CONGENERS (NG/L) IN 1999/2000 ELUTRIATES FROM BALTIMORE APPROACH CHANNELS, OCEAN REFERENCE SITE, OUTSIDE SITE 104, AND INSIDE SITE 104

ANALYTE	UNIT	TEF	MIN DL	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
# ELUTRIATES TESTED:				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2,3,7,8-TCDD	NG/L	1	0.00160	0.0016 U	0.00396 U	0.00486 U	0.00461 U	0.00379 U	0.0019 U	0.00211 U	0.00343 U	0.00183 U	0.00177 U	0.00352 U	0.00435 U	0.00319 U	0.00297 U	0.00165 U	0.00262 U
1,2,3,7,8-PECDD	NG/L	0.5	0.00072	**0.0013 EMPC**	0.00155 U	0.00169 U	0.00125 U	0.00147 U	0.00192 U	0.00168 U	0.00113 U	0.00103 U	0.00136 U	0.00151 U	0.0013 U	0.0016 U	0.0014 U	0.00128 U	0.00109 U
1,2,3,4,7,8-HXCDD	NG/L	0.1	0.00110	0.0011 U	0.00345 U	0.00657 U	0.00433 U	0.00273 U	0.00254 U	0.00298 U	0.00359 U	0.00303 U	0.00258 U	0.00278 U	0.00518 U	0.00224 U	0.00472 U	0.00372 U	0.00463 U
1,2,3,6,7,8-HXCDD	NG/L	0.1	0.00116	0.00116 U	0.00363 U	0.00691 U	0.00455 U	0.00287 U	0.00267 U	0.00313 U	0.00378 U	0.00319 U	0.00271 U	0.00292 U	0.00545 U	0.00236 U	0.00496 U	0.00391 U	0.00487 U
1,2,3,7,8,9-HXCDD	NG/L	0.1	0.00104	**0.00174 EMPC**	0.00327 U	0.00623 U	0.0041 U	0.00258 U	0.0024 U	0.00282 U	0.0034 U	0.00287 U	0.00244 U	0.00263 U	0.00491 U	0.00212 U	0.00447 U	0.00352 U	0.00439 U
1,2,3,4,6,7,8-HPCDD	NG/L	0.01	0.00215	0.00215 U	0.00285 U	0.00349 U	**0.0094 B**	0.00343 U	0.00368 U	0.00297 U	0.00355 U	0.00269 U	0.0031 U	**0.00238 B**	**0.00308B**	0.00238 U	**0.00426 B**	0.00269 U	**0.00368 B**
OCDD	NG/L	0.001	0.00432	**0.00956 B**	**0.01 B**	**0.01 B**	**0.09000**	**0.02 B**	**0.04 B**	**0.01 B**	**0.01 B**	**0.01 B**	**0.02 B**	**0.01 B**	**0.01 B**	**0.00894 B**	0.03 U	**0.01 B**	**0.03 B**
2,3,7,8-TCDF	NG/L	0.1	0.00101	0.00125 U	0.00167 U	0.00191 U	0.00185 U	0.00147 U	0.00133 U	0.00126 U	0.00155 U	0.00136 U	0.0012 U	0.00156 U	0.00171 U	0.00151 U	0.00161 U	0.00111 U	0.00101 U
1,2,3,7,8-PECDF	NG/L	0.05	0.00072	**0.00108 B**	0.00123 U	0.00135 U	0.00096 U	0.00105 U	0.00139 U	0.0011 U	0.00083 U	0.00092 U	0.00097 U	0.00142 U	0.00103 U	0.00107 U	0.00111 U	0.0011 U	0.00085 U
2,3,4,7,8-PECDF	NG/L	0.5	0.00071	0.00071 U	0.0012 U	0.00131 U	0.00094 U	0.00102 U	0.00136 U	0.00107 U	0.00081 U	0.0009 U	0.00094 U	0.00139 U	0.001 U	0.00105 U	0.00108 U	0.00108 U	0.00083 U
1,2,3,4,7,8-HXCDF	NG/L	0.1	0.00076	**0.00098 J**	0.00141 U	0.00248 U	0.0017 U	0.00143 U	0.00127 U	0.00152 U	0.00154 U	0.00103 U	0.00131 U	0.00146 U	0.00204 U	0.00143 U	0.00137 U	0.0015 U	0.00178 U
1,2,3,6,7,8-HXCDF	NG/L	0.1	0.00072	**0.00118 B**	0.00134 U	0.00237 U	0.00162 U	0.00136 U	0.00122 U	0.00144 U	0.00147 U	0.00098 U	0.00124 U	0.00139 U	0.00195 U	0.00136 U	0.0013 U	0.00143 U	0.0017 U
2,3,4,6,7,8-HXCDF	NG/L	0.1	0.00080	0.0008 U	0.0015 U	0.00264 U	0.0018 U	0.00151 U	0.00135 U	0.00161 U	0.00163 U	0.00109 U	0.00139 U	0.00155 U	0.00217 U	0.00152 U	0.00145 U	0.00159 U	0.00189 U
1,2,3,7,8,9-HXCDF	NG/L	0.1	0.00088	0.00088 U	0.00164 U	0.0029 U	0.00198 U	0.00166 U	0.00149 U	0.00177 U	0.0018 U	0.0012 U	0.00152 U	0.0017 U	0.00238 U	0.00167 U	0.00159 U	0.00175 U	0.00208 U
1,2,3,4,6,7,8-HPCDF	NG/L	0.01	0.00131	**0.00218 J**	0.00168 U	0.00253 U	**0.00374 J**	0.00236 U	0.00185 U	0.00215 U	0.00183 U	0.00157 U	0.00239 U	0.00201 U	**0.00166 J**	0.0018 U	0.00191 U	0.00151 U	0.00183 U
1,2,3,4,7,8,9-HPCDF	NG/L	0.01	0.00160	0.0016 U	0.00205 U	0.00309 U	0.00175 U	0.00287 U	0.00226 U	0.00262 U	0.00224 U	0.00192 U	0.00291 U	0.00245 U	0.00227 U	0.00219 U	0.00233 U	0.00184 U	0.00223 U
OCDF	NG/L	0.001	0.00308	0.00308 U	0.00676 U	0.00761 U	**0.01 J**	0.00693 U	0.00793 U	0.00616 U	0.007 U	0.0051 U	0.00663 U	0.0066 U	0.00816 U	0.00704 U	0.00795 U	0.00716 U	0.0082 U
DIOXINS TEQ (ND=0)	NG/L			**0.00012**	0	0	**0.000137**	0	0	0	0	0	0	0	**0.0000166**	0	0	0	0
DIOXINS TEQ (ND=1/2DL)	NG/L			**0.00138**	0.00363	0.00486	**0.00412**	0.00337	0.00256	0.00264	0.0032	0.00219	0.00225	0.00335	**0.0041**	0.00303	0.00325	. 0.0024	0.00295
DIOXINS TEQ (ND=DL)	NG/L			**0.00263**	0.00726	0.00973	**0.0081**	0.00674	0.00512	0.00528	0.0064	0.00438	0.0045	0.00669	**0.00818**	0.00606	0.00649	0.00481	0.00591

U = not detected. J = estimated value; value below lowest calibration limit B = detected in laboratory blank. EMPC = estimated maximum possible concentration.

MIN DL = minimum detection limit.

NOTE: Shaded and bolded values represent detected concentrations.

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TABLE 7-28 NUMBER OF CONSTITUENTS DETECTED IN RECEIVING WATER, CHANNEL ELUTRIATES, AND PLACEMENT SITE ELUTRIATES

ANALYTICAL FRACTION	RECEIVING WATER		CHANNEL ELUTRIATES		PLACEMENT SITE/REFERENCE ELUTRIATES	
	# constituents detected/ # constituents tested	Percent (%)	# constituents detected/ # constituents tested	Percent (%)	# constituents detected/ # constituents tested	Percent (%)
VOCs	0/32	0	1/35	2.9	1/35	2.9
SVOCs	1/47	2.1	1/44	2.3	1/44	2.3
Chlorinated Pesticides	3/22	13.6	4/22	18.2	3/22	13.6
Organophophorus Pesticides	0/5	0	0/5	0	0/5	0
PCB Aroclors	0/7	0	0/7	0	0/7	0
PCB Congeners	1/26	3.8	5/26	19.2	1/26	3.8
PAHs	0/16	0	1/16	6.3	2/16	12.5
Metals	6/16	37.5	12/16	75	7/16	43.8
Butyltins	1/4	25	1/4	25	1/4	25
Dioxin and Furan Congeners	4/17	23.5	4/17	23.5	7/17	41.2

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TABLE 7-29 CALCULATION OF ELUTRIATE FRACTION BURIED WITH SEDIMENT DURING FIRST 30 MINUTES FOLLOWING DISPOSAL

Time (min)	Solids Material Settled to Bottom (yd^3) (a)	Pore Volume (yd^3)		Bulk Dilution (c)	Elutriate Cloud Volume (yd^3)	Pore Volume Supplied by Elutriate (yd^3) (d)		Percent Total (e)
		Cumulative (b)	Incremental			Incremental	Cumulative	
10	304.8 (56.4%)	1388.5	1388.5	3.3	8,152	421	421	17.1
20	420.3 (77.8%)	1914.9	526.4	5.6	13,778	94	515	20.9
30	472.7 (87.5%)	2153.5	238.6	9.0	22,148	27	541	22.0

Note: Based on STFATE model run for average ebb tide velocity (0.56 ft/sec). Barge (3,000 yd^3) contained 540 yd^3 solids and 2,460 yd^3 water.

(a) Settled material volume provided by STFATE model output (% of total solids in barge).

(b) Pore volume in settled material assuming same ratio as in original dredged material (2,460 yd^3 water to 540 yd^3 solids, 4.55 to 1).

(c) Bulk dilution calculated from volume of elutriate cloud divided by the initial 2,460 yd^3 elutriate volume in barge.

(d) Pore volume divided by bulk dilution

(e) Pore volume supplied by elutriate divided by the initial 2,460 yd^3 elutriate volume.

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TABLE 7-30 STFATE MODELING RESULTS FOR PLACEMENT AT SITE 104 FROM A SPLIT HULL BARGE, AVERAGE EBB AND FLOOD TIDE

Average Ebb Tide Scenario

	Elutriate Availability to Water Column					
	50%		75%		100%	
Dilution	Dist (ft)	Hour	Dist (ft)	Hour	Dist (ft)	Hour
10	660	0.33	774	0.38	958	0.48
20	1015	0.50	1376	0.68	1604	0.80
30	1423	0.71	1761	0.87	2004	0.99
40	1662	0.82	2049	1.02	2507	1.24
50	1875	0.93	2443	1.21	2787	1.38
75	2481	1.23	2961	1.47	3294	1.63
100	2863	1.42	3312	1.64	3712	1.84
150	3378	1.68	3940	1.95	4564	2.26
200	3796	1.88	4601	2.28	5180	2.57
250	4218	2.09	5081	2.52	5660	2.81
300	4631	2.30	5467	2.71	6056	3.00
350	4973	2.47	5797	2.88	6397	3.17
400	5257	2.61	6084	3.02	6714	3.33
450	5512	2.73	6343	3.15	6999	3.47
500	5741	2.85	6588	3.27	7255	3.60
Hour	**Dilution**	**Dist (ft)**	**Dilution**	**Dist (ft)**	**Dilution**	**Dist (ft)**
1	59	2016	39	2016	30	2016
4	1303	8064	880	8064	668	8064

Average Flood Tide Scenario

	Elutriate Availability to Water Column					
	50%		75%		100%	
Dilution	Dist (ft)	Hour	Dist (ft)	Hour	Dist (ft)	Hour
50	1272	0.41	3477	1.12	3816	1.22
100	3880	1.24	5083	1.63	5566	1.79
150	5135	1.65	5906	1.89	6863	2.20
200	5654	1.81	6909	2.22	7593	2.44
250	6487	2.08	7465	2.39	8456	2.71
300	6961	2.23	8188	2.63	8986	2.88
350	7323	2.35	8637	2.77	9625	3.09
400	7782	2.50	9041	2.90	10095	3.24
450	8249	2.65	9543	3.06	10481	3.36
500	8561	2.75	9932	3.19	10902	3.50
Hour	**Dilution**	**Dist (ft)**	**Dilution**	**Dist (ft)**	**Dilution**	**Dist (ft)**
1	59	3118	40	3118	31	3118
4	1420	12470	959	12470	731	12470

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TABLE 7-31 STFATE MODELING RESULTS FOR PLACEMENT AT SITE 104 BY HYDRAULIC PUMPING FROM A BARGE, AVERAGE EBB AND FLOOD TIDE SCENARIOS

Average Ebb Tide Scenario

	Elutriate Availability to Water Column					
	50%		75%		100%	
Dilution	Dist (ft)	Hour	Dist (ft)	Hour	Dist (ft)	Hour
50	531	0.26	1086	0.54	1468	0.73
100	1518	0.75	2140	1.06	2683	1.33
150	2169	1.08	2960	1.47	3583	1.78
200	2731	1.35	3608	1.79	4267	2.12
250	3213	1.59	4139	2.05	4787	2.37
300	3638	1.80	4568	2.27	5220	2.59
350	3997	1.98	4931	2.45	5597	2.78
400	4316	2.14	5244	2.60	5955	2.95
450	4595	2.28	5536	2.75	6297	3.12
500	4837	2.40	5814	2.88	6621	3.28
Hour	Dilution	Dist (ft)	Dilution	Dist (ft)	Dilution	Dist (ft)
1	139	2016	94	2016	72	2016
4	1545	8064	1041	8064	787	8064

Average Flood Tide Scenario

	Elutriate Availability to Water Column					
	50%		75%		100%	
Dilution	Dist (ft)	Hour	Dist (ft)	Hour	Dist (ft)	Hour
50	945	0.30	1306	0.42	1637	0.53
100	1721	0.55	2374	0.76	2884	0.92
150	2412	0.77	3208	1.03	4033	1.29
200	2971	0.95	4078	1.31	5024	1.61
250	3552	1.14	4828	1.55	5861	1.88
300	4120	1.32	5501	1.76	6604	2.12
350	4630	1.49	6089	1.95	7284	2.34
400	5105	1.64	6647	2.13	7847	2.52
450	5538	1.78	7168	2.30	8378	2.69
500	5935	1.90	7604	2.44	8902	2.86
Hour	Dilution	Dist (ft)	Dilution	Dist (ft)	Dilution	Dist (ft)
1	213	3118	144	3118	110	3118
4	2070	12470	1392	12470	1051	12470

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TABLE 7-32 STFATE MODELING RESULTS FOR PLACEMENT FROM A SPLIT HULL BARGE, AVERAGE TIDE SCENARIO AT THE NORFOLK OCEAN DISPOSAL SITE

Average Tide Scenario

	Elutriate Availability to Water Column					
	50%		75%		100%	
Dilution	Dist (ft)	Hour	Dist (ft)	Hour	Dist (ft)	Hour
10	308	0.26	436	0.37	501	0.42
20	532	0.45	690	0.58	813	0.68
30	699	0.59	929	0.78	1127	0.95
40	857	0.72	1143	0.96	1330	1.12
50	1026	0.86	1296	1.09	1487	1.25
75	1314	1.11	1605	1.35	1838	1.55
100	1519	1.28	1857	1.56	2129	1.79
150	1875	1.58	2265	1.91	2551	2.15
200	2166	1.82	2569	2.16	2872	2.42
250	2399	2.02	2811	2.37	3144	2.65
300	2589	2.18	3021	2.54	3385	2.85
350	2746	2.31	3219	2.71	3597	3.03
400	2906	2.45	3402	2.86	3778	3.18
450	3042	2.56	3563	3.00	3945	3.32
500	3177	2.67	3707	3.12	4098	3.45
Hour	**Dilution**	**Dist (ft)**	**Dilution**	**Dist (ft)**	**Dilution**	**Dist (ft)**
1	63	1188	43	1188	33	1188
4	1483	4752	1000	4752	759	4752

TABLE 7-33A MAXIMUM CONCENTRATIONS OF ANALYTES DETECTED IN 1999 CHANNEL ELUTRIATES THAT EXCEED USEPA ACUTE SALTWATER CRITERIA

ANALYTE	UNIT	EPA SALTWATER ACUTE	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
NON-METALS															
CYANIDE	MG/L	0.001											0:005		
NITROGEN, AMMONIA	MG/L	43													
SULFIDE, TOTAL	MG/L	a													
VOCs															
DICHLOROMETHANE	UG/L	a													
SVOCs															
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	a													
PESTICIDES															
BETA-BHC	UG/L	a													
GAMMA-BHC	UG/L	0.16													
HEPTACHLOR	UG/L	0.053		0.07	0.07		0.07	0.19	0.08		0.06	0.06			
HEPTACHLOR EPOXIDE	UG/L	0.053													
PCB CONGENERS															
TOTAL PCB (ND=0)	UG/L	a													
TOTAL PCB (ND=1/2)	UG/L	a													
TOTAL PCB (ND=DL)	UG/L	a													
PAHs															
FLUORENE	UG/L	a													
METALS															
ANTIMONY	UG/L	a													
ARSENIC	UG/L	69													
BERYLLIUM	UG/L	a													
CHROMIUM	UG/L	1100													
COPPER	UG/L	4.8		5.8											
LEAD	UG/L	210													
MANGANESE	UG/L	a													
NICKEL	UG/L	74													
SELENIUM	UG/L	290													
SILVER	UG/L	1.9													2.3
ZINC	UG/L	90													

a = no USEPA acute saltwater criterion.

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TABLE 7-33B MIXING FACTORS REQUIRED TO COMPLY WITH USEPA ACUTE SALTWATER CRITERIA

ANALYTE	UNIT	USEPA SALTWATER ACUTE	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
NON-METALS															
CYANIDE	MG/L	0.001											5		
NITROGEN, AMMONIA	MG/L	43													
SULFIDE, TOTAL	MG/L	a													
VOCs															
DICHLOROMETHANE	UG/L	a													
SVOCs															
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	a													
PESTICIDES															
BETA-BHC	UG/L	a													
GAMMA-BHC	UG/L	0.16													
HEPTACHLOR	UG/L	0.053		1	1		1	4	2		1	1			
HEPTACHLOR EPOXIDE	UG/L	0.053													
PCB CONGENERS															
TOTAL PCB (ND=0)	UG/L	a													
TOTAL PCB (ND=1/2)	UG/L	a													
TOTAL PCB (ND=DL)	UG/L	a													
PAHs															
FLUORENE	UG/L	a													
METALS															
ANTIMONY	UG/L	a													
ARSENIC	UG/L	69													
BERYLLIUM	UG/L	a													
CHROMIUM	UG/L	1100													
COPPER	UG/L	4.8		1											
LEAD	UG/L	210													
MANGANESE	UG/L	a													
NICKEL	UG/L	74													
SELENIUM	UG/L	290													
SILVER	UG/L	1.9													1
ZINC	UG/L	90													

a = no USEPA acute saltwater criterion.

Acute criteria based on 1-hr. average exposure concentrations.
Maximum detected concentrations compared to acute criteria.

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TABLE 7-34A MEAN CONCENTRATIONS OF ANALYTES DETECTED IN 1999 CHANNEL ELUTRIATES THAT EXCEED USEPA CHRONIC SALTWATER CRITERIA

ANALYTE	UNIT	EPA SALTWATER CHRONIC	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
NON-METALS															
CYANIDE	MG/L	0.001											0.005		
NITROGEN, AMMONIA	MG/L	6.4					10.2		6.45						
SULFIDE, TOTAL	MG/L	0.002												0.395	
VOCs															
DICHLOROMETHANE	UG/L	a													
SVOCs															
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	a													
PESTICIDES															
BETA-BHC	UG/L	a													
GAMMA-BHC	UG/L	a													
HEPTACHLOR	UG/L	0.0036	0.03	0.045	0.045	0.03	0.045	0.105	0.05		0.04	0.04	0.035	0.03	0.025
HEPTACHLOR EPOXIDE	UG/L	0.0036	0.015	0.015			0.015	0.02	0.015	0.02	0.02	0.025	0.02	0.02	0.02
PCB CONGENERS															
TOTAL PCB (ND=0)	UG/L	a													
TOTAL PCB (ND=1/2)	UG/L	a													
TOTAL PCB (ND=DL)	UG/L	a													
PAHs															
FLUORENE	UG/L	a													
METALS															
ANTIMONY	UG/L	a													
ARSENIC	UG/L	36													
BERYLLIUM	UG/L	a													
CHROMIUM	UG/L	50													
COPPER	UG/L	3.1		3.25											
LEAD	UG/L	8.1													
MANGANESE	UG/L	a													
NICKEL	UG/L	8.2													
SELENIUM	UG/L	71													
SILVER	UG/L	a													
ZINC	UG/L	81													

a = no USEPA chronic saltwater criterion.

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TABLE 7-34B MIXING FACTORS REQUIRED TO COMPLY WITH USEPA CHRONIC SALTWATER CRITERIA

ANALYTE	UNIT	EPA SALTWATER CHRONIC	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
NON-METALS															
CYANIDE	MG/L	0.001											5		
NITROGEN, AMMONIA	MG/L	6.4													
SULFIDE, TOTAL	MG/L	0.002												198	
VOCs															
DICHLOROMETHANE	UG/L	a													
SVOCs															
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	a													
PESTICIDES															
BETA-BHC	UG/L	a													
GAMMA-BHC	UG/L	a													
HEPTACHLOR	UG/L	0.0036	8	13	13	8	13	29	14		11	11	10	8	7
HEPTACHLOR EPOXIDE	UG/L	0.0036	4	4			4	6	4	6	6	7	6	6	6
PCB CONGENERS															
TOTAL PCB (ND=0)	UG/L	a													
TOTAL PCB (ND=1/2)	UG/L	a													
TOTAL PCB (ND=DL)	UG/L	a													
PAHs															
FLUORENE	UG/L	a													
METALS															
ANTIMONY	UG/L	a													
ARSENIC	UG/L	36													
BERYLLIUM	UG/L	a													
CHROMIUM	UG/L	50													
COPPER	UG/L	3.1		1											
LEAD	UG/L	8.1													
MANGANESE	UG/L	a													
NICKEL	UG/L	8.2													
SELENIUM	UG/L	71													
SILVER	UG/L	a													
ZINC	UG/L	81													

a = no USEPA chronic saltwater criterion.

Chronic criteria based on 4-day average exposure concentrations.
Mean detected concentrations compared to chronic criteria.

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TABLE 7-35A MEAN CONCENTRATIONS OF ANALYTES DETECTED IN 1999 CHANNEL ELUTRIATES THAT EXCEED USEPA HUMAN HEALTH CRITERIA FOR CONSUMPTION OF AQUATIC ORGANISMS

ANALYTE	UNIT	EPA SALTWATER HUMAN HEALTH	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
NON-METALS															
CYANIDE	MG/L	a													
NITROGEN, AMMONIA	MG/L	a													
SULFIDE, TOTAL	MG/L	a													
VOCs															
DICHLOROMETHANE	UG/L	16000													
SVOCs															
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	59													
PESTICIDES															
BETA-BHC	UG/L	0.46													
GAMMA-BHC	UG/L	0.63													
HEPTACHLOR	UG/L	0.0021	0.03	0.045	0.045	0.03	0.045	0.105	0.05		0.04	0.04	0.035	0.03	0.025
HEPTACHLOR EPOXIDE	UG/L	0.0011	0.015	0.015			0.015	0.02	0.015	0.02	0.02	0.025	0.02	0.02	0.02
PCB CONGENERS															
TOTAL PCB (ND=0)	UG/L	0.0017	0.0119	0.012	0.02		0.0166	0.01	0.0167		0.01	0.0078	0.0253		0.0181
TOTAL PCB (ND=1/2)	UG/L	0.0017	0.0617	0.0598	0.0678		0.0644	0.061	0.0645	0.0535	0.0593	0.0571	0.0716		0.0645
TOTAL PCB (ND=DL)	UG/L	0.0017	0.112	0.108	0.116		0.112	0.112	0.112	0.105	0.109	0.106	0.118		0.111
PAHs															
FLUORENE	UG/L	14000													
METALS															
ANTIMONY	UG/L	4300													
ARSENIC	UG/L	1.4	4.1	3.2	2.45	2	8.8	3.95	5.05	3.55	6.05	4.6	5.2	3.05	18.2
BERYLLIUM	UG/L	0.117													0.315
CHROMIUM	UG/L	a													
COPPER	UG/L	a													
LEAD	UG/L	a													
MANGANESE	UG/L	100	6625	4465	2245	847	3280	2750	1565	1960	5520	2620	3830	2210.5	1850
NICKEL	UG/L	4600													
SELENIUM	UG/L	a													
SILVER	UG/L	a													
ZINC	UG/L	a													

a = no USEPA human health saltwater criterion.

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TABLE 7-35B MIXING FACTORS REQUIRED TO COMPLY WITH USEPA HUMAN HEALTH SALTWATER CRITERIA FOR CONSUMPTION OF AQUATIC ORGANISMS

ANALYTE	UNIT	EPA SALTWATER HUMAN HEALTH	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
NON-METALS															
CYANIDE	MG/L	a													
NITROGEN, AMMONIA	MG/L	a													
SULFIDE, TOTAL	MG/L	a													
VOCs															
DICHLOROMETHANE	UG/L	16000												< 1	< 1
SVOCs															
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	59												< 1	< 1
PESTICIDES															
BETA-BHC	UG/L	0.46												< 1	< 1
GAMMA-BHC	UG/L	0.63												< 1	< 1
HEPTACHLOR	UG/L	0.0021	14	21	21	14	21	50	24		19	19	17	14	12
HEPTACHLOR EPOXIDE	UG/L	0.0011	14	14			14	18	14	18	18	23	18	18	18
PCB CONGENERS															
TOTAL PCB (ND=0)	UG/L	0.0017	7	7	12		10	6	10	< 1	6	5	15		11
TOTAL PCB (ND=1/2)	UG/L	0.0017	36	35	40		38	36	38	31	35	34	42		38
TOTAL PCB (ND=DL)	UG/L	0.0017	66	63	68		66	66	66	62	64	63	69		65
PAHs															
FLUORENE	UG/L	14000													
METALS															
ANTIMONY	UG/L	4300												< 1	< 1
ARSENIC	UG/L	1.4	3	2	2	1	6	3	4	3	4	3	4	2	13
BERYLLIUM	UG/L	0.117													3
CHROMIUM	UG/L	a													
COPPER	UG/L	a													
LEAD	UG/L	a													
MANGANESE	UG/L	100	66	45	22	8	33	28	16	20	55	26	38	22	19
NICKEL	UG/L	4600												< 1	< 1
SELENIUM	UG/L	a													
SILVER	UG/L	a													
ZINC	UG/L	a													

a = no USEPA human health saltwater criterion.

Human health criteria based on daily lifetime (70-year) average consumption of aquatic organisms.

Mean detected concentrations compared to chronic criteria.

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TABLE 7-36 MIXING FACTORS FOR ANALYTES IN CHANNEL ELUTRIATES THAT EXCEED WATER QUALITY CRITERIA

Values in parenthesis indicate the estimated time and distance required to comply with applicable WQC for open-water placement at Site 104.

Brewerton Channel, Eastern Ext.

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.16 hrs, 322 ft)
MANGANESE			66 (1.39 hrs, 2799 ft)
TOTAL PCB (ND=0)			7 (0.33 hrs, 666 ft)
TOTAL PCB (ND=1/2DL)			36 (0.96 hrs, 1940 ft)
TOTAL PCB (ND=DL)			66 (1.39 hrs, 2788 ft)
HEPTACHLOR		8 (0.36 hrs, 723 ft)	14 (0.52 hrs, 1056 ft)
HEPTACHLOR EPOXIDE		4 (0.21 hrs, 420 ft)	14 (0.5 hrs, 1012 ft)

C&D Approach Channels (Cores)

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			2 (0.08 hrs, 149 ft)
MANGANESE			22 (0.74 hrs, 1482 ft)
TOTAL PCB (ND=0)			12 (0.43 hrs, 862 ft)
TOTAL PCB (ND=1/2DL)			40 (1.02 hrs, 2043 ft)
TOTAL PCB (ND=DL)			68 (1.41 hrs, 2833 ft)
HEPTACHLOR	1 (0.03 hrs, 64 ft)	13 (0.46 hrs, 924 ft)	21 (0.72 hrs, 1440 ft)

C&D Approach Channels (Surficial)

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			2 (0.12 hrs, 236 ft)
COPPER	1 (0.02 hrs, 41 ft)	1 (0 hrs, 10 ft)	
MANGANESE			45 (1.12 hrs, 2256 ft)
TOTAL PCB (ND=0)			7 (0.33 hrs, 669 ft)
TOTAL PCB (ND=1/2DL)			35 (0.95 hrs, 1913 ft)
TOTAL PCB (ND=DL)			63 (1.36 hrs, 2746 ft)
HEPTACHLOR	1 (0.03 hrs, 64 ft)	13 (0.46 hrs, 924 ft)	21 (0.72 hrs, 1440 ft)
HEPTACHLOR EPOXIDE		4 (0.21 hrs, 420 ft)	14 (0.5 hrs, 1012 ft)

Note: Time and distance modeled using STFATE assuming average ebb tide velocities, 75% elutriate availability, and placement via split hull barge.

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TABLE 7-36 (CONTINUED)

Craighill Angle East

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
NITROGEN, AMMONIA		2 (0.06 hrs, 118 ft)	
ARSENIC			6 (0.31 hrs, 623 ft)
MANGANESE			33 (0.92 hrs, 1849 ft)
TOTAL PCB (ND=0)			10 (0.38 hrs, 767 ft)
TOTAL PCB (ND=1/2DL)			38 (0.98 hrs, 1975 ft)
TOTAL PCB (ND=DL)			66 (1.39 hrs, 2794 ft)
HEPTACHLOR	1 (0.03 hrs, 64 ft)	13 (0.46 hrs, 924 ft)	21 (0.72 hrs, 1440 ft)
HEPTACHLOR EPOXIDE		4 (0.21 hrs, 420 ft)	14 (0.5 hrs, 1012 ft)

Craighill Angle West

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.15 hrs, 308 ft)
MANGANESE			28 (0.83 hrs, 1667 ft)
TOTAL PCB (ND=0)			6 (0.3 hrs, 596 ft)
TOTAL PCB (ND=1/2DL)			36 (0.96 hrs, 1930 ft)
TOTAL PCB (ND=DL)			66 (1.39 hrs, 2792 ft)
HEPTACHLOR	4 (0.18 hrs, 371 ft)	29 (0.86 hrs, 1731 ft)	50 (1.21 hrs, 2443 ft)
HEPTACHLOR EPOXIDE		6 (0.28 hrs, 569 ft)	18 (0.64 hrs, 1278 ft)

Craighill Channel

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			1 (0.04 hrs, 85 ft)
MANGANESE			8 (0.36 hrs, 727 ft)
HEPTACHLOR		8 (0.36 hrs, 723 ft)	14 (0.52 hrs, 1056 ft)

Note: Time and distance modeled using STFATE assuming average ebb tide velocities, 75% elutriate availability, and placement via split hull barge.

TABLE 7-36 (CONTINUED)

Craighill Entrance

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
NITROGEN, AMMONIA		1 (0 hrs, 2 ft)	
ARSENIC			4 (0.18 hrs, 373 ft)
MANGANESE			16 (0.56 hrs, 1135 ft)
TOTAL PCB (ND=0)			10 (0.38 hrs, 769 ft)
TOTAL PCB (ND=1/2DL)			38 (0.98 hrs, 1977 ft)
TOTAL PCB (ND=DL)			66 (1.39 hrs, 2795 ft)
HEPTACHLOR	2 (0.05 hrs, 101 ft)	14 (0.51 hrs, 1030 ft)	24 (0.76 hrs, 1532 ft)
HEPTACHLOR EPOXIDE		4 (0.21 hrs, 420 ft)	14 (0.5 hrs, 1012 ft)

Craighill Upper Range

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.13 hrs, 270 ft)
MANGANESE			20 (0.67 hrs, 1356 ft)
TOTAL PCB (ND=1/2DL)			31 (0.9 hrs, 1808 ft)
TOTAL PCB (ND=DL)			62 (1.35 hrs, 2722 ft)
HEPTACHLOR EPOXIDE		6 (0.28 hrs, 569 ft)	18 (0.64 hrs, 1278 ft)

Cutoff Angle

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			4 (0.22 hrs, 439 ft)
MANGANESE			55 (1.28 hrs, 2579 ft)
TOTAL PCB (ND=0)			6 (0.3 hrs, 596 ft)
TOTAL PCB (ND=1/2DL)			35 (0.95 hrs, 1906 ft)
TOTAL PCB (ND=DL)			64 (1.37 hrs, 2757 ft)
HEPTACHLOR	1 (0.01 hrs, 26 ft)	11 (0.4 hrs, 806 ft)	19 (0.66 hrs, 1327 ft)
HEPTACHLOR EPOXIDE		6 (0.28 hrs, 569 ft)	18 (0.64 hrs, 1278 ft)

Note: Time and distance modeled using STFATE assuming average ebb tide velocities, 75% elutriate availability, and placement via split hull barge.

TABLE 7-36 (CONTINUED)

Inside Site 104

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
SULFIDE, TOTAL		700 (3.65 hrs, 7365 ft)	
ARSENIC			4 (0.18 hrs, 373 ft)
MANGANESE			10 (0.38 hrs, 763 ft)
HEPTACHLOR		8 (0.36 hrs, 723 ft)	14 (0.52 hrs, 1056 ft)
HEPTACHLOR EPOXIDE		5 (0.24 hrs, 477 ft)	15 (0.55 hrs, 1108 ft)

Ocean Reference

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
SULFIDE, TOTAL		245 (2.5 hrs, 5033 ft)	
TRIBUTYLTIN			

Outside Site 104

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			6 (0.3 hrs, 610 ft)
MANGANESE			34 (0.93 hrs, 1887 ft)
TOTAL PCB (ND=0)			9 (0.37 hrs, 748 ft)
TOTAL PCB (ND=1/2DL)			38 (0.98 hrs, 1982 ft)
TOTAL PCB (ND=DL)			67 (1.4 hrs, 2819 ft)
HEPTACHLOR		8 (0.36 hrs, 723 ft)	14 (0.52 hrs, 1056 ft)

Swan Point Channel

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.17 hrs, 351 ft)
MANGANESE			26 (0.8 hrs, 1611 ft)
TOTAL PCB (ND=0)			5 (0.24 hrs, 472 ft)
TOTAL PCB (ND=1/2DL)			34 (0.93 hrs, 1871 ft)
TOTAL PCB (ND=DL)			63 (1.36 hrs, 2734 ft)
HEPTACHLOR	1 (0.01 hrs, 26 ft)	11 (0.4 hrs, 806 ft)	19 (0.66 hrs, 1327 ft)
HEPTACHLOR EPOXIDE		7 (0.33 hrs, 663 ft)	23 (0.74 hrs, 1493 ft)

Note: Time and distance modeled using STFATE assuming average ebb tide velocities, 75% elutriate availability, and placement via split hull barge.

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TABLE 7-36 (CONTINUED)

Tolchester Channel - North

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
CYANIDE	5 (0.26 hrs, 523 ft)	5 (0.26 hrs, 523 ft)	
ARSENIC			4 (0.19 hrs, 380 ft)
MANGANESE			38 (0.98 hrs, 1984 ft)
TOTAL PCB (ND=0)			15 (0.55 hrs, 1093 ft)
TOTAL PCB (ND=1/2DL)			42 (1.06 hrs, 2149 ft)
TOTAL PCB (ND=DL)			69 (1.42 hrs, 2860 ft)
HEPTACHLOR		10 (0.38 hrs, 766 ft)	17 (0.59 hrs, 1187 ft)
HEPTACHLOR EPOXIDE		6 (0.28 hrs, 569 ft)	18 (0.64 hrs, 1278 ft)

Tolchester Channel - South

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
SULFIDE, TOTAL		198 (2.26 hrs, 4568 ft)	
ARSENIC			2 (0.11 hrs, 222 ft)
MANGANESE			22 (0.73 hrs, 1469 ft)
HEPTACHLOR		8 (0.36 hrs, 723 ft)	14 (0.52 hrs, 1056 ft)
HEPTACHLOR EPOXIDE		6 (0.28 hrs, 569 ft)	18 (0.64 hrs, 1278 ft)

Tolchester Straightening

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			13 (0.48 hrs, 966 ft)
BERYLLIUM			3 (0.14 hrs, 291 ft)
MANGANESE			19 (0.65 hrs, 1296 ft)
SILVER	1 (0.02 hrs, 42 ft)		
TOTAL PCB (ND=0)			11 (0.39 hrs, 789 ft)
TOTAL PCB (ND=1/2DL)			38 (0.98 hrs, 1977 ft)
TOTAL PCB (ND=DL)			65 (1.38 hrs, 2782 ft)
HEPTACHLOR		7 (0.33 hrs, 663 ft)	12 (0.44 hrs, 874 ft)
HEPTACHLOR EPOXIDE		6 (0.28 hrs, 569 ft)	18 (0.64 hrs, 1278 ft)

Note: Time and distance modeled using STFATE assuming average ebb tide velocities, 75% elutriate availability, and placement via split hull barge.

TABLE 7-37 MIXING FACTORS FOR ANALYTES IN CHANNEL ELUTRIATES THAT EXCEED WATER QUALITY CRITERIA

Values in parenthesis indicate the estimated time and distance required to comply with applicable WQC for open-water placement at the Norfolk Ocean Disposal Site.

Brewerton Channel, Eastern Ext.

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.15 hrs, 173 ft)
MANGANESE			66 (1.26 hrs, 1496 ft)
TOTAL PCB (ND=0)			7 (0.26 hrs, 314 ft)
TOTAL PCB (ND=1/2DL)			36 (0.9 hrs, 1073 ft)
TOTAL PCB (ND=DL)			66 (1.26 hrs, 1490 ft)
HEPTACHLOR		8 (0.32 hrs, 378 ft)	14 (0.47 hrs, 552 ft)
HEPTACHLOR EPOXIDE		4 (0.18 hrs, 218 ft)	14 (0.45 hrs, 529 ft)

C&D Approach Channels (Cores)

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			2 (0.07 hrs, 80 ft)
MANGANESE			22 (0.61 hrs, 727 ft)
TOTAL PCB (ND=0)			12 (0.41 hrs, 479 ft)
TOTAL PCB (ND=1/2DL)			40 (0.96 hrs, 1141 ft)
TOTAL PCB (ND=DL)			68 (1.28 hrs, 1518 ft)
HEPTACHLOR	1 (0.03 hrs, 34 ft)	13 (0.42 hrs, 495 ft)	21 (0.6 hrs, 712 ft)

C&D Approach Channels (Surficial)

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			2 (0.11 hrs, 127 ft)
COPPER	1 (0.02 hrs, 22 ft)	1 (0 hrs, 5 ft)	
MANGANESE			45 (1.02 hrs, 1214 ft)
TOTAL PCB (ND=0)			7 (0.26 hrs, 317 ft)
TOTAL PCB (ND=1/2DL)			35 (0.88 hrs, 1048 ft)
TOTAL PCB (ND=DL)			63 (1.23 hrs, 1467 ft)
HEPTACHLOR	1 (0.03 hrs, 34 ft)	13 (0.42 hrs, 495 ft)	21 (0.6 hrs, 712 ft)
HEPTACHLOR EPOXIDE		4 (0.18 hrs, 218 ft)	14 (0.45 hrs, 529 ft)

Note: Time and distance modeled using STFATE assuming average NODS velocities (USEPA Region III 1992), 75% elutriate availability, and placement via split hull barge.

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TABLE 7-37 (CONTINUED)

Craighill Angle East

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
NITROGEN, AMMONIA		2 (0.05 hrs, 63 ft)	
ARSENIC			6 (0.22 hrs, 268 ft)
MANGANESE			33 (0.84 hrs, 993 ft)
TOTAL PCB (ND=0)			10 (0.36 hrs, 428 ft)
TOTAL PCB (ND=1/2DL)			38 (0.93 hrs, 1105 ft)
TOTAL PCB (ND=DL)			66 (1.26 hrs, 1493 ft)
HEPTACHLOR	1 (0.03 hrs, 34 ft)	13 (0.42 hrs, 495 ft)	21 (0.6 hrs, 712 ft)
HEPTACHLOR EPOXIDE		4 (0.18 hrs, 218 ft)	14 (0.45 hrs, 529 ft)

Craighill Angle West

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.14 hrs, 165 ft)
MANGANESE			28 (0.72 hrs, 860 ft)
TOTAL PCB (ND=0)			6 (0.21 hrs, 247 ft)
TOTAL PCB (ND=1/2DL)			36 (0.9 hrs, 1063 ft)
TOTAL PCB (ND=DL)			66 (1.26 hrs, 1492 ft)
HEPTACHLOR	4 (0.17 hrs, 199 ft)	29 (0.76 hrs, 907 ft)	50 (1.09 hrs, 1296 ft)
HEPTACHLOR EPOXIDE		6 (0.21 hrs, 243 ft)	18 (0.55 hrs, 656 ft)

Craighill Channel

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			1 (0.04 hrs, 45 ft)
MANGANESE			8 (0.32 hrs, 383 ft)
HEPTACHLOR		8 (0.32 hrs, 378 ft)	14 (0.47 hrs, 552 ft)

Note: Time and distance modeled using STFATE assuming average NODS velocities (USEPA Region III 1992), 75% elutriate availability, and placement via split hull barge.

TABLE 7-37 (CONTINUED)

Craighill Entrance

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
NITROGEN, AMMONIA		1 (0 hrs, 1 ft)	
ARSENIC			4 (0.17 hrs, 200 ft)
MANGANESE			16 (0.5 hrs, 594 ft)
TOTAL PCB (ND=0)			10 (0.36 hrs, 430 ft)
TOTAL PCB (ND=1/2DL)			38 (0.93 hrs, 1106 ft)
TOTAL PCB (ND=DL)			66 (1.26 hrs, 1494 ft)
HEPTACHLOR	2 (0.05 hrs, 54 ft)	14 (0.46 hrs, 539 ft)	24 (0.63 hrs, 745 ft)
HEPTACHLOR EPOXIDE		4 (0.18 hrs, 218 ft)	14 (0.45 hrs, 529 ft)

Craighill Upper Range

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.12 hrs, 145 ft)
MANGANESE			20 (0.58 hrs, 683 ft)
TOTAL PCB (ND=1/2DL)			31 (0.81 hrs, 963 ft)
TOTAL PCB (ND=DL)			62 (1.22 hrs, 1453 ft)
HEPTACHLOR EPOXIDE		6 (0.21 hrs, 243 ft)	18 (0.55 hrs, 656 ft)

Cutoff Angle

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			4 (0.19 hrs, 221 ft)
MANGANESE			55 (1.15 hrs, 1373 ft)
TOTAL PCB (ND=0)			6 (0.21 hrs, 247 ft)
TOTAL PCB (ND=1/2DL)			35 (0.88 hrs, 1041 ft)
TOTAL PCB (ND=DL)			64 (1.24 hrs, 1473 ft)
HEPTACHLOR	1 (0.01 hrs, 14 ft)	11 (0.39 hrs, 464 ft)	19 (0.57 hrs, 673 ft)
HEPTACHLOR EPOXIDE		6 (0.21 hrs, 243 ft)	18 (0.55 hrs, 656 ft)

Note: Time and distance modeled using STFATE assuming average NODS velocities (USEPA Region III 1992), 75% elutriate availability, and placement via split hull barge.

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TABLE 7-37 (CONTINUED)

Inside Site 104

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
SULFIDE, TOTAL		700 (3.19 hrs, 3787 ft)	
ARSENIC			4 (0.17 hrs, 200 ft)
MANGANESE			10 (0.36 hrs, 424 ft)
HEPTACHLOR		8 (0.32 hrs, 378 ft)	14 (0.47 hrs, 552 ft)
HEPTACHLOR EPOXIDE		5 (0.19 hrs, 227 ft)	15 (0.48 hrs, 580 ft)

Ocean Reference

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
SULFIDE, TOTAL		245 (1.95 hrs, 2323 ft)	
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Outside Site 104

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			6 (0.21 hrs, 254 ft)
MANGANESE			34 (0.86 hrs, 1026 ft)
TOTAL PCB (ND=0)			9 (0.34 hrs, 406 ft)
TOTAL PCB (ND=1/2DL)			38 (0.93 hrs, 1110 ft)
TOTAL PCB (ND=DL)			67 (1.27 hrs, 1508 ft)
HEPTACHLOR		8 (0.32 hrs, 378 ft)	14 (0.47 hrs, 552 ft)

Swan Point Channel

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			3 (0.16 hrs, 188 ft)
MANGANESE			26 (0.69 hrs, 819 ft)
TOTAL PCB (ND=0)			5 (0.19 hrs, 226 ft)
TOTAL PCB (ND=1/2DL)			34 (0.85 hrs, 1011 ft)
TOTAL PCB (ND=DL)			63 (1.23 hrs, 1460 ft)
HEPTACHLOR	1 (0.01 hrs, 14 ft)	11 (0.39 hrs, 464 ft)	19 (0.57 hrs, 673 ft)
HEPTACHLOR EPOXIDE		7 (0.26 hrs, 310 ft)	23 (0.62 hrs, 731 ft)

Note: Time and distance modeled using STFATE assuming average NODS velocities (USEPA Region III 1992), 75% elutriate availability, and placement via split hull barge.

TABLE 7-37 (CONTINUED)

Tolchester Channel - North

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
CYANIDE	5 (0.2 hrs, 235 ft)	5 (0.2 hrs, 235 ft)	
ARSENIC			4 (0.17 hrs, 204 ft)
MANGANESE			38 (0.94 hrs, 1112 ft)
TOTAL PCB (ND=0)			15 (0.48 hrs, 572 ft)
TOTAL PCB (ND=1/2DL)			42 (0.99 hrs, 1178 ft)
TOTAL PCB (ND=DL)			69 (1.29 hrs, 1537 ft)
HEPTACHLOR		10 (0.36 hrs, 427 ft)	17 (0.52 hrs, 621 ft)
HEPTACHLOR EPOXIDE		6 (0.21 hrs, 243 ft)	18 (0.55 hrs, 656 ft)

Tolchester Channel - South

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
SULFIDE, TOTAL		198 (1.82 hrs, 2171 ft)	
ARSENIC			2 (0.1 hrs, 119 ft)
MANGANESE			22 (0.61 hrs, 722 ft)
HEPTACHLOR		8 (0.32 hrs, 378 ft)	14 (0.47 hrs, 552 ft)
HEPTACHLOR EPOXIDE		6 (0.21 hrs, 243 ft)	18 (0.55 hrs, 656 ft)

Tolchester Straightening

Analyte	EPA Acute Aquatic Life	EPA Chronic Aquatic Life	EPA Human Health
ARSENIC			13 (0.43 hrs, 505 ft)
BERYLLIUM			3 (0.13 hrs, 156 ft)
MANGANESE			19 (0.56 hrs, 662 ft)
SILVER	1 (0.02 hrs, 22 ft)		
TOTAL PCB (ND=0)			11 (0.38 hrs, 453 ft)
TOTAL PCB (ND=1/2DL)			38 (0.93 hrs, 1106 ft)
TOTAL PCB (ND=DL)			65 (1.25 hrs, 1487 ft)
HEPTACHLOR		7 (0.26 hrs, 310 ft)	12 (0.41 hrs, 482 ft)
HEPTACHLOR EPOXIDE		6 (0.21 hrs, 243 ft)	18 (0.55 hrs, 656 ft)

Note: Time and distance modeled using STFATE assuming average NODS velocities (USEPA Region III 1992), 75% elutriate availability, and placement via split hull barge.

CHAPTER 8 -
TOXICITY TESTING

8. TOXICITY TESTING

EA's Ecotoxicology Laboratory performed water column and whole sediment toxicity testing on sediment composites collected from the approach channels, from Site 104, from an Outside Site 104 reference area, and from the Norfolk Ocean Disposal Site reference area. The testing was in compliance with ITM requirements. The toxicity testing program consisted of acute water column bioassays with *Mysidopsis bahia* (opossum shrimp), *Cyprinodon variegatus* (sheepshead minnow), *Mytilus* sp. (blue mussel), and *Menidia beryllina* (inland silverside), and 10-day whole sediment toxicity tests with *Neanthes arenaceodentata* (estuarine polychaete) and *Leptocheirus plumulosus* (estuarine amphipod). Acute water column bioassays with *Arbacia punctulata* (purple sea urchin) were initially conducted. However, USEPA Region III did not recommend this species, and USEPA representatives indicated that this species did not accurately represent aquatic organisms that could potentially be impacted in the Bay. The results of these tests are not discussed in this chapter, but are provided in Attachment V. The acute water column bioassays and the whole sediment toxicity tests evaluated the effects of exposure to the sediment elutriates and whole-sediment, respectively, on survival of the test organisms.

8.1 METHODS

The toxicity testing program consisted of three separate sequential rounds of testing:

- *Round 1*: Initial water column and solid phase testing with sediment from the approach channels and from Inside Site 104 (September-November 1999).

- *Round 2:* Additional water column and solid phase testing conducted in response to recommendations from USEPA Region III–Philadelphia. Additional testing with sediment from an Outside Site 104 reference area and additional testing of sediment from approach channels and Inside Site 104 with additional test species (December 1999-February 2000) was conducted.

- *Round 3:* Testing of Ocean Reference sediment (in conjunction with Woodrow Wilson Bridge sediment testing program) (February-March 2000).

A summary of the toxicity testing schedule is provided in Table 8-1. The water column and whole sediment toxicity testing was conducted in accordance with USEPA/USACE guidance (1998) and EA (1996b). The testing procedures, acceptability criteria, and quality assurance protocols are fully documented in the Quality Assurance Project Plan (QAPP) for the ecotoxicological testing program (EA 2000d) (Appendix B). To take advantages in efficiencies from testing on two concurrent programs using the same ocean placement reference site, testing procedures for the Ocean Reference sediment followed the same methodology as the Site 104 testing and are documented in the ecotoxicology QAPP for the Woodrow Wilson Bridge project (EA 2000b).

Original data sheets, records, memoranda, notes, and computer printouts for toxicity testing components are archived at EA's Baltimore Office in Sparks, Maryland. These data will be retained for a period of 5 years unless a longer period of time is requested by USACE–Baltimore District.

8.1.1 Sample Receipt and Preparation

Approximately 20 gallons of composited sediment from each sampling reach were required for the ecotoxicological (including bioaccumulation) testing. Sediment composites for the ecotoxicological testing are described in Table 8-2. Processing and homogenization of sediment followed procedures described in Chapter 4.

After completion of processing, compositing, and homogenization, reach composites and site water samples were logged in and assigned EA laboratory accession numbers. The sediment and water samples were stored in the dark in a secured walk-in cooler at 4°C until used for testing. Prior to use in toxicity testing, large rocks and debris were manually removed and discarded from each sample. Table 8-3A summarizes the sample identifications, accession numbers, and collection and receipt information for sediment and water from the approach channels, Inside Site 104, and Outside Site 104 sampling areas. Table 8-3B summarizes the sample identifications, accession numbers, and collection and receipt information for sediment and water collected from the Ocean Reference site. Copies of chain-of-custody records are provided in Attachments V-A and V-B for approach channels/Site 104 and Ocean Reference, respectively.

8.1.2 Water Column Testing

For the water column toxicity testing, elutriates were prepared from each composited sediment sample. Prior to elutriate preparation, the site water for each sampling reach was salinity adjusted to 30 ppt, as per USEPA/USACE (1998) guidance for the selected test species, using Forty Fathoms synthetic sea salts. Following USEPA/USACE (1998) guidance, a subsample of each homogenized sediment was combined with its respective site water in a 1:4 sediment to water ratio, on a volume/volume basis. The sediment/water combination was thoroughly mixed by vigorous aeration and manually stirred for 30 minutes at 20°C, and was then allowed to settle for one hour. After settling, the supernatant was decanted off and used for the water column acute toxicity testing. All elutriates were used for testing within 24 hours of preparation.

Static, non-renewal bioassays were conducted on the prepared elutriates using *Mysidopsis bahia* (opossum shrimp), *Cyprinodon variegatus* (sheepshead minnow), *Menidia beryllina* (inland silverside), and *Mytilus* sp. (blue mussel). All tests were conducted using either juvenile or laval organisms as required by the test protocols (USEPA/USACE 1998). The required ages of the test organisms were as follows: opossum shrimp (1-5 days ± 24 hours); sheepshead minnow (1-14 days ± 24 hours); inland silverside (9-14 days ± 24 hours); and blue mussel larvae (<4 hours old). The test organisms were acquired from scientific organism vendors and, when appropriate, gradually acclimated to test temperature and salinity prior to use in testing. The *Mytilus* sp. testing was performed by Northwestern Aquatic Sciences (NAS) located in Newport, Oregon. Elutriates for the *Mytilus* sp. testing were prepared by EA's Ecotoxicology Laboratory, shipped via overnight delivery on the day of preparation, and were used by NAS for the *Mytilus* sp. test within 24 hours of preparation.

8.1.2.1 *Mysidopsis bahia* and *Cyprinodon variegatus* Water Column Toxicity Testing

Approach Channels and Inside Site 104 (Round 1)

The 96-hour toxicity tests with *M. bahia* and *C. variegatus* were conducted in two batches (25-29 October 1999, 26-30 October 1999). Two lots of test organisms per species were acquired from Cosper Environmental Services, Inc. (Bohemia, New York). For use in the 25 October testing, stocks of *M. bahia* (lot number MB-402) and *C. variegatus* (CV-287) were received at EA on 23 October from Cosper Environmental Services. Additional lots from Cosper Environmental Services, *M. bahia* (lot MB-403) and *C. variegatus* (lot CV-288), were received on 26 October for use in toxicity testing the same day. The opossum shrimp and sheepshead minnows were fed freshly hatched *Artemia* sp. nauplii (<24 hours old) during holding.

Outside Site 104 (Round 2)

The 96-hour toxicity tests with *M. bahia* and *C. variegatus* were conducted 4-8 January 2000. An additional test with the Inside Site 104 sediments was conducted concurrently with the Outside Site 104 sediment to compare the consistency of results for the Inside Site 104 testing in Round 1 and Round 2. Test organisms were acquired from Aquatic BioSystems (Fort Collins, Colorado). The lots of organisms MB-413 (*M. bahia*) and CV-304 (*C. variegatus*) were received on 4 January 2000 from Aquatic BioSystems for use in toxicity testing the same day. The opossum shrimp and sheepshead minnows were fed freshly hatched *Artemia* sp. nauplii (<24 hours old) during holding.

Ocean Reference Site (Round 3)

The 96-hour toxicity test with *M. bahia* was conducted on 16-20 February 2000. The test organisms were acquired from Aquatic BioSystems (Fort Collins, Colorado). The organisms, *M. bahia* (lot MB-422), were received at EA on 15 February 2000. The opossum shrimp were fed freshly hatched *Artemia* sp. nauplii (<24 hours old) during holding. *C. variegatus* tests were not conducted under the Woodrow Wilson Bridge testing program.

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

The opossum shrimp and sheepshead minnow testing utilized 1-L beakers as test chambers. Each beaker contained 250 ml of test solution, and there were five replicate beakers per test concentration. Ten organisms were randomly introduced into each replicate for a total of 50 organisms per test concentration. The test chambers were maintained at 20± 1 °C with a 16-hour light/8-hour dark photoperiod. Temperature, pH, and dissolved oxygen were measured in one replicate of each concentration daily for the 96-hour exposure period. Due to the size of the water quality probe and the danger of injury to the test organisms, salinity was measured in each concentration only at test initiation (prior to introduction of the test organisms) and at termination. A summary of water quality measurements is presented in Table 8-4A and 8-4B (*M. bahia*–approach channels and Site 104), Table 8-4C (*M. bahia*- ocean reference), and Tables 8-5A and 8-5B (*C. variegatus*–approach channels and Inside Site 104). The number of live organisms were counted daily and recorded on the test data sheets. The opossum shrimp were fed freshly hatched *Artemia* sp. daily to avoid cannibalism during testing. Copies of the opossum shrimp and sheepshead minnow acute toxicity test data sheets are included in Attachments V-A and V-B, for the approach channel/Site 104 and the Ocean Reference, respectively.

8.2.1.2 *Menidia beryllina* Water Column Toxicity Testing

Approach Channels, Inside Site 104, and Outside Site 104 (Round 2)

The 96-hour *M. beryllina* acute toxicity tests were conducted in five batches (20-24, 21-25, and 25-29 January 2000, and 4-8 and 7-11 February 2000). The test methodologies followed those of the *M. bahia* and *C. variegatus* water column testing. Each test chamber for the *M. beryllina* testing contained 200 ml of test solution.

The *M. beryllina* toxicity testing was performed with 9-14 day old fish (hatched within a 24-hour period). During the testing program, five lots of *M. beryllina* were acquired from Aquatic BioSystems (Fort Collins, Colorado), and were gradually acclimated to test conditions in EA's Culture Facility prior to use in testing. The *M. beryllina* were fed *Artemia* nauplii at the 48-hour intermediate observation period during testing.

Ocean Reference (Round 3)

The 96-hour toxicity test with *M. beryllina* was conducted on 16-20 February 2000. The test organisms were acquired from Aquatic BioSystems (Fort Collins, Colorado). The organisms, *M. menidia* (lot MS-080), were received at EA on 15 February 2000, and were gradually acclimated to test conditions in EA's Culture Facility prior to use in testing. The *M. beryllina* were fed *Artemia* sp, nauplii (<24 hours old) during the holding period.

A summary of water quality parameters measured during the *M. beryllina* testing is presented in Tables 8-6A (approach channels, Inside Site 104, and Outside Site 104) and 8-6B (Ocean Reference). Attachments V-A and V-B contain copies of the data sheets from the *M. beryllina* toxicity testing for the approach channels/Site 104 and ocean testing, respectively.

8.1.2.3.1 *Mytilus* sp. Water Column Toxicity Testing

The *Mytilus* sp. bivalve embryo-larval toxicity testing was conducted by Northwestern Aquatic Sciences (NAS) located in Newport, Oregon. The 30 ppt salinity elutriates were prepared by EA on 20 December 1999 (approach channels and Site 104) and on 14 February 2000 (Ocean Reference), packed on wet ice the same day as the elutriate preparation, and shipped by overnight courier to NAS. The bivalve toxicity tests were initiated by Northwestern upon receipt of the elutriate samples on 21 December 1999 and on 15 February 2000.

The adult mussels were acquired from Carlsbad Aquafarm (Carlsbad, California) on 21 December 1999 and 15 February 2000. The mussels were induced to spawn by gradually cycling the temperature of the holding water several times through the range of 15-23°C. Spawning animals were rinsed and isolated in small dishes containing clean filtered seawater for collection of gametes. Four females and three males were isolated for gamete collection.

Unfertilized eggs were rinsed and suspended in clean seawater at a concentration of approximately 5,000 eggs/ml. Sufficient sperm was added to the egg suspension to achieve an approximate sperm to eggs ratio of 5:1. Ten minutes after sperm addition, the suspension was filtered through a 25 μm Nitex® screen to remove remaining sperm, and the embryos were re-suspended and adjusted to achieve a stock concentration of about 2,500 embryos/ml.

Test chambers were 30 ml borosilicate glass vials containing 10 ml of test solution. Test concentrations of 100, 50, 10, and 0 percent elutriate were prepared using 30 ppt site water (Yaquina Bay, Oregon) for the dilution. A laboratory control of natural clean seawater was also utilized. At test initiation, 100 μl of well-mixed embryo suspension was added to each test chamber. The tests were maintained at 15±1°C with a 16-hour light/8-hour dark photoperiod. Temperature, pH, dissolved oxygen, and salinity were measured daily on surrogate test chambers (without test organisms). A summary of water quality measurements from the *Mytilus* sp. testing is provided in Table 8-7A (approach channels, Inside Site 104, Outside Site 104) and Table 8-7B (Ocean Reference). The toxicity tests were terminated on 23 December 1999 and 17 February 2000 by adding 1 ml of 37 percent buffered formalin to each test chamber. The preserved embryos were observed microscopically, to determine the percentage of normally developed larvae. The complete reports for the *Mytilus* sp. elutriate testing are presented in Attachments V-A and V-B.

8.1.3 Whole Sediment Testing

8.1.3.1 *Neanthes arenaceodentata* and *Leptocheirus plumulosus* Whole Sediment Testing

<u>Approach Channels and Inside Site 104 (Round 1)</u>

Whole sediment toxicity testing was conducted with the estuarine polychaete *Neanthes arenaceodentata* and the estuarine amphipod *Leptocheirus plumulosus*. The approach channel and Inside Site 104 sediments were evaluated on 22 October-1 November with

N. arenaceodentata and on 23 October-2 November 1999 with *L. plumulosus*. The polychaete worms (organism lot numbers NA-005) were acquired from Dr. Donald Riesh, California State University (Long Beach, California) on 21 October 1999, and the amphipods (LP-010) were acquired from University of Maryland, Wye Research and Education Center (Queenstown, Maryland) on 21 October 1999. During the holding period, the organisms were gradually acclimated to laboratory water at 20°C and to the appropriate test salinity [20 (±10%) ppt for *Leptocheirus plumulosus* and 30 (±10%) ppt for *Neanthes arenaceodentata*, as per USEPA/USACE (1998)].

Outside Site 104 (Round 2)

Additional lots of *N. arenaceodentata* and *L. plumulosus* were acquired for the later testing of the Outside Site 104 sediment. The Inside Site 104 sediment was re-run concurrently with the Outside Site 104 tests to compare the consistency of results for Inside Site 104 testing in Round 1 and Round 2. The *N. arenaceodentata* lot (NA-006) was received on 28 December from Dr. Donald Reish for use in toxicity testing on 30 December 1999. The *L. plumulosus* lot (LP-012) was acquired from Aquatic BioSystems on 27 January for use in toxicity testing on 28 January 2000.

Ocean Reference (Round 3)

L. plumulosus (organism lot # NA-005) were acquired from Aquatic BioSystems (Fort Collins, CO) on 23 February 2000. During the holding period, the organisms were gradually acclimated to laboratory water at 20°C. Based on recommendations from USEPA Region III, a lower Chesapeake Bay control sediment (collected from a USEPA Region III approved location) was tested in place of the Ocean Reference Site sediment. *L. plumulosus* are sensitive to sediment grain size characteristics (USEPA 1993b). This species of estuarine amphipod prefers fine sediment characteristic of the Chesapeake Bay and does not typically survive well in coarse-grained sandy sediment. The lower Chesapeake Bay control sediment was tested in place of the Ocean Reference sediment to reduce the potential for adverse grain-size effects on survival.

The whole sediment toxicity tests were conducted as static, non-renewal tests with 10 days of exposure to the whole sediments and overlying water. Artificial seawater (Forty Fathoms sea salts) at 30 ppt salinity for *N. arenaceodentata* and 20 ppt salinity for *L. plumulosus* was used as the overlying water. The sediments and overlying water were added to the test chambers, and the suspended sediments were allowed to settle 1-3 days. During the settling period, ammonia was monitored in the overlying water of each sediment test chamber as directed by USEPA/USACE guidance to ensure that ammonia was not an artifact of the sediment test. No replacement of the overlying water was required due to the low measured levels of ammonia (<2 mg/L NH_3-N). The addition of the test organisms to the exposure chambers marked the initiation of the toxicity tests. A Chesapeake Bay field sediment was used as a laboratory control for the whole sediment toxicity tests.

The *N. arenaceodentata* and *L. plumulosus* tests utilized 1-L beakers as the exposure chambers, with each beaker containing 200 ml of sediment and 700 ml of overlying water. There were five replicate chambers for each sediment sample and control. Test organisms were randomly assigned to the test chambers. The *N. arenaceodentata* test had 5 organisms per replicate for a total of 25 organisms exposed per sample, while the *L. plumulosus* test had either 20 or 25 organisms per replicate chamber for a total of 100 organisms per sample (23 October 1999 testing) or 125 organisms per sample (28 January 2000 testing).

The tests were maintained at 20± 1 °C with a 16-hour light/8-hour dark photoperiod. Water quality measurements of temperature, pH, dissolved oxygen, and salinity were recorded daily on one replicate of each sample and control. Water quality parameters measured during the *N. arenaceodentata* testing are summarized in Tables 8-8A (approach channels and Inside Site 104) and 8-8B (Outside and Inside Site 104). Water quality parameters measured during the *L. plumulosus* testing are summarized in Tables 8-9A (approach channels and Inside Site 104), 8-9B (Outside and Inside Site 104), and 8-9C (Ocean Reference). Additionally, test chambers were visually inspected daily for abnormal organism behavior/lack of burrowing. The test organisms were not fed during the 10-day exposure period.

After 10 days of exposure, the test organisms were retrieved from the samples and the number of live organisms per replicate was recorded. Copies of the original data sheets for the *N. arenaceodentata* and the *L. plumulosus* testing are included in Attachments V-A (approach channels/Site 104) and V-B (Ocean Reference), respectively.

8.1.3.2 *Mysidopsis bahia* Whole Sediment Testing

For the Ocean Reference sediment, *Mysidopsis bahia* was tested as the second species for the whole sediment bioassays. The Ocean Reference sediment was tested in conjunction with another testing program (Woodrow Wilson Bridge) that requested *M. bahia* testing, rather than *Neanthes arenaceodentata*. Either species is acceptable to USEPA Region III for evaluating open water and ocean placement.

The opossum shrimp (lot MB-423) were acquired from Aquatic BioSystems on 18 February 2000. During the holding period, the organisms were gradually acclimated to laboratory water at 20°C and at the required test salinity (30 ppt).

The whole sediment toxicity tests were conducted as static, non-renewal tests with 10 days of exposure to the whole sediments and overlying water. Artificial seawater (Forty Fathoms sea salts) at 30 ppt salinity for *M. bahia* was used as the overlying water. The sediments and overlying water were added to the test chambers on 17 February 2000, and the suspended sediments were allowed to settle 1-5 days. During the settling period, ammonia was monitored in the overlying water of each sediment chamber. Due to the low measured levels of ammonia (<2 mg/L NH_3-N), no replacement of the overlying water was required. The addition of the test organisms to the exposure chambers marked the initiation of the toxicity tests. The *M. bahia* whole sediment toxicity tests were initiated on 18 February 2000. A Chesapeake Bay field sediment was used as a laboratory control for the *M. bahia* tests.

The *M. bahia* tests utilized 1-L beakers as the exposure chambers, with each beaker containing 300 ml of sediment and 650 ml of overlying water. There were five replicate chambers for each sediment sample and control. Test organisms were randomly assigned to the test chambers. The *M. bahia* tests had 10 organisms per replicate for a total of 50 organisms exposed per sample.

The tests were maintained at 20± 1 °C with a 16-hour light/8-hour dark photoperiod. Water quality measurements of temperature, pH, dissolved oxygen, and salinity were recorded daily on one replicate of each sample and control. Water quality parameters measured during the Ocean Reference *M. bahia* testing are summarized in Table 8-10. The test organisms were not fed during the 10-day exposure period. After 10 days of exposure, the test organisms were retrieved from the samples and the number of live organisms per replicate was recorded. Copies of the original data sheets for the *M. bahia* testing are included in Attachment V-B.

8.1.4 Data Analysis / Statistics

Statistical analyses were performed on the water column and whole sediment test data according to USEPA/USACE (1998) guidance. Survival (or larval development) of the organisms exposed to the test material for the prescribed time period was statistically compared (p=0.05) to either the laboratory control (elutriate tests) or the reference sediment (whole-sediment tests) as appropriate for each test using the student t-test.

For the elutriate testing, a 96-hour LC50 (median lethal concentration), or EC50 (median effective concentration for *Mytlius* sp.), was calculated for each test species using either the linear interpolation, trimmed Spearman-Karber method (Hamilton et al., 1977), or probit method (as described by Stephan 1977). The LC50 is an estimate of the elutriate concentration that is lethal to 50 percent of the test organisms, or that creates a sub-lethal effect on the development of 50 percent (EC50) of the test organisms, in the time period prescribed by the test. If survival in the 100 percent elutriate concentration was at least 10 percent lower than the dilution water control, then a statistical comparison (t-Test) was performed between the 100 percent elutriate concentration and the control. The t-test was based on the assumptions that the observations were independent and normally distributed, and that the variances of the observations were equal between the two groups. The F-Test was used to test for homogeneity of variance. The test for normality was the Shapiro-Wilk's Test. When the data did not meet the normality assumption, the nonparametric test, Wilcoxon's Rank-Sum Test, was used to analyze the data. An arc sine (square root [Y]) transformation was performed on the survival percentages, where appropriate.

For data sets in which the 100 percent concentration was statistically different from the control, an additional analysis was performed to determine the No Observed Adverse Effect Concentration (NOAEC). Based on USEPA (1993d) guidance for standard multi-concentration effluent toxicity tests, a multiple mean comparison was conducted to statistically compare the 100, 50, and 10 percent concentrations to the control. This comparison utilized the dose response data from the three test concentrations and control. A concentration which had no surviving organisms was excluded from the analysis. A parametric or nonparametric statistical test was utilized based on the assumptions of normality and homogeneity of variance. The test for normality was the Shapiro-Wilk's Test, and the test for homogeneity of variance was the Bartlett's Test. For parametric data, an analysis of variance (ANOVA) and either Dunnett's Mean Comparison test or Bonferroni's T-test was used (depending on equal or unequal replicate numbers). Steel's Many-One Rank Test or the Wilcoxon Rank Sum Test were the alternative nonparametric tests.

For the whole sediment toxicity test data, statistical analyses were performed to determine if exposure to any of the sediment samples resulted in significantly lower survival of the test organisms as compared to the reference site. If survival in a test sample was at least 10 percent lower than the reference, then a t-test or Wilcoxon's Rank-Sum Test (depending on data characteristics) was performed to compare the single test sample to the reference (Inside Site 104).

For the whole sediment bioassays, only results generated within a single round of testing should be statistically compared to each other because of potential differences associated with survival in the control organisms. In this testing program, data from different rounds of whole-sediment testing could not be statistically compared against each other, but were compared qualitatively (i.e., toxic or non-toxic). For the water column bioassays, statistical comparisons are conducted against a laboratory or test control (not a reference sample). In these cases, each sample had an independent statistical comparison against a control, and the results generated by different rounds of testing stand as independent measures of toxicity.

8.1.5 Reference Toxicant Testing

In conformance with EA's QA/QC program requirements, reference toxicant testing was performed on the acquired lots of organisms utilized in the testing program or reference toxicant data were obtained from the test organism supplier. The reference toxicant tests consisted of a graded concentration series of a specific toxicant in water only tests, with no sediment present in the test chambers.

The reference toxicant for *M. bahia*, *C. variegatus*, and *M. beryllina* was potassium chloride (KCl); the reference toxicant for *Mytilus* sp. was copper sulfate ($CuSO_4 \cdot 5H_20$); and the reference toxicant for *N. arenaceodentata* and *L. plumulosus* was cadmium chloride ($CdCl_2$). Reference toxicant testing was also conducted for the species utilized in the bioaccumulation studies (Chapter 9). The results of the reference toxicant tests were compared to established control chart limits.

8.2 RESULTS

8.2.1 Water Column Testing

8.2.1.1 *Mysidopsis bahia*

The results of the *M. bahia* toxicity testing are presented in Tables 8-11A (approach channels and Inside Site 104), 8-11B (Inside and Outside Site 104), and 8-11C (Ocean Reference).

Approach Channels and Inside Site 104 (Round 1)

The results of the initial 14 elutriate tests with *M. bahia* are provided in Table 8-11A. Five of the prepared elutriates exhibited some inhibition of survival to *M. bahia*. Samples from the Craighill Entrance (CRE), Craighill Angle-West (CRA-W), Tolchester-South (TLC-S), Brewerton Channel Eastern Extension (BE), and C& D Approaches (surficial CD) had 96-hour LC50s of >100 percent elutriate; however, the survival in the 100 percent elutriate concentration for each sample was statistically lower than the control. Calculation of NOAECs for these samples indicated that no effect would be expected at elutriate concentrations of >50%. Samples from the Craighill Channel (CR), Craighill Angle-East (CRA-E), Craighill Upper Range (CRU), Cutoff Angle (CUT), Tolchester Channel North (TLC-N), Tolchester Straightening (TLS), Swan Point Channel (SWP), C&D Approaches (cores CD-VC), and Inside Site 104 (KI-Reference) were not acutely toxic to *M. bahia*, with 96-hour LC50s of >100 percent elutriate and no statistically difference in survival between the control and the 100 percent elutriate concentration.

Outside Site 104 (Round 2)

The results of the *M. bahia* testing on the Outside Site 104 (KI-OUT) reference elutriate are presented in Table 8-11B. The Outside Site 104 sample was not acutely toxic to *M. bahia* with 94 percent survival in the 100 percent elutriate concentration (96-hour LC50 >100 percent elutriate). The Inside Site 104 reference elutriate was re-analyzed concurrently with the Outside Site 104 elutriate using a fresh sample of Inside Site 104 sediment and site water. The Inside Site 104 elutriate was again not acutely toxic to *M. bahia* (96-hour LC50 >100 percent elutriate), with 100 percent survival in the 100 percent elutriate concentration.

Ocean Reference (Round 3)

The results of the Ocean Reference elutriate testing with *M. bahia* are provided in Table 8-11C. The Ocean Reference sample was not acutely toxic to *M. bahia*, with a 96-hour LC50 of >100 percent elutriate and no statistical difference in survival between the control and the 100 percent elutriate concentration.

8.2.1.2 *Cyprinodon variegatus*

The results of the sheepshead minnow acute toxicity tests are summarized in Tables 8-12A (approach channels and Inside Site 104) and 8-12B (Inside and Outside Site 104).

Approach Channels and Inside Site 104 (Round 1)

Results of the *C. variegatus* acute toxicity tests conducted on the 13 channel elutriates and Inside Site 104 are provided in Table 8-12A. None of the elutriates was acutely toxic to *C. variegatus*. Survival in the 100 percent elutriate concentrations was at least 92 percent, while survival in the controls was a minimum of 98 percent. The 96-hour *C. variegatus* LC50s for all of the tested elutriates, including the Inside Site 104 reference, were >100 percent elutriate.

Outside Site 104 (Round 2)

The results of the Outside Site 104 reference elutriate testing with *C. variegatus* are summarized in Table 8-12B. The Outside Site 104 elutriate was not acutely toxic to *C. variegatus*, with 96 percent survival in the 100 percent elutriate concentration. The re-analyzed Inside Site 104 reference elutriate was also not acutely toxic (100 percent survival in the 100 percent elutriate concentration). The 96-hour LC50s for the Inside Site 104 and Outside Site 104 elutriates were both >100 percent elutriate.

Ocean Reference (Round 3)

C. variegatus was not tested with the Ocean Reference sediment.

8.2.1.3 *Menidia beryllina*

Results of the inland silverside testing are summarized in Table 8-13A (approach channels, Inside Site 104, and Outside Site 104) and Table 8-13B (Ocean reference). These tests were performed as an additionally requested species during the testing program.

Approach Channels, Inside Site 104 and Outside Site 104 (Round 2)

The *M. beryllina* acute toxicity test results are summarized in Table 8-13A. Four of the elutriates (Inside Site 104, Outside Site 104, Swan Point, and Tolchester Straightening) were not acutely toxic to *M. beryllina*, with 96-hour LC50s of >100 percent elutriate and no statistical difference in survival between the 100 percent elutriate concentration and the control. Samples for the Craighill Upper Range and the C&D Approaches (cores) had 96-hour LC50s of >100 percent elutriate; however, there was a statistically significant decrease in survival in the 100 percent elutriate concentration when compared to the control. Calculations of NOAECs indicated that no effects to survival would be expected in the 10% elutriate and 50% elutriate for the Craighill Upper Range and C&D Approach (cores), respectively.

The remaining nine elutriates [Craighill Channel, Craighill Entrance, Craighill Angle-East, Craighill Angle West, Cutoff Angle, Brewerton Channel Eastern Extension, C&D Approaches (surficial), Tolchester Channel-South, and Tolchester Channel-North] were all acutely toxic to *M. beryllina* with 96-hour LC50s ranging from 23.8 percent elutriate (Tolchester Channel-South) to 70.7 percent elutriate (Craighill Entrance). Calculation of NOAECs indicated that no effects to survival would be expected at a concentration of 10% elutriate in 8 of the 9 channel elutriates. The NOAEC was <10% elutriate for Brewerton Channel Eastern Extension.

Ocean Reference (Round 3)

The *M. beryllina* acute toxicity test results for the Ocean Reference site are presented in Table 8-13B. The Ocean Reference elutriate was not acutely toxic to *M. beryllina*, with 96-hour LC50 of >100 percent elutriate and no statistical difference in survival between the control and the 100 percent elutriate concentration.

8.2.1.4 *Mytilus* sp.

Results of the blue mussel testing are summarized in Table 8-14A (approach channels, Inside Site 104, Outside Site 104) and Table 8-14B (Ocean Reference).

Approach Channels, Inside Site 104 and Outside Site 104 (Round 2)

Results of the *Mytilus* sp. embryo larval toxicity tests are presented in Table 8-14A. Two samples (Craighill Channel and Craighill Upper Range) were not acutely toxic to *Mytilus* sp., with
87 percent normal development in the 100 percent elutriate concentration and 48-hour EC50s of >100 percent elutriate. The Inside Site 104 reference elutriate (48-hour EC50 >100 percent elutriate) was marginally toxic with 82 percent normal development in the 100 percent elutriate concentration which was statistically lower than the control (97 percent normal development). The Outside Site 104 reference elutriate was more toxic than the Inside Site 104 elutriate, with a 48-hour EC50 of 63.8 percent elutriate.

Elutriates for the Cutoff Angle, Tolchester Channel-South, Tolchester Channel-North, Tolchester Straightening, Brewerton Channel Eastern Extension, and the C&D Approaches (surficial) had 48-hour EC50s ranging from 56.4 to 79.7 percent elutriate. Elutriates for the Craighill Angle-East, Craighill Angle-West, and Swan Point Channel had 48-hour EC50s of 43.5, 46.8, and 47.8 percent elutriate, respectively. Elutriates for the Craighill Entrance and C&D Approaches (cores) were the most toxic with 48-hour EC50s of 22.0 and 21.2 percent elutriate, respectively. Overall, calculation of NOECs indicated that only one elutriate (C&D Approach cores) would be expected to affect larval development at concentrations of <10% elutriate.

Ocean Reference (Round 3)

The results of the elutriate testing with *Mytilus* sp. for the Ocean Reference are presented in Table 8-14B. The Ocean Reference sediment elutriate was not acutely toxic to *Mytilus* sp. (EC50 > 100 percent).

8.2.2 Whole Sediment Testing

8.2.2.1 *Neanthes arenaceodentata*

The results of the estuarine polychaete toxicity tests are summarized in Tables 8-15A (approach channels and Inside Site 104) and 8-15B (Outside and Inside Site 104).

Approach Channels and Inside Site 104 (Round 1)

The results of the *N. arenaceodentata* toxicity testing conducted on the approach channel and Inside Site 104 sediments are summarized in Table 8-15A. After ten days of exposure, the lowest survival (92 percent) was recorded in the sediment from Craighill Angle-West. Sediments from Craighill Channel, Cutoff Angle, Tolchester Channel-South, Tolchester Straightening, and C&D Approaches (cores) had 96 percent survival, while sediments from

Craighill Entrance, Craighill Angle-East, Craighill Upper Range, Tolchester Channel-North, Brewerton Channel Eastern Extension, Swan Point Channel, and C&D Approaches (surficial) had 100 percent survival. Survival in all of the sediments was within 10 percent of the Inside Side 104 sediment, which had 96 percent survival, indicating that the sediments are not toxic and are not statistically different from those at the proposed placement site. The laboratory control sediment for the *N. arenaceodentata* testing had 100 percent survival.

Outside Site 104 (Round 2)

As summarized in Table 8-15B, the Outside Site 104 reference sediment had 80 percent survival compared to 88 percent survival in the Inside Site 104 reference and 96 percent survival in the control. When tested statistically, survival in the Outside Site 104 sediment was not significantly different from the Inside Site 104 survival or the control survival.

Ocean Reference (Round 3)

N. arenaceodentata was not tested for the Ocean Reference site.

8.2.2.2 *Leptocheirus plumulosus*

The results of the estuarine amphipod toxicity tests are summarized in Tables 8-16A (approach channels and Inside Site 104), 8-16B (Outside and Inside Site 104), and 8-16C (Ocean Reference).

Approach Channels and Inside Site 104 (Round 1)

The *L. plumulosus* whole sediment toxicity test results are presented in Table 8-16A. Survival in the channel sediments ranged from 86 to 96 percent, which was within the allowable 20 percent difference from the Inside Site 104 survival of 93 percent. Based on the survival results, the whole sediments were not acutely toxic to *L. plumulosus*. The control sediment for the *L. plumulosus* toxicity testing had 96 percent survival.

Outside Site 104 (Round 2)

The Outside Site 104 reference sediment had 96 percent survival indicating that this sample was not acutely toxic to *L. plumulosus* (Table 8-16B). Survival for Inside Site 104 and the control were 87 and 98 percent, respectively.

Ocean Reference (Round 3)

The *L. plumulosus* whole sediment toxicity test results are presented in Table 8-16C. The lower Chesapeake Bay control sediment had 94 percent survival to estuarine amphipods.

8.2.2.3 *Mysidopsis bahia*

Ocean Reference (Round 3 only)

The results of the opossum shrimp whole sediment toxicity testing for the Ocean Reference are summarized in Table 8-17. The Ocean Reference sediment had 94 percent survival, indicating that the sediment was not acutely toxic to opossum shrimp.

8.2.3 Reference Toxicant Tests

The results of the reference toxicant tests are summarized in Table 8-18A (Round 1 and Round 2) and Table 8-18B (Round 3). The LC50s from the *M. bahia*, *C. variegatus*, *Mytilus* sp., *M. beryllina*, and *L. plumulosus* (96-hours; Round 1 and Round 2) reference toxicant tests all fell within the established laboratory control chart limits.

For *N. arenaceodentata*, control chart limits have not yet been established, because an insufficient number of reference toxicant tests (less than five) have been conducted. The LC50 of 6.4 mg/L Cd was similar to the LC50 of 5.7 mg/L Cd for a previous lot of *N. arenaceodentata* from September 1999.

For *L. plumulosus* (reference toxicant tests for Ocean Reference-Round 3), control chart limits have not yet been established (48-hour LC50), because an insufficient number of reference toxicant tests (less than five) have been conducted. The LC50 of 5.9 mg/L Cd (48-hour) falls within the range of LC50's from previous *L. plumulosus* reference toxicant tests (2.2-9.0 mg/L Cd).

8.3 DISCUSSION AND TIER III TOXICITY EVALUATION

The Tier III toxicity evaluation requires an analysis of water column and benthic toxicity test data. The following sections discuss the results of the water column and whole-sediment bioassays, and the potential for impacts to the aquatic environment.

8.3.1 Water Column Bioassays

According to the ITM (USEPA/USACE 1998), after considering water column test results and expected mixing at the placement site, one of the following conclusions is reached:

1. The 100% dredged material elutriate toxicity is not statistically higher than the dilution water (laboratory control). Therefore, the dredged material is not predicted to be acutely toxic to water column organisms. However, benthic impact must also be evaluated.

2. The concentration of dissolved plus suspended contaminants, after allowance for mixing, does not exceed 0.01 (1%) of the toxic LC50 or EC50 concentration beyond the boundaries of the mixing zone. Therefore, the dredged material is not predicted to be acutely toxic to water column organisms. However, benthic impact must also be evaluated.

3. The concentration of dissolved plus suspended contaminants, after allowance for mixing, exceeds 0.01 (1%) of the toxic LC50 or EC50 concentration beyond the boundaries of the mixing zone. Therefore, the dredged material may have the potential to be acutely toxic to water column organisms.

The evaluation guidelines in the ITM assume that state regulatory agencies will issue or permit an allowable mixing zone for open water placement events. It is important to recognize that the evaluation protocols in the ITM are guidelines, not regulations. More specifically, 40 CFR Part 230.10 (c) states that dredged material placement may not result in unacceptable adverse impact; however, the guidance in the ITM *suggests* the 0.01 (1%) LC50/EC50 concentrations as a quantitative method for assessing whether unacceptable adverse impacts might occur in the water column.

The ITM explicitly states that regional modifications of the national guidelines may be required or may be appropriate based on project-specific requirements or circumstances (ITM, p.1-1). In a situation where a mixing zone is not issued, the evaluation of the water column impacts requires alternative methods to demonstrate whether an unacceptable adverse impact is expected during placement or as a result of placement. Therefore, the evaluation of water column impacts for open-water placement at Site 104 is based on an assessment of elutriate concentration and duration of exposure to aquatic organisms. Evaluation of dredged material placement at the NODS is based on the *Ocean Testing Manual* (USEPA/USACE 1991) guidance which specifies that the 0.01 (1%) of LC50/EC50 must occur within a 4-hour time period inside the boundaries of the ocean placement site (NODS).

Results of the water column toxicity testing are summarized in Tables 8-19A and 8-19B. LC50/EC50 and No Observed Acute Effect Concentration/No Observed Effect Concentration (NOAEC/NOEC) values are provided in Table 8-19A, and mixing factors that would be required to determine compliance for ocean placement are provided in Table 8-19B.

In the water column tests, survival was the endpoint for the opposum shrimp, sheepshead minnow, and inland silverside tests. The endpoint of the blue mussel test was normal hinge development. As a worst case assessment, all water column tests were conducted with larval or juvenile tests organisms which as considered the most sensitive life stage. The age ranges as specified by the USEPA/USACE (1998) testing guidelines were: opposum shrimp (1-5 days old), sheepshead minnow (1-14 days old), inland silverside (9-14 days old), and blue mussels (< 4 hours old). In water column tests, results for 100% test elutriates are statistically compared (single-point comparison) to results of the laboratory controls as per ITM evaluation protocols, not to the results for the placement site or reference area.

Results of the water column tests indicated that the blue mussel and inland silverside were the most sensitive water column species to the project elutriates. None of the tested 100% elutriates was acutely toxic to sheepshead minnow. Although the LC50 values were >100% elutriate for all of the opposum shrimp tests, mean survival in 5 of the 13 elutriates was statistically lower than the mean laboratory control survival.

Normal development in the blue mussel is defined as transformation to the fully shelled, straight hinged, D-shaped prodissoconch I stage. In the blue mussel tests, the 48-hr EC50 (median effect concentration) for the channel sediments ranged from 21.2 to >100% elutriate. Eleven of the 13 reaches had EC50 values for 100% elutriate that were statistically lower than the laboratory controls, indicating that 11 of the 100% elutriates affected normal development in the larval (<4 hrs old) organisms. Craighill Channel and Craighill Upper Range were the only channels where development was not statistically lower than the laboratory control. The lowest EC50 values were reported for the C&D Approach Channel-cores (21.2% elutriate) and the Craighill Entrance (22% elutriate).

Results of the inland silverside bioassays indicated that 11 of the 13 channel elutriates elicited some level of acute toxicity to juvenile (9-14 day old) inland silversides when exposed to undiluted elutriate. Tolchester Straightening and Swan Point Channel were the only channel elutriates (100%) that were not acutely toxic to the juvenile inland silverside (LC50 >100%) and were not significantly different than the laboratory control. LC50 values for inland silverside ranged from 23.8% elutriate to >100% elutriate. The lowest LC50 value was reported for Tolchester Channel– South (23.8% elutriate).

Calculation of NOAECs for oppossum shrimp, sheepshead minnow, and inland silverside, and NOECs for blue mussel water column tests indicated that 11 of the 13 test reaches had NOAECs or NOECs of ≥10% elutriate for all of the test species data. Brewerton Channel Eastern Extension (inland silverside test) and C&D Approaches–cores (blue mussel test) yielded an NOAEC of <10% and an NOEC of <10%, respectively. These results indicated that no effect to survival or larval development would be expected to occur at elutriate concentrations below 10% based on a continuous 96-hour exposure period (oppossum shrimp, sheepshead minnow, and inland silverside) or based on a 48-hour continuous exposure period (blue mussel), with the exception of the two specified channel/species combinations with an NOAEC or NOEC of <10% elutriate. Based on the results of the STFATE modeling, an elutriate concentration of 10% would be expected at the placement site within less than 30 minutes after placement occurs. The NOAECs indicate that no effect is expected for the majority of test organisms/channels at a concentration of greater than 10% over either a 96-hour (opossum shrimp, sheepshead minnow, and inland silverside) or a 48-hour (blue mussel) exposure period. For each placement event, the duration of organism exposure to elutriate constituents in the water column would be expected to be short (acute), not a long-term continuous chronic exposure. Therefore, assuming that material would not be placed successively or consecutively at the same location within a proposed placement area, no unacceptable adverse acute impact to water column organisms would be expected for a single placement event.

Evaluation of the elutriate data using methodology for whole effluent toxicity (USEPA 1991b) yields similar results. The most restrictive acute toxicity test value presented in Table 8-19A is a 48-hour EC50 value for the blue mussel (21.2 percent elutriate). Per USEPA guidance, converting this value to acute toxic units (TUa) yields a value of 4.7 TUa (100/21.2). USEPA (1991b) guidance in the Technical Support Document for Water Quality-Based Toxics Control requires compliance with the USEPA's 0.3 TUa (acute Toxicity Units) criterion at the edge of an acute mixing zone. Further, the 0.3 TUa criterion is generally interpreted as a 1-hour average concentration (p. 35), which "*is expected to be fully protective for the fast-acting toxicants* [e.g., chlorine, ammonia], *and even more protective for slower-acting toxicants*" (p. 35). Based on this guidance, the most restrictive of the elutriate test results would require 15.7 fold dilution [4.7/0.3] within 1 hour to comply with USEPA's Technical Support Document guidance. STFATE modeling results presented in Chapter 7 indicates that a 16:1 dilution factor would be achieved within 1 hour under conservative modeling conditions. Using this approach, the other acute toxicity results presented in Table 8-19 would also not be expected to result in acute toxicity in the water column. Furthermore, this evaluation approach is believed to be conservative because it compares 48- and 96-hour continuous exposure acute toxicity test results to a 1 hour exposure duration criterion, and "fast-acting toxicants" are not expected to be present in the elutriate samples in meaningful concentrations (e.g., free chlorine, ammonia).

<u>Ocean Placement</u>
Based on the results of the water column toxicity testing, a maximum mixing factor of 472-fold would be required for all reaches to comply with the 0.01 LC50/EC50 requirement at the edge of the allowable mixing zone for ocean placement (Table 8-19B). This value is based on the lowest EC50 of 21.2% (C&D approach –core elutriate for blue mussel) in combination with a very conservative acute to chronic conversion factor of 0.01. Modeling of conditions at the ocean placement site indicated that a 1,000-fold dilution would occur within the disposal site boundary during the allowable 4-hour ocean placement mixing period (see Chapter 7). Therefore, none of the channel elutriates is expected to be acutely toxic to aquatic organisms during ocean placement.

8.3.2 Whole-Sediment Bioassays

According to Tier III of the ITM (USEPA/USACE 1998), benthic toxicity testing of contaminants in the dredged material in Tier III will result in one of the following possible conclusions:

1) Mean test organism mortality in the dredged material is not statistically greater than in the reference sediment, or does not exceed mean mortality in the reference sediment by at least 10 percentage points (or 20 percentage points for amphipods). Therefore, the dredged material is predicted not to be acutely toxic to benthic organisms. However, bioaccumulation of contaminants must also be considered.

2) Mean test organism mortality in the dredged material is statistically greater than in the reference sediment *and* exceeds mortality in the reference sediment by at least 10 percentage points (or 20 percentage points for amphipods). In this case, the dredged material has the potential to be acutely toxic to benthic organisms.

Results of the whole-sediment bioassays are summarized in Table 8-20. Results of the first round of the whole-sediment bioassays indicated that none of the mean survival values in the channel sediments was statistically lower than survival in the laboratory control or Inside Site 104 sediments. None of the channel sediments was acutely toxic to either the estuarine polychaete (*Neanthes arenaceodentata*) or estuarine amphipod (*Leptocheirus plumulosus*). Therefore, the dredged material is not predicted to be acutely toxic to benthic organisms after placement occurs.

The whole sediment test results demonstrate that the sediment proposed for dredging is not predicted to be toxic to benthic organisms after placement. The evaluation of benthic-effects for whole sediment bioassays is based on the Limiting Permissible Concentration (LPC). The LPC is defined as "...that concentration which will not cause unreasonable acute or chronic toxicity or sublethal adverse effects based on bioassay results using...appropriate sensitive marine organisms..." (USEPA/USACE 1991 and USEPA/USACE 1998). Based on the results of the whole sediment bioassays, the proposed dredged material from the channels is not significantly toxic to the tested benthic organisms. The statistical comparisons of the channel sediments to Inside Site 104 indicate that all of the channel sediments comply with Conclusion 1, above. Because the whole-sediment test results indicate that the channel sediments are not acutely toxic to aquatic test organisms, the channel sediments are expected to be suitable for open water or ocean placement

8.3.3 Conclusions

In summary, conditions that would have the potential to produce adverse effects in the water column at a placement site exist for a short-duration (minutes to a few hours following placement). Laboratory elutriate tests represent continuous exposure periods (48-96 hours) that greatly exceed the exposure durations that would be expected in the field. The laboratory elutriate tests provide conservative estimates of the potential for adverse water column effects. The conservatism is compounded by multiplying the LC50 concentration by a factor 0.01 for use in the mixing model. Overall, results of the whole-sediment toxicity tests are considered to be much more significant measures of the potential for adverse effects as a result of dredged material placement. Post-placement, benthic organisms and communities will be exposed to dredged material for weeks, months, or years, in comparison to the minutes or few hours of exposure experienced by organisms in the water column during the placement event. No toxicity was observed in the whole-sediment tests for the channel sediments, indicating that there would be little potential for long-term, adverse effects following open-water placement. The water column toxicity that could occur during the placement event would be short-term and localized. In addition, placement would occur during a time period when larval organisms (such as those tested in the laboratory water column bioassays) would not be expected to occur in the water column.

TABLE 8-1 SUMMARY OF TOXICITY TESTING SCHEDULE

TEST ROUND	DATES	TEST SEDIMENT	WATER COLUMN TESTING				WHOLE SEDIMENT TESTING		
			opossum shrimp	sheepshead minnow	blue mussel	inland silverside	estuarine polychaete	estuarine amphipod	opossum shrimp
			Mysidopsis bahia	*Cyprinodon variegatus*	*Mytilus* sp.	*Menidia beryllina*	*Neanthes arenaceodentata*	*Leptocheirus plumulosus*	*Mysidopsis bahia*[(a)]
1	September – November 1999	Inside Site 104	X	X			X	X	
		Approach Channels	X	X			X	X	
2	December 1999–February 2000	Inside Site 104	X	X	X	X	X	X	
		Outside Site 104	X	X	X	X	X	X	
		Approach Channels			X	X			
3	February – March 2000	Ocean Reference	X		X	X		X [(b)]	X

(a) *Mysidopsis bahia* tested in conjunction with Woodrow Wilson Bridge testing; *Neanthes arenaceodentata* not tested for Ocean Reference.

(b) Lower Chesapeake Bay control sediment substituted for Ocean Reference site sediment (as requested by USEPA Region III Philadelphia) in *Leptocheirus* tests to minimize potential grain-size effects.

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TABLE 8-2 SAMPLE COMPOSITES FOR ECOTOXICOLOGICAL TESTING

Sampling Reach	Station	Sediment Volume (gallons)	Composite Sample
Inside Site 104	KI-3	4	KI-TOX
	KI-5	4	
	KI-7-Ref	4	
	KI-S-1	4	
	KI-S-2	4	
Outside Site 104	KI-11	5	KI-OUT-TOX
	KI-14	5	
	KI-15	5	
	KI-16	5	
Brewerton Channel Eastern Extension	BE-1	5	BE-TOX
	BE-2	5	
	BE-3	5	
	BE-4	5	
C&D Approach Channel	CD-001VC	10	CD-TOX
	CD-002VC	10	
	CD003	5	
	CD004	5	
	CD005	5	
	CD006	5	
Craighill Channel	CR1	7	CR-TOX
	CR2	7	
	CR3	7	
Craighill Angle–East	CRA-E-001VC	7	CRA-E-TOX
	CRA-E-002VC	7	
	CRA-E-003VC	7	
Craighill Angle–West	CRA-W-001VC	7	CRA-W-TOX
	CRA-W-002VC	7	
	CRA-W-003VC	7	
Craighill Entrance	CRE-001VC	5	CRE-TOX
	CRE-002VC	5	
	CRE-003VC	5	
	CRE-004VC	5	
Cutoff Angle	CUT1	7	CUT-TOX
	CUT2	7	
	CUT3	7	
Swan Point Channel	SWP-001VC	3.5	SWP-TOX
	SWP-002VC	3.5	
	SWP-003VC	3.5	
	SWP-004VC	3.5	
	SWP-005VC	3.5	
	SWP-006VC	3.5	
Tolchester Channel – North	TLC-005VC	3.5	TLC-N-TOX
	TLC-006VC	3.5	
	TLC-007VC	3.5	
	TLC-008VC	3.5	
	TLC-009VC	3.5	
	TLC-010VC	3.5	
Tolchester Channel –South	TLC-001VC	5	TLC-S-TOX
	TLC-002VC	5	
	TLC-003VC	5	
	TLC-004VC	5	
Tolchester Straightening	TLS-001VC	10	TLS-TOX
	TLS-002VC	10	

TABLE 8-3A SUMMARY OF COLLECTION AND RECEIPT INFORMATION FOR SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104

Sample Identification	Sample Description	Sample Type	EA Accession Number	Collection Time and Date	Receipt Time and Date
CRE	Craighill Entrance	Sediment	AT9-1430	1600, 14 October 1999	1600, 14 October 1999
CR	Craighill Channel	Sediment	AT9-1431	1600, 14 October 1999	1600, 14 October 1999
CRA-E	Craighill Angle East	Sediment	AT9-1432	1600, 14 October 1999	1600, 14 October 1999
CRA-W	Craighill Angle West	Sediment	AT9-1433	1600, 14 October 1999	1600, 14 October 1999
CRU	Craighill Upper Range	Sediment	AT9-1434	1600, 14 October 1999	1600, 14 October 1999
CUT	Cutoff Angle	Sediment	AT9-1435	1600, 14 October 1999	1600, 14 October 1999
TLC-S	Tolchester Channel South	Sediment	AT9-1436	1600, 14 October 1999	1600, 14 October 1999
TLC-N	Tolchester Channel North	Sediment	AT9-1437	1600, 14 October 1999	1600, 14 October 1999
TLS	Tolchester Straightening	Sediment	AT9-1438	1600, 14 October 1999	1600, 14 October 1999
BE	Brewerton Channel Eastern Extension	Sediment	AT9-1439	1600, 14 October 1999	1600, 14 October 1999
SWP	Swan Point Channel	Sediment	AT9-1440	1600, 14 October 1999	1600, 14 October 1999
CD-VC	C&D Approaches - Cores	Sediment	AT9-1441	1600, 14 October 1999	1600, 14 October 1999
CD	C&D Approaches - Surficial Grabs	Sediment	AT9-1442	1600, 14 October 1999	1600, 14 October 1999
KI - Reference	Inside Site 104	Sediment	AT9-1443	1600, 14 October 1999	1600, 14 October 1999
CRE	Craighill Entrance	Site Water	AT9-1444	1052, 19 September 1999	1500, 13 October 1999
CRE	Craighill Entrance	Site Water	AT9-1611	1118, 22 November 1999	1515, 22 November 1999
CR	Craighill Channel	Site Water	AT9-1445	1205, 28 September 1999	1500, 13 October 1999
CRA-E	Craighill Angle East	Site Water	AT9-1446	1315, 18 September 1999	1500, 13 October 1999
CRA-E	Craighill Angle East	Site Water	AT9-1609	1029, 22 November 1999	1515, 22 November 1999
CRA-W	Craighill Angle West	Site Water	AT9-1447	1645, 18 September 1999	1500, 13 October 1999
CRA-W	Craighill Angle West	Site Water	AT9-1610	1041, 22 November 1999	1515, 22 November 1999
CRU	Craighill Upper Range	Site Water	AT9-1448	1020, 28 September 1999	1500, 13 October 1999

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TABLE 8-3A (CONTINUED)

Sample Identification	Sample Description	Sample Type	EA Accession Number	Collection Time and Date	Receipt Time and Date
CUT	Cutoff Angle	Site Water	AT9-1449	0835, 28 September 1999	1500, 13 October 1999
CUT	Cutoff Angle	Site Water	AT9-1608	0958, 22 November 1999	1515, 22 November 1999
TLC-S	Tolchester Channel South	Site Water	AT9-1450	0850, 20 September 1999	1500, 13 October 1999
TLC-N	Tolchester Channel North	Site Water	AT9-1451	1130, 20 September 1999	1500, 13 October 1999
TLS	Tolchester Straightening	Site Water	AT9-1452	1520, 27 September 1999	1500, 13 October 1999
BE	Brewerton Channel Eastern Extension	Site Water	AT9-1453	1645, 27 September 1999	1500, 13 October 1999
SWP	Swan Point Channel	Site Water	AT9-1454	1530, 19 September 1999	1500, 13 October 1999
CD-VC	C&D Approaches - Cores	Site Water	AT9-1455	1230, 21 September 1999	1500, 13 October 1999
CD-SW	C&D Approaches - Surficial Grabs	Site Water	AT9-1456	1420, 27 September 1999	1500, 13 October 1999
KI – Reference	Inside Site 104	Site Water	AT9-1457	1540, 28 September 1999	1500, 13 October 1999
KI – Reference	Inside Site 104	Site Water	AT9-1612	1147, 22 November 1999	1515, 22 November 1999
CRE	Craighill Entrance	Sediment	AT9-1702	1430, 16 December 1999	0830, 20 December 1999
CRE	Craighill Entrance	Site Water	AT9-1703	1300, 15 December 1999	0830, 20 December 1999
CR	Craighill Channel	Sediment	AT9-1704	(a), 17 December 1999	0830, 20 December 1999
CR	Craighill Channel	Site Water	AT9-1705	1600, 13 December 1999	0830, 20 December 1999
CRA-E	Craighill Angle East	Sediment	AT9-1706	1430, 16 December 1999	0830, 20 December 1999
CRA-E	Craighill Angle East	Site Water	AT9-1707	0930, 15 December 1999	0830, 20 December 1999
CRA-W	Craighill Angle West	Sediment	AT9-1708	1430, 16 December 1999	0830, 20 December 1999
CRA-W	Craighill Angle West	Site Water	AT9-1709	0950, 14 December 1999	0830, 20 December 1999
CRU	Craighill Upper Range	Sediment	AT9-1710	(a), 17 December 1999	0830, 20 December 1999
CRU	Craighill Upper Range	Site Water	AT9-1711	0915, 15 December 1999	0830, 20 December 1999
CUT	Cutoff Angle	Sediment	AT9-1712	(a), 17 December 1999	0830, 20 December 1999
CUT	Cutoff Angle	Site Water	AT9-1713	1035, 15 December 1999	0830, 20 December 1999

(a) Time of collection not provided by sampler.

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TABLE 8-3A (CONTINUED)

Sample Identification	Sample Description	Sample Type	EA Accession Number	Collection Time and Date	Receipt Time and Date
TLC-S	Tolchester Channel South	Sediment	AT9-1714	1310, 17 December 1999	0830, 20 December 1999
TLC-S	Tolchester Channel South	Site Water	AT9-1715	0950, 9 December 1999	0830, 20 December 1999
TLC-N	Tolchester Channel North	Sediment	AT9-1716	1040, 17 December 1999	0830, 20 December 1999
TLC-N	Tolchester Channel North	Site Water	AT9-1717	1315, 8 December 1999	0830, 20 December 1999
TLS	Tolchester Straightening	Sediment	AT9-1718	1310, 17 December 1999	0830, 20 December 1999
TLS	Tolchester Straightening	Site Water	AT9-1719	0830, 9 December 1999	0830, 20 December 1999
BE	Brewerton Channel Eastern Extension	Sediment	AT9-1720	(a), 17 December 1999	0830, 20 December 1999
BE	Brewerton Channel Eastern Extension	Site Water	AT9-1721	1420, 14 December 1999	0830, 20 December 1999
SWP	Swan Point Channel	Sediment	AT9-1722	1420, 17 December 1999	0830, 20 December 1999
SWP	Swan Point Channel	Site Water	AT9-1723	1145, 9 December 1999	0830, 20 December 1999
CD-VC	C&D Approaches – Cores	Sediment	AT9-1724	1040, 17 December 1999	0830, 20 December 1999
CD-VC	C&D Approaches – Cores	Site Water	AT9-1725	0845, 8 December 1999	0830, 20 December 1999
CD	C&D Approaches – Surficial Grabs	Sediment	AT9-1726	(a), 17 December 1999	0830, 20 December 1999
CD	C&D Approaches – Surficial Grabs	Site Water	AT9-1727	1210, 14 December 1999	0830, 20 December 1999
KI – Reference	Inside Site 104	Sediment	AT9-1728	(a), 17 December 1999	0830, 20 December 1999
KI – Reference	Inside Site 104	Site Water	AT9-1729	1430, 13 December 1999	0830, 20 December 1999
KI-OUT - Reference	Outside Site 104	Sediment	AT9-1730	(a), 17 December 1999	0830, 20 December 1999
KI-OUT - Reference	Outside Site 104	Site Water	AT9-1731	1235, 13 December 1999	0830, 20 December 1999

(a) Time of collection not provided by sampler.

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TABLE 8-3B SUMMARY OF COLLECTION AND RECEIPT INFORMATION FOR SAMPLES FROM THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA

Sample Identification	Sample Type	EA Accession Number	Collection Time and Date	Receipt Time and Date
Lower Chesapeake Bay Control	Sediment	AT0-050	1200, 12 January 2000	0910, 19 January 2000
Ocean Reference	Sediment	AT0-097	1130, 1 February 2000	0903, 3 February 2000
Ocean Reference	Water	AT0-098	1130, 1 February 2000	0903, 3 February 2000

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TABLE 8-4A WATER QUALITY PARAMETERS MEASURED DURING *Mysidopsis bahia* (OPOSSUM SHRIMP) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September–November 1999)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	19.8 (±0.6)	8.2 (±0.1)	6.9 (±0.5)	29.0 (±0.7)
Brewerton Channel Eastern Extension	20.1 (±0.4)	8.2 (±0.1)	6.8 (±0.4)	29.0 (±0.6)
C&D Approaches - Cores	20.4 (±0.5)	8.1 (±0.2)	6.7 (±0.5)	29.6 (±1.2)
C&D Appr. - Surf. Grabs	20.6 (±0.7)	8.2 (±0.1)	7.0 (±0.4)	29.1 (±0.7)
Craighill Channel	20.0 (±0.6)	8.1 (±0.1)	6.6 (±0.4)	29.2 (±0.6)
Craighill Angle East	20.2 (±0.6)	8.1 (±0.2)	6.9 (±0.3)	29.3 (±0.7)
Craighill Angle West	19.9 (±0.3)	8.2 (±0.1)	6.7 (±0.4)	29.4 (±0.7)
Craighill Entrance	20.2 (±0.4)	8.1 (±0.1)	6.7 (±0.6)	29.1 (±0.8)
Craighill Upper Range	19.6 (±0.4)	8.1 (±0.1)	6.8 (±0.4)	29.3 (±0.7)
Cutoff Angle	20.4 (±0.6)	8.1 (±0.1)	6.8 (±0.4)	29.2 (±0.5)
Swan Point Channel	20.0 (±0.5)	8.2 (±0.1)	6.9 (±0.8)	29.4 (±0.5)
Tolchester Channel North	19.4 (±0.5)	8.1 (±0.2)	6.9 (±0.5)	28.9 (±0.3)
Tolchester Channel South	20.0 (±0.6)	8.1 (±0.1)	6.9 (±0.4)	29.2 (±0.8)
Tolchester Straightening	20.0 (±0.7)	8.1 (±0.1)	6.8 (±0.4)	29.0 (±0.6)

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TABLE 8-4B WATER QUALITY PARAMETERS MEASURED DURING *Mysidopsis bahia* (OPOSSUM SHRIMP) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999–February 2000)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	20.2 (±0.6)	8.3 (±0.1)	7.0 (±0.3)	30.5 (±1.7)
Outside Site 104	19.8 (±1.0)	8.3 (±0.1)	7.0 (±0.3)	30.8 (±1.6)
Laboratory Control Sediment	19.5 (±1.0)	8.3 (±0.1)	7.1 (±0.4)	30.4 (±1.8)

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TABLE 8-4C SUMMARY OF WATER QUALITY PARAMETERS MEASURED DURING *Mysidopsis bahia* (OPOSSUM SHRIMP) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000)

Test Elutriate	Water Quality Parameters – Mean (± Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Ocean Reference	19.3 (±0.5)	8.0 (±0.2)	6.7 (±0.9)	31.6 (±1.6)

TABLE 8-5A WATER QUALITY PARAMETERS MEASURED DURING *Cyprinodon variegatus* (SHEEPSHEAD MINNOW) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September–November 1999)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	20.8 (±0.8)	8.2 (±0.1)	7.1 (±0.3)	29.0 (±0.5)
Brewerton Channel Eastern Extension	20.2 (±0.7)	8.2 (±0.1)	6.9 (±0.4)	28.9 (±0.5)
C&D Approaches - Cores	20.5 (±0.5)	8.2 (±0.2)	7.0 (±0.2)	28.9 (±0.5)
C&D Approaches - Surf. Grabs	20.4 (±0.4)	8.1 (±0.1)	7.0 (±0.3)	28.8 (±0.4)
Craighill Channel	20.6 (±0.6)	8.1 (±0.1)	6.9 (±0.4)	29.3 (±0.8)
Craighill Angle East	20.2 (±0.7)	8.2 (±0.1)	7.1 (±0.3)	28.9 (±0.3)
Craighill Angle West	20.1 (±0.6)	8.2 (±0.1)	7.2 (±0.2)	29.0 (±0.3)
Craighill Entrance	20.0 (±0.5)	8.2 (±0.1)	7.0 (±0.2)	28.9 (±0.6)
Craighill Upper Range	20.2 (±0.5)	8.1 (±0.1)	7.0 (±0.2)	29.0 (±0.4)
Cutoff Angle	20.5 (±0.5)	8.2 (±0.1)	7.0 (±0.2)	29.0 (±0.6)
Swan Point Channel	20.3 (±0.3)	8.2 (±0.1)	7.1 (±0.2)	29.6 (±0.7)
Tolchester Channel North	20.7 (±0.5)	8.2 (±0.2)	7.0 (±0.2)	29.2 (±0.7)
Tolchester Channel South	20.3 (±0.6)	8.1 (±0.1)	7.1 (±0.3)	29.4 (±0.9)
Tolchester Straightening	20.8 (±0.5)	8.1 (±0.2)	6.9 (±0.4)	29.1 (±0.4)

TABLE 8-5B WATER QUALITY PARAMETERS MEASURED DURING *Cyprinodon variegatus* (SHEEPSHEAD MINNOW) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999–February 2000)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	19.6 (±1.0)	8.3 (±0.1)	7.2 (±0.3)	30.7 (±1.9)
Outside Site 104	20.0 (±0.9)	8.3 (±0.1)	7.1 (±0.2)	30.8 (±1.6)
Laboratory Control Sediment	19.7 (±1.1)	8.3 (±0.1)	7.2 (±0.3)	30.4 (±1.9)

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TABLE 8-6A WATER QUALITY PARAMETERS MEASURED DURING *Menidia beryllina* (INLAND SILVERSIDE) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: December 1999–February 2000)

Test Elutriate	Mean (± Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	20.2 (±0.8)	8.2 (±0.1)	5.7 (±1.3)	33.2 (±2.9)
Outside Site 104	20.6 (±0.7)	8.3 (±0.1)	5.7 (±1.1)	32.3 (±2.7)
Brewerton Channel Eastern Extension	20.4 (±1.1)	8.3 (±0.1)	6.6 (±0.6)	33.8 (±3.7)
C&D Approaches - Cores	20.9 (±0.8)	8.1 (±0.1)	6.3 (±1.0)	29.8 (±1.1)
C&D Appr. - Surf. Grabs	20.4 (±1.1)	8.3 (±0.1)	6.7 (±0.6)	32.1 (±3.2)
Craighill Channel	20.2 (±0.5)	8.2 (±0.1)	6.6 (±0.5)	32.1 (±1.6)
Craighill Angle East	20.6 (±0.8)	8.2 (±0.1)	6.5 (±0.9)	29.8 (±1.0)
Craighill Angle West	20.7 (±1.1)	8.2 (±0.2)	6.5 (±0.7)	30.7 (±1.9)
Craighill Entrance	19.9 (±1.7)	8.3 (±0.2)	5.9 (±1.4)	33.0 (±3.0)
Craighill Upper Range	20.5 (±0.6)	8.3 (±0.1)	6.6 (±0.6)	33.1 (±3.2)
Cutoff Angle	19.0 (±0.7)	8.3 (±0.1)	6.7 (±0.6)	29.3 (±1.1)
Swan Point Channel	20.9 (±0.9)	8.2 (±0.1)	5.8 (±1.3)	35.1 (±5.6)
Tolchester Channel North	19.3 (±0.6)	8.1 (±0.1)	6.6 (±0.7)	29.3 (±0.9)
Tolchester Channel South	21.1 (±0.8)	8.2 (±0.1)	6.7 (±0.5)	29.5 (±1.7)
Tolchester Straightening	20.3 (±0.7)	8.0 (±0.1)	6.3 (±1.2)	29.8 (±0.4)

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TABLE 8-6B SUMMARY OF WATER QUALITY PARAMETERS MEASURED DURING *Menidia beryllina* (INLAND SILVERSIDE) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000)

Test Elutriate	Water Quality Parameters – Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Ocean Reference	19.8 (±0.3)	8.1 (±0.1)	6.7 (±0.9)	31.7 (±1.5)

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TABLE 8-7A WATER QUALITY PARAMETERS MEASURED DURING *Mytilus* sp. (BLUE MUSSEL) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: December 1999-February 2000) [(a)]

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	16.0 (±0.7)	8.4 (±0.1)	8.2 (±0.2)	30.2 (±0.3)
Outside Site 104	16.0 (±0.4)	8.4 (±0.1)	8.2 (±0.2)	30.2 (±0.2)
Brewerton Channel Eastern Extension	16.0 (±0.7)	8.4 (±0.2)	8.2 (±0.2)	29.8 (±0.7)
C&D Approaches - Cores	16.3 (±0.2)	8.3 (±0.2)	8.2 (±0.2)	26.2 (±4.7)
C&D Appr. - Surf. Grabs	15.9 (±0.7)	8.4 (±0.2)	8.2 (±0.2)	30.2 (±0.3)
Craighill Channel	16.2 (±0.6)	8.1 (±0.1)	8.2 (±0.2)	30.1 (±0.2)
Craighill Angle East	16.2 (±0.7)	8.2 (±0.1)	8.1 (±0.2)	30.0 (±0.2)
Craighill Angle West	15.7 (±0.6)	8.2 (±0.2)	8.2 (±0.2)	30.0 (±0.2)
Craighill Entrance	16.3 (±0.5)	8.2 (±0.2)	8.1 (±0.1)	30.0 (±0.2)
Craighill Upper Range	16.1 (±0.7)	8.2 (±0.1)	8.1 (±0.1)	30.0 (±0.4)
Cutoff Angle	16.1 (±0.7)	8.3 (±0.2)	8.2 (±0.2)	30.2 (±0.3)
Swan Point Channel	16.5 (±0.1)	8.2 (±0.2)	8.2 (±0.2)	29.0 (±2.0)
Tolchester Channel North	16.7 (±0.2)	8.2 (±0.2)	8.1 (±0.2)	29.0 (±1.5)
Tolchester Channel South	16.0 (±0.8)	8.2 (±0.1)	8.2 (±0.2)	30.0 (±0.2)
Tolchester Straightening	16.0 (±0.8)	8.3 (±0.1)	8.2 (±0.1)	30.2 (±0.3)

(a) Embryo larval toxicity testing with *Mytilus* sp. was conducted by Northwestern Aquatic Sciences (NAS).

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TABLE 8-7B WATER QUALITY PARAMETERS MEASURED DURING *Mytilus* sp. (BLUE MUSSEL) ELUTRIATE TOXICITY TESTING ON SAMPLES FROM NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000) [(a)]

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Ocean Reference	15.8(±0.2)	8.0(±0.1)	8.1 (±0.2)	30.9 (±0.3)

(a) Embryo larval toxicity testing with *Mytilus* sp. was conducted by Northwestern Aquatic Sciences (NAS).

TABLE 8-8A WATER QUALITY PARAMETERS MEASURED DURING 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Neanthes arenaceodentata* (ESTUARINE POLYCHAETE) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September-November 1999)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control Sediment	19.2 (±0.4)	7.8 (±0.3)	6.2 (±0.6)	30.9 (±1.0)
Inside Site 104	19.2 (±0.6)	7.9 (±0.2)	5.6 (±0.4)	31.0 (±0.7)
Brewerton Channel Eastern Extension	19.1 (±0.4)	7.9 (±0.2)	5.9 (±0.7)	31.0 (±0.8)
C&D Approaches - Cores	19.0 (±0.5)	7.9 (±0.2)	6.2 (±0.5)	30.8 (±0.8)
C&D Approaches - Surface Grabs	19.0 (±0.6)	7.7 (±0.4)	6.1 (±0.7)	31.1 (±0.8)
Craighill Channel	19.1 (±0.5)	7.8 (±0.2)	6.2 (±0.4)	31.7 (±1.3)
Craighill Angle East	19.1 (±0.4)	7.8 (±0.3)	5.7 (±0.7)	31.4 (±1.0)
Craighill Angle West	19.1 (±0.4)	7.8 (±0.2)	5.7 (±0.6)	31.3 (±1.1)
Craighill Entrance	19.1 (±0.4)	7.9 (±0.3)	5.7 (±0.5)	31.5 (±1.0)
Craighill Upper Range	19.1 (±0.4)	7.9 (±0.2)	6.1 (±0.6)	31.6 (±1.1)
Cutoff Angle	19.1 (±0.4)	7.8 (±0.2)	5.7 (±0.6)	31.3 (±1.0)
Swan Point Channel	19.1 (±0.4)	7.9 (±0.3)	5.9 (±0.7)	31.1 (±0.7)
Tolchester Channel North	19.1 (±0.4)	7.7 (±0.3)	5.6 (±0.5)	31.2 (±0.9)
Tolchester Channel South	19.1 (±0.5)	7.8 (±0.3)	6.0 (±0.8)	31.2 (±1.0)
Tolchester Straightening	19.1 (±0.5)	7.8 (±0.3)	6.3 (±0.7)	31.3 (±1.0)

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TABLE 8-8B WATER QUALITY PARAMETERS MEASURED DURING ADDITIONAL 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Neanthes arenaceodentata* (ESTUARINE POLYCHAETE) ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999-February 2000)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	20.4 (±0.6)	8.3 (±0.1)	7.2 (±0.3)	29.2 (±0.4)
Outside Site 104	20.3 (±0.6)	8.2 (±0.2)	7.2 (±0.3)	28.8 (±0.7)
Laboratory Control Sediment	20.5 (±0.4)	8.2 (±0.2)	7.2 (±0.3)	29.6 (±1.9)

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TABLE 8-9A WATER QUALITY PARAMETERS MEASURED DURING 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* (ESTUARINE AMPHIPOD) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September-November 1999)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control Sediment	19.5 (±0.5)	7.6 (±0.2)	6.2 (±0.7)	20.9 (±0.6)
Inside Site 104	19.4 (±0.4)	7.7 (±0.3)	5.8 (±0.8)	21.6 (±0.8)
Brewerton Channel Eastern Extension	19.4 (±0.4)	7.7 (±0.2)	6.0 (±0.8)	21.3 (±0.7)
C&D Approaches - Cores	19.3 (±0.4)	7.6 (±0.2)	5.9 (±0.7)	20.9 (±0.6)
C&D Approaches – Surface Grabs	19.3 (±0.4)	7.7 (±0.2)	6.3 (±1.0)	21.0 (±0.7)
Craighill Channel	19.6 (±0.5)	7.7 (±0.2)	6.0 (±0.6)	21.3 (±0.7)
Craighill Angle East	19.5 (±0.5)	7.5 (±0.2)	5.1 (±1.0)	21.2 (±0.6)
Craighill Angle West	19.5 (±0.5)	7.6 (±0.2)	5.0 (±0.9)	21.2 (±0.6)
Craighill Entrance	19.5 (±0.4)	7.6 (±0.2)	5.5 (±1.1)	21.5 (±0.6)
Craighill Upper Range	19.4 (±0.5)	7.6 (±0.2)	6.3 (±0.7)	21.5 (±0.7)
Cutoff Angle	19.4 (±0.5)	7.6 (±0.2)	5.7 (±0.9)	21.3 (±0.8)
Swan Point Channel	19.3 (±0.3)	7.6 (±0.2)	5.8 (±0.9)	21.3 (±0.7)
Tolchester Channel North	19.3 (±0.4)	7.5 (±0.2)	5.3 (±0.9)	21.1 (±0.6)
Tolchester Channel South	19.4 (±0.3)	7.6 (±0.2)	5.7 (±0.6)	21.3 (±0.7)
Tolchester Straightening	19.4 (±0.4)	7.7 (±0.2)	6.2 (±0.7)	21.1 (±0.5)

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TABLE 8-9B WATER QUALITY PARAMETERS MEASURED DURING ADDITIONAL 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* (ESTUARINE AMPHIPOD) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: Dec. 1999-February 2000)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Inside Site 104	21.8 (±3.2)	8.0 (±0.1)	5.5 (±1.0)	22.6 (±1.8)
Outside Site 104	22.1 (±2.8)	8.0 (±0.1)	3.9 (±1.1)	21.0 (±1.6)
Laboratory Control Sediment	21.9 (±3.1)	7.9 (±0.2)	5.7 (±0.7)	20.0 (±2.2)

TABLE 8-9C SUMMARY OF WATER QUALITY PARAMETERS FROM 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* (ESTUARINE AMPHIPOD) FOR THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Lower Chesapeake Bay Control[a]	20.3 (±0.4)	8.1 (±0.1)	5.2 (±0.6)	21.5 (±1.2)

(a) = Tested in place of Ocean Reference sediment due to potential for adverse grain size effects.

TABLE 8-10 SUMMARY OF WATER QUALITY PARAMETERS FROM 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Mysidopsis bahia* FOR THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000)

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Ocean Reference	20.5 (±0.6)	8.0 (±0.2)	6.2 (±0.5)	31.5 (±1.3)

TABLE 8-11A RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Mysidopsis bahia* (OPOSSUM SHRIMP) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September-November 1999)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Inside Site 104	100	98	98	100	> 100	100
Brewerton Channel Eastern Extension	98	92	96	78 [(a)]	> 100	50
C&D Approaches – Cores	94	98	96	86	> 100	100
C&D Approaches – Surface Grabs	100	92	98	84 [(a)]	> 100	50
Craighill	98	94	98	94	> 100	100
Craighill Angle East	96	92	92	92	> 100	100
Craighill Angle West	98	98	98	76 [(a)]	> 100	50
Craighill Entrance	98	98	98	54 [(a)]	> 100	50
Craighill Upper Range	100	98	98	98	> 100	100
Cutoff Angle	98	90	98	92	> 100	100
Swan Point Channel	96	94	90	84	> 100	100
Tolchester Channel North	98	96	98	94	> 100	100
Tolchester Channel South	100	98	92	83 [(a)]	> 100	100 [(b)]
Tolchester Straightening	96	92	98	94	> 100	100

*Survival based on a mean of 5 replicate tests.

(a) Percent survival in the 100 percent test concentration was statistically (p=0.05) lower than the laboratory control.

(b) Multiple comparison (100, 50, 10 vs. control) shows no significance; single comparison (50 vs. control) shows significance (NOAEC = 10).

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TABLE 8-11B RESULTS OF ADDITIONAL ELUTRIATE TOXICITY TESTING WITH *Mysidopsis bahia* (OPOSSUM SHRIMP) ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999-February 2000)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Inside Site 104	98	100	96	100	> 100	100
Outside Site 104	96	98	94	94	> 100	100
Laboratory Control Sediment	94	92	90	88	> 100	100

*Survival based on a mean of 5 replicate tests.

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TABLE 8-11C RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Mysidopsis bahia* (OPOSSUM SHRIMP) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Ocean Reference	98	100	98	100	> 100	100

*Survival based on a mean of 5 replicate tests.

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TABLE 8-12A RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Cyprinodon variegatus* (SHEEPSHEAD MINNOW) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September-November 1999)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Inside Site 104	100	100	100	100	> 100	100
Brewerton Channel Eastern Extension	100	100	100	96	> 100	100
C&D Approaches – Cores	100	100	96	98	> 100	100
C&D Approaches – Surface Grabs	100	98	100	98	> 100	100
Craighill Channel	98	98	94	100	> 100	100
Craighill Angle East	100	98	96	100	> 100	100
Craighill Angle West	100	94	96	96	> 100	100
Craighill Entrance	100	100	98	98	> 100	100
Craighill Upper Range	100	98	98	98	> 100	100
Cutoff Angle	100	92	98	92	> 100	100
Swan Point Channel	100	98	100	94	> 100	100
Tolchester Channel North	100	100	100	98	> 100	100
Tolchester Channel South	98	98	98	98	> 100	100
Tolchester Straightening	100	100	98	98	> 100	100

*Survival based on a mean of 5 replicate tests.

(a) Percent survival in the 100 percent test concentration was statistically (p=0.05) lower than the laboratory control.

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TABLE 8-12B RESULTS OF ADDITIONAL ELUTRIATE TOXICITY TESTING WITH *Cyprinodon variegatus* (SHEEPSHEAD MINNOW) ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999-February 2000)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Inside Site 104	100	100	100	100	> 100	100
Outside Site 104	98	100	100	96	> 100	100
Laboratory Control Sediment	100	100	100	100	> 100	100

*Survival based on a mean of 5 replicate tests.

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TABLE 8-13A RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Menidia beryllina* (INLAND SILVERSIDE) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: December 1999-February 2000)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Inside Site 104	94	92	90	86	> 100	100
Outside Site 104	90	94	92	74	> 100	100
Brewerton Channel Eastern Extension	100	80	56	4 (a)	53.4	<10
C&D Approaches – Cores	91	98	90	76 (a)	> 100	50
C&D Approaches – Surface Grabs	94	78	54	10 (a)	52.9	10
Craighill Channel	96	98	60	38 (a)	69.7	10
Craighill Angle East	92	97	60	0 (b)	54.4	10
Craighill Angle West	92	97	77	0 (b)	60.7	10
Craighill Entrance	92	96	72	22 (a)	70.7	10
Craighill Upper Range	90	84	56	64 (a)	> 100	10
Cutoff Angle	92	94	50	0 (b)	41.5	10
Swan Point Channel	92	94	80	86	> 100	100
Tolchester Channel North	91	88	60	6 (a)	50.8	10
Tolchester Channel South	100	100	2	0 (b)	23.8	10
Tolchester Straightening	91	90	92	80	> 100	100

*Survival based on a mean of 5 replicate tests.

(a) Percent survival in the 100 percent test concentration was statistically (p=0.05) lower than the laboratory control.

(b) Treatment which has no surviving organisms is not statistically compared to the control.

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TABLE 8-13B RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Menidia beryllina* (INLAND SILVERSIDE) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000)

Test Elutriate	96-Hour Survival (%)*				96-Hour LC_{50} (% elutriate)	96-Hour NOAEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Ocean Reference	98	98	100	98	> 100	100

*Survival based on a mean of 5 replicate tests.

TABLE 8-14A RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Mytilus* sp. (BLUE MUSSEL) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: December 1999-February 2000) [a]

Test Elutriate	48-Hour Normal Development (%)*				48-Hour EC_{50} (% elutriate)	NOEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Inside Site 104	97	95	91	82 [b]	> 100	50
Outside Site 104	96	92	85	2 [b]	63.8	10
Brewerton Channel Eastern Extension	94	91	81	0.1 [b]	60.9	10
C&D Approaches – Cores	98	92	0	0 [c]	21.2	<10
C&D Approaches – Surface Grabs	99	98	87	2 [b]	64.2	10
Craighill Channel	93	89	91	87	> 100	100
Craighill Angle East	92	94	54	0 [c]	43.5	10
Craighill Angle West	91	90	59	0 [c]	46.8	10
Craighill Entrance	95	93	0	0 [c]	22.0	10
Craighill Upper Range	90	89	86	87	> 100	100
Cutoff Angle	96	98	92	27 [b]	79.7	50
Swan Point Channel	96	94	63	0 [c]	47.8	10
Tolchester Channel North	99	95	78	0.1 [b]	56.4	10
Tolchester Channel South	96	93	83	0 [c]	61.7	10
Tolchester Straightening	95	95	84	0 [c]	61.7	10

*Survival based on a mean of 5 replicate tests.

(a) Embryo larval toxicity testing with *Mytilus* sp. was conducted by Northwestern Aquatic Sciences (NAS).

(b) Percent normal development in the 100 percent test concentration was statistically (p=0.05) lower than the laboratory control.

(c) A concentration which had no normally developed organisms was not statistically compared to the laboratory control.

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TABLE 8-14B RESULTS OF ELUTRIATE TOXICITY TESTING WITH *Mytilus* sp. (BLUE MUSSEL) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000) [(a)]

Test Elutriate	48-Hour Normal Development (%)*				48-Hour EC_{50} (% elutriate)	96-Hour NOEC (% elutriate)
	Lab Control	Percent Elutriate				
		10 %	50 %	100%		
Ocean Reference	98.2	99.5	98.8	98.5	> 100	100

*Survival based on a mean of 5 replicate per tests.

(a) Embryo larval toxicity testing with *Mytilus* sp. was conducted by Northwestern Aquatic Sciences (NAS).

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TABLE 8-15A RESULTS OF 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Neanthes arenaceodentata* (ESTUARINE POLYCHAETE) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September-November 1999)

Test Sediment	No. Alive/ No. Exposed*	10-Day Percent Survival (mean)
Laboratory Control Sediment	25 / 25	100
Inside Site 104	24 / 25	96
Brewerton Channel Eastern Extension	25 / 25	100
C&D Approaches – Cores	24 / 25	96
C&D Approaches - Surf. Grabs	25 / 25	100
Craighill Channel	24 / 25	96
Craighill Angle East	25 / 25	100
Craighill Angle West	23 / 25	92
Craighill Entrance	25 / 25	100
Craighill Upper Range	25 / 25	100
Cutoff Angle	24 / 25	96
Swan Point Channel	25 / 25	100
Tolchester Channel North	25 / 25	100
Tolchester Channel South	24 / 25	96
Tolchester Straightening	24 / 25	96

*Based on 5 replicates of five animals each

TABLE 8-15B RESULTS OF ADDITIONAL 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Neanthes arenaceodentata* (ESTUARINE POLYCHAETE) ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999-February 2000)

Test Sediment	No. Alive/ No. Exposed*	10-Day Percent Survival (mean)
Inside Site 104	22 / 25	88
Outside Site 104	20 / 25	80
Laboratory Control Sediment	24 / 25	96

*Based on 5 replicates of five animals each

TABLE 8-16A RESULTS OF 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* (ESTUARINE AMPHIPOD) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: September-November 1999)

Test Sediment	No. Alive/ No. Exposed*	10-Day Percent Survival (mean)
Laboratory Control Sediment	96 / 100	96
Inside Site 104	93 / 100	93
Brewerton Channel Eastern Extension	88 / 100	88
C&D Approaches – Cores	88 / 100	88
C&D Approaches - Surf. Grabs	94 / 100	94
Craighill Channel	93 / 100	93
Craighill Angle East	91 / 100	91
Craighill Angle West	93 / 100	93
Craighill Entrance	96 / 100	96
Craighill Upper Range	86 / 100	86
Cutoff Angle	92 / 100	92
Swan Point Channel	89 / 100	89
Tolchester Channel North	93 / 100	93
Tolchester Channel South	92 / 100	92
Tolchester Straightening	89 / 100	89

*Based on 5 replicates of 20 animals each

TABLE 8-16B RESULTS OF ADDITIONAL 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* (ESTUARINE AMPHIPOD) ON SAMPLES FROM INSIDE SITE 104 AND OUTSIDE SITE 104 (Round 2: December 1999-February 2000)

Test Sediment	No. Alive/ No. Exposed*	10-Day Percent Survival (mean)
Inside Site 104	87 / 100	87$^{(b)}$
Outside Site 104	96 / 100	96
Laboratory Control Sediment	98 / 100	98

(a) Survival in sample Inside Site 104 was statistically less (P=0.05) than the laboratory control sediment.

*Based on 5 replicates of 20 animals each

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TABLE 8-16C RESULTS OF 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Leptocheirus plumulosus* (ESTUARINE AMPHIPOD) FOR THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000) [(a)]

Test Sediment	No. Alive/ No. Exposed*	10-Day Percent Survival (mean)
Lower Chesapeake Bay Control	94 / 100	94

(a) Lower Chesapeake Bay control sediment tested in place of Norfolk Ocean Disposal Site sediment to minimize potential grain size effect.

*Based on 5 replicates of 20 animals each

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TABLE 8-17 RESULTS OF 10-DAY WHOLE SEDIMENT TOXICITY TESTING WITH *Mysidopsis bahia* (OPOSSUM SHRIMP) FOR THE NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA (Round 3: February 2000) [(a)]

Test Sediment	No. Alive/ No. Exposed*	10-Day Percent Survival (mean)
Ocean Reference	47 / 50	94

(a) *Mysidopsis bahia* tested in place of *Neanthes arenaceodentata* for Ocean Reference testing.
*Based on 5 replicates of 10 animals each

TABLE 8-18A RESULTS OF REFERENCE TOXICANT TESTING – BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104

Test Species	Reference Toxicant	Testing Date	Endpoint	Acceptable Control Chart Limits
Mysidopsis bahia	Potassium chloride (KCl)	October 1999 January 2000	48-hour LC50: 0.57 g/L KCl 48-hour LC50: 0.71 g/L KCl	0.12-0.65 g/L KCl 0.32-0.86 g/L KCl
Cyprinodon variegatus	Potassium chloride (KCl)	October 1999 January 2000	48-hour LC50: 1.65 g/L KCl 48-hour LC50: 1.41 g/L KCl	1.20-1.87 g/L KCl 1.25-1.60 g/L KCl
Menidia beryllina	Potassium chloride (KCl)	January 2000	48-hour LC50: 1.18 g/L KCl	1.10-1.49 g/L KCl
Mytilus sp.	Copper sulfate ($CuSO_4 \cdot 5H_2O$)	December 1999	48-hour EC50: 10.3 μg/L Cu	8.05-12.5 μg/L Cu
Neanthes arenaceodentata	Cadmium chloride ($CdCl_2$)	October 1999 December 1999	96-hour LC50: 6.4 mg/L Cd 96-hour LC50: 5.7 mg/L Cd	(a) (a)
Leptocheirus plumulosus	Cadmium chloride ($CdCl_2$)	October 1999 January 2000	96-hour LC50: 0.22 mg/L Cd 96-hour LC50: 0.24 mg/L Cd	0.21-0.26 mg/L Cd 0.21-0.25 mg/L Cd

(a) Control chart limits have not yet been established, because an insufficient number of reference toxicant tests (less than five) have been conducted. The LC50s of 6.4 and 5.7 mg/L Cd were similar to the LC50 of 5.7 mg/L Cd on a previous lot of *N. arenaceodentata* from September 1999.

TABLE 8-18B RESULTS OF REFERENCE TOXICANT TESTING – NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA

Test Species	Reference Toxicant	Endpoint	Acceptable Control Chart Limits
Mysidopsis bahia	Potassium chloride (KCl)	96-hour LC50: 0.65 g/L KCl	0.59-0.72 g/L KCl
Menidia beryllina	Potassium chloride (KCl)	96-hour LC50: 0.969 g/L KCl	0.82-1.15 g/L KCl
Leptocheirus plumulosus	Cadmium chloride ($CdCl_2$)	48-hour LC50: 5.9 mg/L Cd	(a)

(a) Control chart limits have not yet been established, because an insufficient number of reference toxicant tests (less than five) have been conducted. The LC50 of 5.9 mg/L Cd falls within the range of LC50's from previous *L. plumulosus* reference toxicant tests (2.2-9.0 mg/l Cd).

TABLE 8-19A SUMMARY OF RESULTS FOR WATER COLUMN BIOASSAYS BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104 REFERENCE, AND NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA

	Opossum Shrimp *Mysidopsis bahia*			Sheepshead Minnow *Cyprinodon variegatus*			Blue Mussel *Mytilus* sp.			Inland Silverside *Menidia beryllina*		
Sample Identification	96-hour LC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	96-Hour NOAEC (% elutriate)	96-hour LC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	96-Hour NOAEC (% elutriate)	48-hour EC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	48-Hour NOEC (% elutriate)	96-hour LC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	96-Hour NOAEC (% elutriate)
Inside Site 104	>100	No	100	>100	No	100	>100	Yes	50	>100	No	100
Brewerton Channel Eastern Extension	>100	Yes	50	>100	No	100	60.9	Yes	10	53.4	Yes	<10
C&D Approaches (Cores)	>100	No	100	>100	No	100	21.2	Yes	<10	>100	Yes	50
C&D Approaches (Surficial)	>100	Yes	50	>100	No	100	64.2	Yes	10	52.9	Yes	10
Craighill Channel	>100	No	100	>100	No	100	>100	No	100	69.7	Yes	10
Craighill Entrance	>100	Yes	50	>100	No	100	22.0	Yes	10	70.7	Yes	10
Craighill Angle - East	>100	No	100	>100	No	100	43.5	Yes	10	54.4	Yes	10
Craighill Angle - West	>100	Yes	50	>100	No	100	46.8	Yes	10	60.7	Yes	10
Craighill Upper Range	>100	No	100	>100	No	100	>100	No	100	>100	Yes	10
Cutoff Angle	>100	No	100	>100	No	100	79.7	Yes	50	41.5	Yes	10
Swan Point Channel	>100	No	100	>100	No	100	47.8	Yes	10	>100	No	100
Tolchester Channel - North	>100	No	100	>100	No	100	56.4	Yes	10	50.8	Yes	10
Tolchester Channel - South	>100	Yes	100	>100	No	100	61.7	Yes	10	23.8	Yes	10
Tolchester Straightening	>100	No	100	>100	No	100	61.7	Yes	10	>100	No	100
Inside Site 104[b]	>100	No	100	>100	No	100	-	-	-	-	-	-
Outside Site 104 [c]	>100	No	100	>100	No	100	63.8	Yes	10	>100	No	100
Norfolk Ocean Reference Site[d]	>100	No	100	NT	NT	NT	>100	No	100	>100	No	100

NT = not tested; water column bioassays with Norfolk Ocean Reference elutriate conducted with opossum shrimp, blue mussel, and inland silverside only

(a) Statistical significance analyzed at P=0.05; survival (LC50) or normal development (EC50) in 100% elutriate significantly lower than the control.

(b) Inside Site 104 elutriate re-tested concurrently with Outside Site 104 water column bioassays (re-tested with opossum shrimp and sheepshead minnow only)

(c) Outside Site 104 water column bioassays with opossum shrimp and sheepshead minnow conducted separately from channel elutriate bioassays

(d) Norfolk Ocean Reference testing conducted independently of Inside/Outside Site 104 and channel elutriate tests

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TABLE 8-19B SUMMARY OF RESULTS FOR WATER COLUMN BIOASSAYS BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104 REFERENCE, AND NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA

	Opossum Shrimp *Mysidopsis bahia*			Sheepshead Minnow *Cyprinodon variegatus*			Blue Mussel *Mytilus* sp.			Inland Silverside *Menidia beryllina*		
Sample Identification	96-hour LC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	Mixing Factor Required to Achieve 0.01 LC50	96-hour LC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	Mixing Factor Required to Achieve 0.01 LC50	48-hour EC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	Mixing Factor Required to Achieve 0.01 EC50	96-hour LC50 (% elutriate)	Statistical Difference 100% vs. Control[a]	Mixing Factor Required to Achieve 0.01 LC50
Inside Site 104	>100	No	NA	>100	No	NA	>100	Yes	<100	>100	No	NA
Brewerton Channel Eastern Extension	>100	Yes	<100	>100	No	NA	60.9	Yes	164	53.4	Yes	188
C&D Approaches (Cores)	>100	No	NA	>100	No	NA	21.2	Yes	472	>100	Yes	<100
C&D Approaches (Surficial)	>100	Yes	<100	>100	No	NA	64.2	Yes	156	52.9	Yes	189
Craighill Channel	>100	No	NA	>100	No	NA	>100	No	NA	69.7	Yes	144
Craighill Entrance	>100	Yes	<100	>100	No	NA	22.0	Yes	454	70.7	Yes	141
Craighill Angle - East	>100	No	NA	>100	No	NA	43.5	Yes	230	54.4	Yes	184
Craighill Angle - West	>100	Yes	<100	>100	No	NA	46.8	Yes	214	60.7	Yes	165
Craighill Upper Range	>100	No	NA	>100	No	NA	>100	No	NA	>100	Yes	NA
Cutoff Angle	>100	No	NA	>100	No	NA	79.7	Yes	126	41.5	Yes	241
Swan Point Channel	>100	No	NA	>100	No	NA	47.8	Yes	209	>100	No	NA
Tolchester Channel - North	>100	No	NA	>100	No	NA	56.4	Yes	177	50.8	Yes	197
Tolchester Channel - South	>100	Yes	<100	>100	No	NA	61.7	Yes	162	23.8	Yes	420
Tolchester Straightening	>100	No	NA	>100	No	NA	61.7	Yes	162	>100	No	NA
Inside Site 104[b]	>100	No	NA	>100	No	NA	-	-	-	-	-	-
Outside Site 104 [c]	>100	No	NA	>100	No	NA	63.8	Yes	157	>100	No	NA
Norfolk Ocean Reference Site[d]	>100	No	NA	NT	NT	-	>100	No	NA	>100	No	NA

NT = not tested; water column bioassays with Norfolk Ocean Reference elutriate conducted with opossum shrimp, blue mussel, and inland silverside only

(a) Statistical significance analyzed at P=0.05; survival (LC50) or normal development (EC50) in 100% elutriate significantly lower than the control.

(b) Inside Site 104 elutriate re-tested concurrently with Outside Site 104 water column bioassays (re-tested with opossum shrimp and sheepshead minnow only)

(c) Outside Site 104 water column bioassays with opossum shrimp and sheepshead minnow conducted separately from channel elutriate bioassays

(d) Norfolk Ocean Reference testing conducted independently of Inside/Outside Site 104 and channel elutriate tests

NA = mixing calculation is not applicable if mean survival in 100% elutriate is not statistically lower than the mean survival in the laboratory control.

TABLE 8-20 SUMMARY OF RESULTS FOR WHOLE SEDIMENT BIOASSAYS BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104, AND NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA

	Estuarine Polychaete *Neanthes arenaceodata*			**Estuarine Amphipod** *Leptocheirus plumulosus*		
Sample Identification	Mean Survival (%)	Statistical Difference vs. Inside Site 104[a]	10% Difference vs. Inside Site 104	Mean Survival (%)	Statistical Difference vs. Inside Site 104 [a]	20% Difference vs. Inside Site 104
Laboratory Control Sediment [b]	100	NA	NA	96	NA	NA
Inside Site 104	96	NA	NA	93	NA	NA
Brewerton Channel Eastern Extension	100	No	No	88	No	No
C&D Approaches (Cores)	96	No	No	88	No	No
C&D Approaches (Surficial)	100	No	No	94	No	No
Craighill Channel	96	No	No	93	No	No
Craighill Entrance	100	No	No	96	No	No
Craighill Angle - East	100	No	No	91	No	No
Craighill Angle - West	92	No	No	93	No	No
Craighill Upper Range	100	No	No	86	No	No
Cutoff Angle	96	No	No	92	No	No
Swan Point Channel	100	No	No	89	No	No
Tolchester Channel - North	100	No	No	93	No	No
Tolchester Channel - South	96	No	No	92	No	No
Tolchester Straightening	96	No	No	89	No	No
Laboratory Control Sediment [b]	96	NA	NA	98	NA	NA
Inside Site 104	88	NA	NA	87	NA	NA
Outside Site 104	80	NA	NA	96	NA	NA
Norfolk Ocean Reference Site [c][d]	94	NA	NA	-	-	-
Southern Chesapeake Bay Control Sediment [d][e]	-	-	-	94	NA	NA

NA = not applicable; control and reference (Inside Site 104) survival not statistically compared as per USEPA/USACE guidelines (1998)

(a) Statistical significance analyzed at P=0.05; channel sediments statistically compared to Inside Site 104
(b) Control serves as indicator for test acceptability/validity
(c) *Mysidoposis bahia* tested in place of *Neanthes arenaceodentata* for Norfolk Ocean Disposal Site reference area sediment
(d) Norfolk Ocean Reference tests conducted independently of Inside/Outside Site 104 and channel whole-sediment tests
(e) Southern Chesapeake Bay Control Sediment tested with *Leptocheirus* in place of Norfolk Ocean Reference sediment as requested by EPA Region III-Philadelphia

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CHAPTER 9 -
BIOACCUMULATION

9. BIOACCUMULATION STUDIES

Sediments from the approach channels, placement site, and reference areas were evaluated in 28-day bioaccumulation studies with *Nereis virens* (sand worm) and *Macoma nasuta* (blunt-nose clam). The studies measured survival of the test organisms and the potential for bioaccumulation of contaminants in organism tissue as a result of exposure to the channel, placement site, and reference area sediments. The design of the bioaccumulation studies followed guidance from USEPA/USACE (1991 and 1998) with input from USEPA Region III–Philadelphia.

9.1 BIOACCUMULATION EXPOSURE METHODS

The bioaccumulation testing program consisted of three separate rounds of testing (Table 9-1):

- *Round 1*: Initial bioaccumulation testing of sediment from the approach channels and from Inside Site 104 (November–December 1999).

- *Round 2:* Additional bioaccumulation testing conducted in response to recommendations from USEPA Region III–Philadelphia. Testing of sediment from an Outside Site 104 reference area for tissue analysis; additional testing of sediment from Inside Site 104 for tissue analysis; and additional testing of sediment from approach channels for tissue analysis of dioxin and furan congeners (January-February 2000).

- *Round 3:* Bioaccumulation testing of Ocean Reference sediment (in conjunction with Woodrow Wilson Bridge sediment testing program) (February-March 2000) to evaluate the potential for ocean placement of dredged material.

A summary of the bioaccumulation testing schedule is provided in Table 9-1. Methodology for the bioaccumulation studies followed guidance in the ITM (USEPA/USACE 1998) and the *Ocean Testing Manual* (USEPA/USACE 1991). Bioaccumulation testing protocols are thoroughly described in the Quality Assurance Project Plan for the ecotoxicological testing program (EA 2000d) (Appendix B). Testing procedures for the Ocean Reference sediment followed the same guidance as the Site 104 testing and are documented in the Ecotoxicology QAPP for the Woodrow Wilson Bridge Project (EA 2000b). Original data sheets, records, notes, memoranda, and computer printouts for the bioaccumulation exposures are archived at EA's Baltimore Office in Sparks, Maryland. These data will be retained for a period of 5 years unless a longer period is requested by USACE–Baltimore District.

9.1.1 Test Set-Up and Procedures

Bioaccumulation testing was conducted with the sand worm (*Nereis virens*) and the blunt-nose clam (*Macoma nasuta*). The 13 test sediments from the approach channel and one sediment sample from Inside Site 104 were evaluated on 5 November–3 December 1999 with *N. virens* and on 4 November–2 December 1999 with *M. nasuta*. The adult worms (organism lot NV-017) were obtained from Aquatic Research Organisms (Hampton, New Hampshire) on 5 November 1999, and the adult clams (lot MA-011) were acquired from Aquatic Research Organisms on 02 November 1999.

A second round of bioaccumulation testing with *N. virens* and *M. nasuta* was conducted in January 2000 to evaluate additional contaminants of concern. The 13 test sediments, Inside Site 104 sediments, and Outside Site 104 sediments were tested during the period 13 January through 10 February 2000 with *N. virens* and during the period 12 January through 9 February *with M. nasuta.* This second round of testing utilized organism lot numbers NV-019 (*N. virens*) and MA-012 (*M. nasuta*). Organism lot NV-019 was received from Aquatic Research Organisms on 13 January 2000, and organism lot MA-012 was received from Brezina & Associates (Dillon Beach, California) on 12 January 2000. Both organism lots were used for testing on the day of receipt.

Bioaccumulation testing was also conducted for the Ocean Reference sediment (Round 3) with the sand worm (*Nereis virens*) and the blunt-nose clam (*Macoma nasuta*). The *N. virens* testing with the Ocean Reference sediment (Round 3) was initiated on 10 February 2000 and completed on 08 March 2000. The *M. nasuta* testing with the Ocean Reference sediment (Round 3) was initiated on 08 February 2000 and completed on 07 March 2000. The adult worms (organism lots NV-020 and NV-021) and adult clams (organism lots MA-013 and MA-014) were obtained from Aquatic Research Organisms (Hampton, New Hampshire) on 8 February 2000 for the Ocean Reference sediment testing.

For the bioaccumulation testing, the sediment samples and overlying water were added to the test chambers the day prior to test initiation. The overlying water was artificial seawater (Forty Fathoms sea salts). Natural sediments from the organism collection sites were used as laboratory controls in the bioaccumulation testing. The bioaccumulation tests were 28 days in duration and were conducted as static, renewal assays. The overlying water was replaced three times a week by siphoning approximately 80 percent of the overlying water from the aquaria and replacing with new overlying water taking care not to disturb the sediment surface.

The bioaccumulation tests were conducted in 10-gallon aquaria with a layer of approximately 3-5 cm (3.8 L) of sediment and 19 L of overlying water per aquarium. There were five replicates per sediment sample and three replicates per control sediment. Based on the analytical tissue biomass requirements, the first round of bioaccumulation testing utilized 26 organisms in each replicate chamber for the *N. virens* testing and 50 organisms per chamber for the *M. nasuta* testing. The second round of bioaccumulation testing (conducted in January 2000) used 20 (*N. virens*) and 30 (*M. nasuta*) organisms per test chamber.

During the 28-day exposure period, the test chambers were maintained at a target temperature of 20°C for the *N. virens* and 13°C for the *M. nasuta*, with a 16-hour light/8-hour dark photoperiod. Gentle aeration was provided to each aquarium throughout the test period. Observations of mortality and abnormal organism behavior were recorded daily, and dead organisms were removed from the test chambers. Measurements of temperature, pH, dissolved oxygen, and salinity of the overlying water were recorded daily on one replicate of each sample and control. The water quality measurements for *N. virens* are summarized in Tables 9-2A (Round 1), 9-2B

(Round 2), and 9-2C (Round 3). Water quality measurements for *M. nasuta* are summarized in Tables 9-3A (Rounds 1), Table 9-3B (Round 2), and 9-3C (Round 3). The organisms were not fed during the exposure period. At the end of the 28-day test periods, the test organisms were retrieved from the test chambers and the number of surviving organisms was recorded. Copies of the original data sheets from the *N. virens* and *M. nasuta* testing are included in Attachments V-A (Round 1 and Round 2) and V-B (Round 3).

9.1.2 Reference Toxicant Testing

In conformance with EA's QA/QC program requirements, reference toxicant testing was performed on the acquired lots of organisms utilized in the testing program or reference toxicant data were obtained from the test organism supplier. The reference toxicant tests consisted of a graded concentration series of a specific toxicant in water only tests, with no sediment present in the test chambers.

The reference toxicant for the bioaccumulation species, *Nereis virens* and *Macoma nasuta,* was sodium dodecyl sulfate (SDS). The results of the reference toxicant tests were compared to established laboratory control chart limits.

9.1.3 Tissue Preparation and Homogenization

After 28 days of exposure, surviving organisms were recovered and placed in holding tanks containing 20 ppt artificial seawater and no sediment to purge their digestive tracts. The organisms were not fed during this period. At the end of the 24-hour purging period, the shells of the clams were rinsed with de-ionized (DI) water, the clams were shucked, and the soft tissues and liquids inside the shell were placed into pre-cleaned glass jars. Worms were rinsed with DI water to remove the external salts (originating from the purge chambers) and were placed directly into pre-cleaned glass jars. Tissues for each replicate were placed into separate jars, labeled, and frozen until delivered to the analytical laboratory. Required containers, preservation techniques, and holding time requirements for tissue samples are provided in Table 9-4. Tissues were processed on 04 December 1999 (worms – Round 1), 05 December 1999 (clams – Round 1), 11 February 2000 (worms – Round 2), 10 February 2000 (clams – Round 2), 09 March 2000 (worms – Round 3), and 08 March (clams – Round 3).

In addition to analyzing test tissues, pre-test tissue and tissue from control organisms were also submitted for chemical analysis. Pre-test tissue represents organism tissue upon delivery at the ecotoxicology laboratory (prior to test initiation). These tissues originate from organisms that are sacrificed from each shipment and subsequently frozen. These organisms are not exposed to test sediments, but contaminants in their tissues would represent baseline contaminants that could accumulate from exposure to their natural environment. Control tissue originates from organisms exposed to natural sediment (that they were collected from and shipped in) after a 28-day exposure period. These organisms are exposed to the same 28-day laboratory environment as the test sediments and organisms.

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Worm and clam tissues were hand-delivered to the analytical laboratory on 08 December 1999 (Round 1), 11 February 2000 (Round 2), and 09 March 2000 (Round 3). The chain-of-custody forms are provided in Attachments V-A and V-B. Tissues were held frozen until analysis. Prior to analysis, tissues for each replicate were separately thawed, homogenized, and weighed to the nearest gram. Aliquots from each replicate were removed for analysis of target fractions. Prior to analytical testing, a 2-gram sub-sample from each replicate was removed for determination of percent moisture by EA's Ecotoxicology Laboratory.

9.1.4 Analytical Methods and Detection Limits

Tissue samples were analyzed for the following analyte fractions: SVOCs, metals, chlorinated pesticides, PAHs, PCB congeners, dioxin and furan congeners, lipids, and moisture content. Target fractions were selected based on the results of the sediment analyses and TBP calculations (as discussed in Chapter 6) and discussions with USEPA Region III–Philadelphia. The project-specific analytical methods for tissue analyses are provided in Table 5-2. Detection limits for tissue analyses are provided in Table 5-5. With the exception of the percent moisture and lipid determinations, Gel Permeation Chromatography (GPC) clean-up was conducted after the extraction process to reduce lipid and other tissue-related matrix interferences that could impact results of the chemical analyses.

9.1.5 Data Analysis and Statistics

The effects of channel sediments on test organism survival and chemical accumulation in tissues were evaluated by comparison to tests with reference sediments. Statistical analyses of survival data and tissue chemistry data were performed according to procedures outlined in the ITM (USEPA/USACE 1998).

9.1.5.1 Test Organism Survival

Overall percent survival of test organisms in the five replicate tests for each sediment sample was calculated to determine whether organism exposure to the channel sediments resulted in reduced survival of the test organisms as compared the placement site or reference sediment.

If survival in the channel test sediments was not more than ten percent less than survival in the reference sediment, no reduction in survival is indicated. If survival in a channel sediment was more than ten percent lower than in a reference sediment, a statistical test to determine whether survival rates were significantly different was performed.

The data were characterized with respect to distribution and equality of variance to determine the appropriate statistical test. The null hypothesis that survival in channel sediment and the reference sediment were equal was tested using a *t*-test or Wilcoxon's Rank-Sum Test. If the test showed that mean survival was not equal in the two sediments, it was concluded that the channel sediment was more toxic to test organisms than the reference or placement site sediment.

9.1.5.2 Tissue Chemical Residue Data

Before performing the statistical protocols to evaluate whether organisms exposed to channel sediments have greater concentrations of analytes in tissue than those exposed to reference or placement site sediments, several steps were taken to prepare the tissue data for evaluation. These steps were:

- Treatment of data reported below the detection limit; and
- Characterizing the distribution (normal, lognormal, nonparametric) and variance of tissue residue data.

Each of these steps is described below. The bioaccumulation data analysis process is illustrated in Figure 9-1.

9.1.5.3 Treatment of Tissue Residues Below the Analytical Detection Limit

When the tissue concentration of an analyte is not greater than a value that reflects a reliable quantity, the analytical laboratory either reports the data as an estimated concentration (qualified by "J') or as not detected (ND or U). Where data were reported as estimated, the reported concentration was assumed to be a true value in the statistical analyses. In cases where a chemical was detected in the laboratory blank (qualified by a "B"), the reported concentration was also assumed to be a true value in the statistical analyses; however, mean concentrations calculated using "B" qualified data are flagged with a "B" in the summary tables.

Data that were reported as not detected (censored) were treated in accordance with guidelines presented by Clark (1995) for small samples. The actual concentrations of these data are unknown and are presumed to fall between zero and the detection limit (DL). Clark (1995) examined various methods for handling small data sets that include non-detects, and found that, in most cases, substitution of DL/2 when more than 40 percent of the data are non-detects was an appropriate conservative approach. In general, statistical power (i.e., the probability of correctly rejecting the null hypothesis) will decline as the amount of censoring increases. In cases where the data are more than 60 to 80 percent non-detects, it is unlikely that any censoring method will result in acceptable statistical power. Following these guidelines, tissue residue data were censored to replace the non-detects with either the analyte's detection limit (≤ 40% of data below detection), or one-half the detection limit (> 40% of data below detection). Where all (100%) bioaccumulation test replicates were reported as non-detected, the analyte was assumed to be absent from the tissue (ND=0).

9.1.5.4 Characterization of Data Distribution and Variance

In order to determine the appropriate statistical test protocol by which to compare channel sediments to reference or placement site sediment, the data for each case need to be characterized with respect to distribution and variance.

Tests for normality for each analyte were conducted by combining tissue-residue concentrations from all channels and computing the Shapiro Wilk's W statistic for the residuals as described in Conover (1980). The W statistic was computed for both original and log-transformed data. Following USEPA/USACE (1998) guidance for $N > 20$, a normal distribution was rejected if $W < W_{crit}$ at the 1% confidence level ($\alpha = 0.01$). If the distribution deviated significantly from normality and a lognormal distribution could not be rejected (i.e., would result in a normalized distribution of the data) ($\alpha = 0.01$), then a lognormal distribution was assumed. In cases in which both normal and lognormal distributions were rejected, data were expressed as rankits (numerical ranks) for the purposes of statistical site comparisons.

Levene's test was used to determine if variances among sites were significantly different ($\alpha = 0.1$) (USEPA/USACE 1998 for $n = 2$ to 9). Results of normality tests and associated data transformation information are provided in Appendix G.

9.1.5.5 Comparisons of Channel Tissue-Residues to Placement/Reference Tissue-Residues

The sample concentrations for each channel, placement site, or reference area were compared to test the null hypothesis that bioaccumulation in organisms exposed to channel sediment did not exceed the bioaccumulation in organisms exposed to reference sediment. There were five replicate data points for each analyte for each site except that some analytes were tested in two rounds for Inside Site 104 resulting in 10 replicates for those cases. For channel reaches, only chemical analytes that were detected in the tissue (i.e., detected in at least one replicate) were evaluated. If a chemical analyte was not detected in any of the replicates for a channel, no comparison of means was conducted. A flow diagram depicting the decision tree for statistical comparisons of channel tissue-residues to the placement site/reference tissue-residues is depicted in Figure 9-1.

The test used to compare tissue residue concentrations is dependent upon whether variances were equal or not equal among placement/reference. In cases where variances were equal, *t*-tests were performed on the Mean Square Error (MSE) determined from an Analysis Of Variance (ANOVA) using channel reaches as the single factor. If an analyte was not detected in all five replicates of the placement/reference tissues, data were censored as described in Section 9.1.4.2 and the MSE among all placement/reference tissues was used as an estimate of the sample variance.

Where variances were not equal, *t*-tests were performed using the Satterhwaite approximation for separate variances (USEPA/USACE 1998). Three sets of one-way *t*-tests were used to determine if the mean tissue-residue concentration for each channels significantly exceeded the mean tissue-residue concentrations of either Inside Site 104, Outside Site 104, or the Ocean Reference at the 95% confidence level. The relevant null-hypothesis depends upon the sample distributions as determined in Section 9.1.4.2. The null hypotheses were:

Analyte Distribution	$\mathbf{H_0}$
• Normal	$\overline{X}_{site} \le \overline{X}_{ref}$
• Lognormal	$\overline{Y}_{site} \le \overline{Y}_{ref}; y_i = \log_{10} x_i$
• Rankits	$Median_{site} \le Median_{ref}$

All statistical analyses were completed using modified programs from USEPA/USACE 1998 for SAS©, Version 7.

9.1.5.6 Determination of Total PCBs, Total PAHs, and TEQs for Dioxin

Statistical comparisons for individual PCB and dioxin congeners provide little meaningful information. Because the majority of criteria and effect data are based on total PCBs and dioxin TEQs (not individual congeners), statistical analyses were only conducted for total PCB and dioxin TEQ concentrations in the tissue.

For each individual tissue replicate, PCB concentrations were determined by summing the 18 summation congeners (as specified in Table 9-3 of the ITM). The total summed concentration was then multiplied by a factor of 2 following the NOAA (1993) approach for total PCB determinations.

Total PAHs were determined by summing the concentrations of PAHs in each sample. One PAH, acenaphthylene, was omitted from the total PAH calculation for tissues. The detected concentrations of acenaphthylene varied widely among the tissue replicates. The USEPA analytical method for analyzing PAHs (method SW8310) uses two types of detectors: an ultraviolet detector (UV) and a flourescence detector. The UV detector is a universal detector that responds to a variety of compounds (not just PAHs); the fluorescence detector responds very specifically to individual PAHs, with the exception of acenaphthylene. False positives for acenaphthalene by SW8310 are common in tissue matrices because of the lack of confirmation by the more selective fluorescence detector (Miller 2000, personal communication). Therefore, the detected concentrations of acenaphthylene may be biased high or may be false positives and are based on instrumentation that is non-specific for acenaphthylene.

In the summation calculations for both total PCBs and total PAHs, three total values are presented in the data tables:

- Non-detects = zero (ND=0);
- Non-detects = ½ of the detection limit (ND=½ DL); and
- Non-detects = the detection limit (ND=DL).

The substitution of the detection limit (ND=DL) provides the most conservative approach to calculating and evaluating the data. However, in cases where few PCB congeners or PAHs are detected, the detection limit drives the total value and overestimates the actual expected concentration.

The TEQs for dioxin were calculated following the approach in USEPA (1989). Each congener was multiplied by the Toxicity Equivalency Factor (TEF) and then the values for each congener were summed. Concentrations that were flagged with a "B" (detected in blank) or "EMPC" (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA Region III dioxin validation guidance (USEPA 1999e). The dioxin TEQs were calculated using ND=0, ND=1/2 DL, and ND=DL.

Mean total PCB, total PAH, and TEQ concentrations that were used in the means comparisons statistics were determined by averaging the total or TEQ that was calculated for each individual replicate. In the PCB, PAH, and dioxin tables, note that the average of the sums does not equal the sum of the average concentrations for each congener or analyte for calculations using ND=0 and ND=1/2DL.

9.1.5.7 Uptake Ratios

In order to evaluate the magnitude of chemical uptake and to assist with the evaluation of the statistically significant tissue-residue results, an Uptake Ratio (UR) was calculated to assess the magnitude of contaminant uptake by organisms during the 28-day period. The 28-day uptake ratio was derived as the ratio of the day 28 mean tissue-residue concentration to the day 0 (PRETEST tissue) mean tissue-residue concentration for each chemical analyte. Because each lot of organisms had a separate set of pre-test analyses, URs were calculated separately for each lot of organisms using the corresponding pre-test tissue-residue results:

$$U_r = \frac{\overline{X}_{t=28}}{\overline{X}_{t=0}}$$

where:

U_r	= Uptake Ratio
$\overline{X}_{t=0}$	= day 0 (PRETEST) mean tissue-residue concentration
$\overline{X}_{t=28}$	=day 28 mean tissue-residue concentration

The chemical data for the three lots of pre-test tissues are presented in Appendix G.

9.2 RESULTS

9.2.1 Survival

9.2.1.1 *Nereis virens*

The survival results of the first round of *N. virens* bioaccumulation testing are summarized in Table 9-5A. Mean survival in the Inside Site 104 sediment was 89%. Mean survival in all the channel sediments ranged from 79 to 98%. With the exception of the C&D Approach (surficial sediment), all channels with mean survival that fell below 89% were within the 10% allowable difference. The C&D Approach (surficial sediment) had the lowest survival (79 percent); however, the mean survival was not statistically lower than Inside Site 104 survival. The control sediment had 95 percent survival.

The results of the second round of bioaccumulation testing with *N. virens* are presented in Table 9-5B. None of the tested sediments was toxic to *N. virens*. The Outside Site 104 reference sediment had the lowest mean survival (83%) of all of the tested sediments. Mean survival in the Inside Site 104 sediment (89%) and in Outside Site 104 sediment (83%) was not statistically different. Mean survival in the channel sediments ranged from 88 to 98 %. Survival in the control sediment was 97%.

Results of the third round of bioaccumulation testing with *N. virens* are provided in Table 9-5C. Mean survival rates in the Ocean Reference sediment and the control sediment was 96 percent.

9.2.1.2 *Macoma nasuta*

Table 9-6A presents the survival results of the first round of *M. nasuta* bioaccumulation testing. None of the sediments were toxic to *M. nasuta*. Mean survival in the channel sediments ranged from 93 to 98 percent, while the sediment from Inside Site 104 had 96 percent survival. The control sediment had 93 percent survival.

The results of the second round of bioaccumulation testing with *M. nasuta* are summarized in Table 9-6B. The Inside Site 104 and Outside Site 104 sediments had 93 and 92 percent survival, respectively. Mean survival rates in sediments from Craighill Entrance (81 percent survival) and Craighill Angle-East (79 percent survival) was statistically lower than mean survival in both the Inside and Outside Site 104 sediments. The remaining channel sediments had mean survival rates ranging from 86 to 97 percent, which were all within 10 percent of mean survival for both Inside and Outside Site 104 sediments. The control sediment had 92 percent survival.

Results of the third round of bioaccumulation testing with *M. nasuta* are provided in Table 9-6C. Mean survival rates in the Ocean Reference sediment and the control sediment were 99 percent.

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9.2.2 Reference Toxicant Tests

The results of the reference toxicant tests are summarized in Table 9-7A (Round 1 and Round 2) and Table 9-7B (Round 3). The LC50s from the *N. virens*, and *M. nasuta* reference toxicant tests all fell within the established laboratory control chart limits.

9.2.3 Tissue Contaminant Analysis

Results of the tissue chemistry analyses are presented in the following subsections. The mean analyte concentration for five replicate analyses was used for statistical comparisons to Inside Site 104, Outside Site, and the Ocean Reference. The raw data for each tissue replicate are provided in Appendix D. In several cases where tissue mass was limited (due to mortality in the test chambers during the 28-day test), four replicates were tested for chemical constituents and used in statistical comparisons, rather than five.

Analytical results for tissue-residues are reported on a wet weight basis. Lipid content is reported as a percent of total wet weight. Data qualifiers for the organic data are provided in Table 3-3. Inorganic data qualifiers are provided in Table 3-4. Dioxin and furan qualifiers are provided in Table 6-1. Prior to data analysis organic data were validated using USPEA Region III protocols as described in Section 5.4). Analytical narratives, which include a synopsis of laboratory QA/QC results for Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Recoveries, are provided in Attachment VI. The analytical laboratory will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

Statistical comparisons of placement sites and reference area tissue residues to each are provided for comparative purposes. These statistical comparisons are not required by the ITM (USEPA/USACE 1998) or the Ocean Testing Manual (USEPA/USACE 1991).

9.2.3.1 Metals

Nereis virens

Table 9-8A presents mean concentrations of metals in worm tissues exposed to channel sediments and highlights concentrations that are statistically higher than concentrations reported for Inside Site 104. Table 9-8B presents mean concentrations of metals in worm tissue and highlights concentrations that are statistically higher than concentrations reported for Outside Site 104. Table 9-8C presents mean concentrations of metals in worm tissue and highlights concentrations that are statistically higher than concentrations reported for the Ocean Reference. Uptake Ratios (UR) for metals in worm tissue are provided in Table 9-9.

<u>Summary</u>

Mercury and thallium were not detected in the worm tissues exposed to channel test sediments. Arsenic, cadmium, iron, lead, and selenium tissue residue concentrations in the channel tests were not found to be significantly different from those exposed to any of the three reference/placement site sediments. While aluminum and silver tissue residues were significantly higher than reference site concentrations in some cases, the actual concentrations were less than in the pretest tissues as indicated by the Uptake Ratios that were less than one or less than in the control tissues. Mean beryllium concentrations in the worm tissue were below the recommended TDL of 0.1 mg/kg in tissue (USEPA/USACE 1995). Antimony, beryllium, chromium, copper, manganese, nickel, and zinc were present in test organism tissues at levels that were significantly higher than references for some cases as discussed below.

Comparisons to Inside Site 104

Antimony, beryllium, chromium, copper, manganese, and nickel had mean tissue-residues concentrations that were statistically higher than the Inside Site 104 tissue-residues for at least one channel. Zinc concentrations were not different than in Inside Site 104 tissues. Beryllium and chromium were statistically higher than the Inside Site 104 tissue for nine of the thirteen channels. None of the metals detected in tissue-residues for Craighill Angle–East and Craighill Entrance was statistically higher than Inside Site 104. Tissues from the remaining channels contained at least one target metal with a mean concentration that was statistically higher than the Inside Site 104.

Comparisons to Outside Site 104

Antimony, beryllium, chromium, copper, manganese, nickel, and zinc had mean tissue concentrations that were statistically higher than the Outside Site 104 tissue. Chromium, copper, and nickel were statistically higher than the Outside Site 104 tissue for all thirteen channel reaches. Tissues from each channel contained at least four target metals with mean concentrations that were statistically higher than the Outside Site 104 tissues.

Comparisons to Ocean Reference

Beryllium, manganese, silver, and zinc had mean concentrations that were statistically higher than the Ocean Reference tissue in at least one channel. Beryllium was the metal that most frequently exceeded the Ocean Reference tissue concentration (9 of 13 channel reaches). However, mean beryllium concentrations in the worm tissue were below the recommended TDL of 0.1 mg/kg in tissue (USEPA/USACE 1995). Tissues from each station, with the exception of Craighill Angle–East and Craighill Entrance, contained one target metal with a mean concentration that was statistically higher than the Ocean Reference.

Macoma nasuta

Table 9-10A presents mean concentrations of metals in clam tissue and highlights concentrations that are statistically higher than Inside Site 104 tissue-residues. Table 9-10B presents mean concentrations of metals in clam tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue-residues. Table 9-10C presents mean concentrations of metals in clam tissue and highlights concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for metals in clam tissue are provided in Table 9-11.

Comparisons to Inside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations of metals were statistically higher than the Inside Site 104 tissue in 61 of 208 cases (29%) (Table 9-10A). Eleven of the sixteen tested metals in clam tissue (aluminum, antimony, arsenic, beryllium, chromium, iron, manganese, mercury, nickel, selenium, and zinc) had mean concentrations that were statistically higher than the Inside Site 104 for at least one channel. Selenium and manganese were statistically higher than the Inside Site 104 reference tissue at twelve and eleven of the thirteen stations, respectively. Mean mercury concentrations were statistically higher than Inside Site 104 at two of the thirteen stations; however, uptake ratios for the significant mercury concentrations were ≤ 1, indicating that these concentrations were actually lower than the concentrations detected in pre-test tissues. Tissues from each channel reach contained at least two target metals with mean concentrations that were statistically higher than Inside Site 104 tissues.

Comparisons to Outside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations of metals were statistically higher than the Outside Site 104 reference tissue in 104 of 208 cases (50%) (Table 9-10B). Twelve of the sixteen tested metals in clam tissue (aluminum, antimony, arsenic, beryllium, cadmium, chromium, iron, manganese, mercury, nickel, selenium, and zinc) had mean concentrations that were statistically higher than the Outside Site 104 tissue for at least one channel. Mean concentrations of chromium and nickel in tissues for all of the channel reaches were statistically higher than the Outside Site 104 tissue. Iron, manganese, and selenium were statistically higher than the Outside Site 104 tissue for 12 of the 13 channel reaches. Uptake ratios for the significant beryllium, cadmium, mercury, and zinc concentrations were frequently ≤ 1, indicating that these concentrations were actually lower than the concentrations detected in pre-test tissues. Tissues from each channel contained at least five target metals with mean concentrations that were statistically higher than Outside Site 104.

Comparisons to Ocean Reference

In the thirteen sets of study area clam tissue tests, mean concentrations of metals were statistically higher than the Ocean Reference tissue in 49 of 208 cases (24%) (Table 9-10C). Ten of the sixteen detected metals in clam tissue (aluminum, antimony, beryllium, chromium, iron, manganese, mercury, nickel, selenium, and silver) had mean concentrations that were statistically higher than the Ocean Reference tissue in at least one channel. Manganese was statistically higher than the Ocean Reference for all thirteen channel reaches. Iron and beryllium were statistically higher than the Ocean Reference tissue at twelve and ten of the thirteen channel reaches, respectively. Concentrations factors for the significant beryllium and mercury concentrations were frequently ≤ 1, indicating that these concentrations were actually lower than the concentrations detected in pre-test tissues. In addition, mean beryllium concentrations in the clam tissue were below the recommended TDL of 0.1 mg/kg in tissue (USEPA/USACE 1995). Tissues from each channel reach contained at least two target metals with mean concentrations that were statistically higher than the Ocean Reference.

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9.2.3.2 Pesticides

Nereis virens

Table 9-12A presents mean concentrations of chlorinated pesticides in worm tissue and highlights concentrations that are statistically higher than Inside Site 104. Table 9-12B presents mean concentrations of chlorinated pesticides in worm tissue and highlights concentrations that are statistically higher than Outside Site 104. Table 9-12C presents mean concentrations of chlorinated pesticides in worm tissue and highlights concentrations that are statistically higher than the Ocean Reference. Uptake ratios for chlorinated pesticides in worm tissue are provided in Table 9-13.

<u>Comparisons to Inside Site 104</u>
In the thirteen sets of channel worm tissue tests, mean concentrations of pesticides were statistically higher than the Inside Site 104 tissue in 34 of 286 cases (12%). Mean concentrations of thirteen chlorinated pesticides detected throughout the channel test tissues were statistically higher than Inside Site 104. 4,4'-DDD, dacthal, delta-BHC, endosulfan II, heptachlor, and heptachlor epoxide were the most frequently detected pesticides with mean concentrations that were statistically higher than Inside Site 104 tissue. Tissue from 11 of the 13 channel reaches contained at least one pesticide compound with a concentration that was statistically higher than the Inside Site 104. Craighill Channel and Craighill Angle East were the only two channel reaches with no statistical exceedances. Uptake ratios for the significant delta-BHC, endrin, and gamma-BHC concentrations were ≤ 1, indicating that these concentrations were actually lower than the concentrations detected in pre-test tissues. Significant concentrations of heptachlor and heptachlor epoxide were below the recommended TDL of 10 µg/kg in tissue (USEPA/USACE 1995).

<u>Comparisons to Outside Site 104</u>
In the thirteen sets of channel worm tissue tests, mean concentrations of pesticides were statistically higher than the Outside Site 104 tissue in 43 of 286 cases (15%). Mean concentrations of eleven chlorinated pesticides were statistically higher than the Outside Site 104 tissue for at least one of the thirteen channel reaches. 4,4'-DDD, aldrin, chlorbenside, dacthal, delta-BHC, gamma-BHC, and heptachlor epoxide were the most frequently detected pesticides with mean concentrations that were statistically higher than the Outside Site 104 tissue. Worm tissue from the each of the thirteen channel reaches contained at least one pesticide compound with a concentration that was statistically higher than Outside Site 104, with the exception of Craighill Angle East (no exceedances). Uptake ratios for many of the significant concentrations of aldrin, chlorbenside, delta-BHC, endrin, and gamma–BHC concentrations were ≤ 1 (with the exception of tissue-residues in C&D Approach–surficial), indicating that these concentrations were actually lower than the concentrations detected in pre-test tissues. Significant concentrations of gamma-BHC, heptachlor, and heptachlor epoxide were below the recommended TDLs of 10 µg/kg in tissue (USEPA/USACE 1995).

Comparisons to the Ocean Reference
In the thirteen sets of channel worm tissue tests, mean concentrations of chlorinated pesticides were statistically higher than the Ocean Reference tissue in 21 of 286 cases (7%). Mean concentrations of seven pesticides were statistically higher than the Ocean Reference tissue for at least one of the thirteen channel reaches. 4,4'-DDD, chlorbenside, dacthal, and heptachlor were the pesticides with mean concentrations that most frequently exceeded the mean concentrations in the Ocean Reference tissue. Significant concentrations of heptachlor were below the recommended TDL of 10 µg/kg in tissue (USEPA/USACE 1995). None of the pesticides detected in tissues for Craighill Channel, Craighill Angle–East, or Craighill Upper Range were statistically higher than the Ocean Reference tissue.

Macoma nasuta

Table 9-14A presents mean concentrations of chlorinated pesticides in clam tissue and highlights concentrations that are statistically higher than the Inside Site 104 tissue. Table 9-14B presents mean concentrations of chlorinated pesticides in clam tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue. Table 9-14C presents mean concentrations of chlorinated pesticides in clam tissue and highlights concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for chlorinated pesticides in clam tissue are provided in Table 9-15.

Comparisons to Inside Site 104
In the thirteen sets of channel clam tissue tests, mean concentrations of pesticides were statistically higher than the Inside Site 104 tissue in 19 of 286 cases (7%). Mean concentrations of seven pesticides (4,4'-DDD, 4,4'-DDT, alpha-BHC, dieldrin, endosulfan II, gamma-BHC, and heptachlor) were statistically higher than the Inside Site 104 tissue for at least one of the thirteen channel reaches. Uptake ratios for the significant 4,4'-DDD, gamma-BHC, and heptachlor concentrations were ≤ 1, indicating that these concentrations were lower than the concentrations detected in pre-test tissues. In addition, mean concentrations of 4,4'-DDD, 4,4'-DDT, dieldrin, endosulfan II, gamma-BHC, and heptachlor were below the recommended TDL of 10 µg/kg in tissue (USEPA/USACE 1995). There were no statistically significant exceedances for pesticides detected in C&D approach (surficial), Craighill Channel, Craighill Angle–East, Craighill Entrance, or Tolchester Channel North.

Comparisons to Outside Site 104
In the thirteen sets of study area clam tissue tests, mean concentrations of pesticides and PCB Aroclors were statistically higher than the Outside Site 104 reference tissue in 21 of 286 cases (7%). Mean concentrations of seven pesticides (4,4'-DDD, 4,4'-DDT, alpha-BHC, dieldrin, endosulfan II, gamma-BHC, and heptachlor) were statistically higher than the Outside Site 104 tissue for at least one of the thirteen channel reaches. Uptake ratios for the significant 4,4'-DDD, gamma-BHC, and heptachlor concentrations were ≤ 1, indicating that these concentrations were lower than the concentrations detected in pre-test tissues. In addition, mean concentrations of 4,4'-DDD, 4,4'-DDT, dieldrin, endosulfan II, gamma-BHC and heptachlor were below the recommended TDL of 10 µg/kg in tissue (USEPA/USACE 1995). There were no statistically

significant exceedances for pesticides detected in the Craighill Channel, Craighill Angle–East, Craighill Entrance, or Tolchester Channel North.

Comparisons to the Ocean Reference
In the thirteen sets of channel clam tissue tests, mean concentrations of pesticides were statistically higher than the Ocean Reference tissue in 22 of 286 cases (8%). Mean concentrations of eight pesticides (4,4'-DDD, 4,4'-DDT, aldrin, alpha-BHC, beta-BHC, endosulfan I, endosulfan II, and gamma-BHC) were statistically higher than the Ocean Reference tissue for at least one of the thirteen channel reaches. Tissue from the thirteen stations contained at least one pesticide compound with a concentration that was statistically higher than the reference with the exception of Tolchester Channel North, Tolchester Channel South, and Tolchester Straightening. Uptake ratios for the significant 4,4'-DDD and heptachlor concentrations were $\leq$1, indicating that these concentrations were actually lower than the concentrations detected in pre-test tissues. In addition, mean concentrations of 4,4'-DDD, 4,4'-DDT, endosulfan II, and gamma-BHC were below the recommended TDL of 10 µg/kg in tissue (USEPA/USACE 1995). There were no statistically significant exceedances for pesticides detected in Tolchester Channel North, Tolchester Channel South, or the Tolchester Straightening.

9.2.3.3 PAHs

Nereis virens

Table 9-16A presents mean concentrations of PAHs in worm tissue and highlights concentrations that are statistically higher than Inside Site 104 tissue. Table 9-16B presents mean concentrations of PAHs in worm tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue. Table 9-16C presents mean concentrations of PAHs in worm tissue and highlights concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for PAHs in worm tissue are provided in Table 9-17.

Comparisons to Inside Site 104
In the thirteen sets of channel worm tissue tests, mean concentrations of PAHs were statistically higher than the Inside Site 104 tissue in 0 of 208 cases (0%). None of the mean individual PAH concentrations or mean total PAH concentrations measured in channel tissues were statistically higher than mean concentrations measured in Inside Site 104 tissues.

Comparisons to Outside Site 104
In the thirteen sets of channel worm tissue tests, mean concentrations of PAHs were statistically higher than the Outside Site 104 tissue in 0 of 208 cases (0%). None of the mean individual PAH concentration or mean total PAH concentrations measured in channel tissues were statistically higher than mean concentrations measured in Outside Site 104 tissues.

Comparisons to the Ocean Reference
In the thirteen sets of channel worm tissue tests, mean concentrations of PAHs were statistically higher than the Ocean Reference tissue in 2 of 208 cases (<1%). The mean worm tissue

concentration for chrysene was statistically higher in tissues for C&D Approach (surficial); however, the uptake ratio was <1, indicating that the mean concentration was actually lower than the mean concentration detected in pre-test tissues. The mean worm tissue concentration for fluoranthene was statistically higher in tissues for Tolchester North; however, the uptake ratio was <1, indicating that indicating that the mean concentration was actually lower than the mean concentration detected in pre-test tissues. The significant concentrations for both chrysene and fluoranthene were both below the recommended TDL of 20 µg/kg in tissue (USEPA/USACE 1995). None of the mean total PAH concentrations measured in the channels were statistically higher than the Ocean Reference concentration, with the exception of Tolchester North; however, the uptake ratio was <1, indicating that the mean concentration was actually lower than the mean concentration detected in pre-test tissues.

Macoma nasuta

Table 9-18A presents mean concentrations of PAHs in clam tissue and highlights concentrations that are statistically higher than Inside Site 104 tissue. Table 9-18B presents mean concentrations of PAHs in clam tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue. Table 9-18C presents mean concentrations of PAHs in clam tissue and highlights concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for PAHs in clam tissue are provided in Table 9-19.

Comparisons to Inside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations of PAHs were statistically higher than the Inside Site 104 tissue in 14 of 208 cases (7%). Mean concentrations of six PAHs [acenaphthylene, benz(a)anthracene, benzo(b)fluoranthene, fluorene, naphthalene, and phenanthrene] were statistically higher than the Inside Site 104 clam tissue for at least one of the thirteen channel reaches. Benz(a)anthracene was the PAH with mean tissue concentrations that most frequently exceeded the Inside Site 104 tissue-residue (7 of 13 channel reaches). Mean concentrations of six PAHs for Tolchester Straightening tissue statistically exceeded Inside Site 104 tissue-residue. Significant concentrations of benz(a)anthracene, benzo(b)fluoranthene, fluorene, and phenanthrene were below the recommended TDL of 20 µg/kg in tissue (USEPA/USACE 1995). There were no statistically significant exceedances for mean PAH concentrations in tissues for Brewerton Channel Eastern Extension, C&D Approach (cores), Craighill Channel, Craighill Angle-East, Craighill Entrance, and Swan Point. None of the mean total PAH concentrations were statistically higher than the tissue-residues measured for Inside Site 104.

Comparisons to Outside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations of PAHs were statistically higher than the Outside Site 104 tissue in 21 of 208 cases (10%). Mean concentrations of six PAHs [acenaphthylene, anthracene, benzo(b)fluoranthene, chrysene, fluoranthene, and naphthalene] were statistically higher than the reference tissue for at least one of the thirteen channel reaches. Acenaphthylene and chrysene were the PAHs with mean tissue concentrations that most frequently exceeded the Outside Site 104 tissue-residues. The uptake ratio for the significant acenaphthylene concentration at C&D Approach (surficial) was <1, indicating that this concentration was actually lower than the concentrations detected in pre-test tissues. Significant concentrations of anthracene, benzo(b)fluoranthene, chrysene, and fluoranthene were below the recommended TDL of 20 μg/kg in tissue (USEPA/USACE 1995). There were no statistically significant exceedances for mean PAH concentrations in clam tissue for Craighill Channel, Craighill Angle–East, Craighill Entrance, and Swan Point Channel. None of the mean total PAH concentrations were statistically higher than the tissue-residues measured for Outside Site 104.

Comparisons to Ocean Reference

In the thirteen sets of channel clam tissue tests, mean concentrations of PAHs were statistically higher than the Ocean Reference tissue in 87 of 208 cases (42%). Mean concentrations of eleven PAHs were statistically higher than the reference tissue for at least one of the thirteen sites. Mean tissue concentrations of benzo(b)fluoranthene and fluorene were statistically higher than the Ocean Reference for all 13 channel reaches. With the exception of acenaphthylene and naphthalene, all other significant PAH concentrations were below the recommended target detection limit of 20 μg/kg in tissue (USEPA/USACE 1995). Clam tissue for each of the thirteen channel reaches contained at least one PAH compound with a mean concentration that was statistically higher than the Ocean Reference. Mean total PAH concentrations measured in all channel tissues (ND=1/2 DL and ND=DL) were statistically higher than the total PAH concentration measured in the Ocean Reference tissue. Uptake ratios for mean total PAHs ranged from 1.07 to 2.65. The highest uptake ratios (>2) were reported for Craighill Upper Range, Tolchester South, and Tolchester Straightening.

9.2.3.4 PCB Aroclors

Nereis virens

Table 9-20A presents mean concentrations of PCB aroclors in worm tissue and highlights concentrations that are statistically higher than the Inside Site 104 tissue. Table 9-20B presents mean concentrations of PCB aroclors in worm tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue. Table 9-20C presents mean concentrations of PCB aroclors in worm tissue and highlights concentrations that are statistically higher than the Ocean Reference. Uptake ratios for PCB aroclors in worm tissue are provided in Table 9-21.

Comparisons to Inside Site 104, Outside Site 104, and Ocean Reference

In the thirteen sets of channel worm tissue tests, none of the tested PCB congeners were detected in either the channel, placement site, or reference worm tissues. There were no statistical exceedances for Inside Site 104, Outside Site 104, or Ocean Reference tissue-residues (0 of 273 cases).

Macoma nasuta

Table 9-22A presents mean concentrations of PCB aroclors in clam tissue and highlights concentrations that are statistically higher than the Inside Site 104 tissue. Table 9-22B presents mean concentrations of PCB aroclors in clam tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue. Table 9-22C presents mean concentrations of PCB aroclors in clam tissue and highlights concentrations that are statistically higher than the Ocean Reference. Uptake ratios for PCB aroclors in clam tissue are provided in Table 9-23.

Comparisons to Inside Site 104, Outside Site 104, and Ocean Reference
In the thirteen sets of channel worm tissue tests, none of the tested PCB aroclors were detected in either the channel, placement site, or reference worm tissues. There were no statistical exceedances for Inside Site 104, Outside Site 104, or Ocean Reference tissue-residues (0 of 273 cases).

9.2.3.5 PCB Congeners

Nereis virens

Table 9-24A presents mean concentrations of PCB congeners in worm tissue and highlights mean concentrations for Total PCBs that are statistically higher than Inside Site 104 tissue. Table 9-24B presents mean concentrations of PCB congeners in worm tissue and highlights mean concentrations for Total PCBs that are statistically higher than Outside Site 104 tissue. Table 9-24C presents mean concentrations of PCB congeners in worm tissue and highlights mean concentrations for Total PCBs that are statistically higher than the Ocean Reference tissue. Uptake ratios for PCB congeners and Total PCBs in worm tissue are provided in Table 9-25.

Because many of the congeners were non-detects or were detected at concentrations that were substantially below the TDL for individual congeners in tissue (2 μg/kg), the total PCB comparisons using ND=0 are the values that will most appropriately show statistical exceedances of the placement site/reference concentrations.

Comparisons to Inside Site 104
In the thirteen sets of channel worm tissue tests, none of the mean concentrations for Total PCBs was statistically higher than the Inside Site 104 tissue-residue (0 of 13 cases).

Comparisons to Outside Site 104
In the thirteen sets of channel worm tissue tests, none of the mean concentrations for Total PCBs was statistically higher than the Outside Site 104 tissue in (0 of 13 cases).

Comparisons to Ocean Reference
In the thirteen sets of channel worm tissue tests, mean concentrations for Total PCBs were statistically higher than the Ocean Reference tissue in 3 of 13 cases (23%) (ND=0). Total PCB concentrations in worm tissue for Craighill Channel, Craighill Entrance, and the Cutoff Angle were statistically higher than the Ocean Reference tissue.

Macoma nasuta

Table 9-26A presents mean concentrations of PCB congeners in clam tissue and highlights mean Total PCB concentrations that are statistically higher than Inside Site 104 tissue. Table 9-26B presents mean concentrations of PCB congeners in clam tissue and highlights mean Total PCB concentrations that are statistically higher than Outside Site 104 tissue. Table 9-26C presents mean concentrations of PCB congeners in clam tissue and highlights mean Total PCB concentrations that are statistically higher than the Ocean Reference. Uptake ratios for PCB congeners and Total PCBs in clam tissue are provided in Table 9-27.

Comparisons to Inside Site 104

In the thirteen sets of channel clam tissue tests, none of the mean concentrations for Total PCBs was statistically higher than the Inside Site 104 tissue-residue (0 of 13 cases).

Comparisons to Outside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations for Total PCBs were statistically higher than the Outside Site 104 tissue in 4 of 13 cases (31%) (ND=0). Total PCB concentrations (ND=0) in clam tissue for Brewerton Channel Eastern Extension, C&D Approach (cores), Craighill Entrance, and Swan Point were statistically higher than Outside Site 104 tissue-residues. Uptake ratios for significant Total PCB tissue-residues were <1, indicating that the mean total concentrations were lower than the mean concentrations detected in pre-test tissues.

Comparisons to Ocean Reference

In the thirteen sets of channel clam tissue tests, mean concentrations for Total PCBs were statistically higher than the Ocean Reference tissue in 7 of 13 cases (54%). Total PCB concentrations (ND=0) in clam tissue for Brewerton Channel Eastern Extension, C&D Approach (surficial), C&D Approach (cores), Craighill Channel, Craighill Angle East, Craighill Entrance, and Swan Point Channel were statistically higher than Outside Site 104 tissue-residues. Uptake ratios for significant Total PCB tissue-residues were <1, however, indicating that the mean total concentrations were lower than the mean concentrations detected in pre-test tissues.

9.2.3.6 Semivolatile Organic Compounds (SVOCs)

Nereis virens

Table 9-28A presents mean concentrations of semivolatile organic compounds in worm tissue and highlights concentrations that are statistically higher than Inside Site 104 tissue. Mean concentrations of semivolatile organic compounds in worm tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue are presented in Table 9-28B. Table 9-28C presents mean concentrations of semivolatile organic compounds in worm tissue and highlights concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for semivolatile organic compounds in worm tissue are provided in Table 9-29.

Comparisons to Inside Site 104 and Ocean Reference

In the thirteen sets of channel worm tissue tests, mean concentrations of SVOCs were statistically higher than the Inside Site 104 and Ocean Reference tissues in 8 of 611 cases (1%) for each site comparison. Five of the forty-seven targeted SVOCs (2-methylphenol, di-n-butyl phthalate, di-n-octyl phthalate, pentachlorophenol, and phenol) were statistically higher than the Inside Site 104 and Ocean Reference worm tissues. 2-Methylphenol was the only constituent with an uptake ratio that exceeded a value of 2; uptake ratios for the other four constituents were <1.4.

Comparisons to Outside Site 104

In the thirteen sets of channel worm tissue tests, mean concentrations of SVOCs were statistically higher than the Outside Site 104 tissues in 7 of 611 cases (1%) for each site comparison. Four of the forty-seven targeted SVOCs (2-methylphenol, di-n-octyl phthalate, pentachlorophenol, and phenol) were statistically higher than the Outside Site 104 worm tissues. 2-Methylphenol was the only constituent with an uptake ratio that exceeded a value of 2; uptake ratios for the other three constituents were <1.4.

Macoma nasuta

Table 9-30A presents mean concentrations of SVOCs in clam tissue and highlights concentrations that are statistically higher than Inside Site 104 tissue-residues. Table 9-30B presents mean concentrations of SVOCs in clam tissue and highlights concentrations that are statistically higher than Outside Site 104 tissue. Table 9-30C presents mean concentrations of SVOCs in clam tissue and highlights concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for semivolatile organic compounds in clam tissue are provided in Table 9-31.

Comparisons to Inside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations of SVOCs were statistically higher than the Inside Site 104 tissue in 11 of 611 cases (2%). Mean concentrations of four of the forty-seven tested SVOCs (2-methylphenol, 3,4-methylphenol, 4-nitrophenol, and benzoic acid) were statistically higher than the Inside Site 104 clam tissue for at least one of the thirteen channel reaches. Uptake ratios for the two of the four significant 3,4-methylphenol concentrations were ≤ 1, indicating that these concentrations were lower than the concentrations detected in pre-test tissues.

Comparisons to Outside Site 104

In the thirteen sets of channel clam tissue tests, mean concentrations of SVOCs were statistically higher than the Outside Site 104 tissue in 15 of 611 cases (2%). Mean concentrations of five of the forty-seven tested SVOCs (1-methylnaphthalene, 2-methylphenol, 3,4-methylphenol, 4-nitrophenol, and benzoic acid) were statistically higher than the Outside Site 104 clam tissue. Uptake ratio for the two of five the significant benzoic acid concentrations were ≤ 1, indicating that these concentrations were lower than the concentrations detected in pre-test tissues.

Comparisons to Ocean Reference

In the thirteen sets of channel clam tissue tests, mean concentrations of SVOCs were statistically higher than the Ocean Reference tissue in 23 of 611 cases (4%). Mean concentrations of six of the forty-seven tested SVOCs (1-methylnaphthalene, 2-methylphenol, 3,4-methylphenol, 4-nitrophenol, benzyl alcohol, and phenol) were statistically higher than the Ocean Reference clam tissue for at least one channel reach. Clam tissue for all thirteen channel reaches contained at least one SVOC with a concentration that was statistically higher than the Outside Site 104 clam tissue.

9.2.3.7 Dioxin and Furan Congeners

Nereis virens

Table 9-32A presents mean concentrations of dioxins and furans in worm tissue and highlights mean TEQ concentrations that are statistically higher than Inside Site 104. Table 9-32B presents mean concentrations of dioxins and furans in worm tissue and highlights mean TEQ concentrations that are statistically higher than Outside Site 104. Table 9-32C presents mean concentrations of dioxins and furans in worm tissue and highlights mean TEQ concentrations that are statistically higher than the Ocean Reference. Uptake ratios for dioxins and furans in worm tissue are provided in Table 9-33.

2,3,7,8-TCDD, the most toxic dioxin congener was detected in worm tissue for 5 of the 13 tested channel reaches, with concentrations ranging from 0.0602 to 0.132 ng/kg. These concentrations are substantially below the recommended TDL of 1 ng/kg in tissue (USEPA/USACE 1995). The highest mean concentrations were measured for the least toxic congener, OCDD, ranging from 5.5 to 10.4 ng/kg. The TDL for OCDD in tissue is 10 ng/kg (USEPA/USACE 1995).

<u>Comparisons to Inside Site 104</u>
In the thirteen sets of channel worm tissue tests, none of the mean TEQ concentrations (ND=0, ND=1/2DL, and ND=DL) for dioxins and furans in worm tissue was statistically higher than the Inside Site 104 tissue-residues (0 of 13 cases).

<u>Comparisons to Outside Site 104</u>
In the thirteen sets of channel worm tissue tests, mean TEQ concentrations for dioxins and furans in worm tissue were statistically higher than the Outside Site 104 in 9 of 13 cases (69%) (ND=1/2 DL), and 11 of 13 cases (ND=DL). When zero was substituted for the detection limit in the TEQ calculations, mean TEQ concentrations for only two channels (Brewerton Channel Eastern Extension and Craighill Entrance) were statistically higher than Outside Site 104.

<u>Comparisons to the Ocean Reference</u>
In the thirteen sets of channel worm tissue tests, mean TEQ concentrations for dioxins and furans were statistically higher than the Ocean Reference tissue in 3 of 13 cases (23%) (ND=1/2 DL) and 9 of 13 cases (ND=DL). When zero was substituted for the detection limit, none of the mean TEQ values were statistically higher than the Outside Site 104 tissue-residue.

Macoma nasuta

Table 9-34A presents mean concentrations of dioxins and furans in clam tissue and highlights mean TEQ concentrations that are statistically higher than Inside Site 104 tissue. Table 9-34B presents mean concentrations of dioxins and furans in clam tissue and highlights mean TEQ concentrations that are statistically higher than Outside Site 104. Table 9-34C presents mean concentrations of dioxins and furans in clam tissue and highlights mean TEQ concentrations that are statistically higher than the Ocean Reference tissue. Uptake ratios for dioxin and furan congeners in clam tissue are provided in Table 9-35.

2,3,7,8-TCDD, the most toxic dioxin congener, was not detected in the channel clam tissues. The highest congener concentrations were reported for OCDD (the least toxic congener).

Comparisons to Inside Site 104
In the thirteen sets of channel clam tissue tests, none of the mean TEQ concentrations for dioxins and furans in worm tissue (ND=0, ND=1/2DL, and ND=DL) was statistically higher than the Inside Site 104 tissue-residues (0 of 13 cases).

Comparisons to Outside Site 104
In the thirteen sets of channel clam tissue tests, mean TEQ concentrations for dioxins and furans were statistically higher than the Outside Site 104 tissue in 1 of 13 cases (8%) (ND=1/2DL and ND=DL). The mean TEQ in clam tissue for the C&D Approach (surficial) was the only concentration that was statistically higher than Outside Site 104. When zero was substituted for the detection limit, the mean TEQ value was not statistically higher than the Outside Site 104 tissue-residue.

Comparisons to the Ocean Reference
In the thirteen sets of channel clam tissue tests, mean TEQ concentrations for dioxins and furans were statistically higher than the Ocean Reference tissue in 7 of 13 cases (54%) (ND=1/2DL) and 13 of 13 cases (ND=DL). When zero was substituted for the detection limit, the mean TEQ value was not statistically higher than the Ocean Reference Site 104 tissue-residue.

9.2.3.8 Lipids and Percent Moisture

Lipid and percent moisture values for worm and clam tissue are provided in Tables 9-36 and 9-37, respectively. Mean lipid values ranged from 0.27% to 1.39% of total wet body weight for worms and from 0.05% to 0.17% of total wet body weight for clams. Mean percent moisture in worm tissue ranged from 84.5% to 87.1%. Percent moisture in clam tissue ranged from 85.7%to 87.5%.

9.2.3.9 Summary

Of the 151 chemical constituents that were tested in the channel tissues, 95 constituents (63%) were detected in the channel worm tissues and 91 constituents (60%) were detected in the channel clam tissues. For all channels combined, 32 constituents in worm tissue statistically exceeded at least one of the placement site/reference area tissue-residues, and 44 constituents in clam tissue statistically exceeded at least one of the placement site/reference area tissue-residues. Overall, metals and PAHs were more frequency detected in clam tissue, and pesticides and dioxins were more frequently detected in worm tissue.

A total of 1,430 statistical comparisons (13 channel reaches x 110 statistically compared constituents) of channel tissue-residues were conducted for each test species at each placement/reference area (i.e., Inside Site 104, Outside Site 104, Ocean Reference), resulting in an overall total of 8,580 statistical comparisons. The 8,580 statistical comparisons resulted in a combined total of 728 statistical exceedances of the placement site/reference tissues (262 worm exceedances and 466 clam exceedances). A summary of statistical exceedances for each placement/reference area is provided in Table 9-38A (worms) and Table 9-38B (clams).

The statistical comparisons of the mean concentrations were conducted at an alpha level of 0.05, which indicates that out of every 100 statistical comparisons, at least 5 statistically significant differences will be due to chance alone. Therefore, in the 8,580 statistical comparisons, approximately 429 of the 728 statistical exceedances may have occurred due to chance alone.

The number of statistical tissue-residue exceedances for each channel versus Inside Site 104 is provided in Table 9-39A (worms) and 9-39B (clams). The number of statistical tissue-residue exceedances for each channel versus Outside Site 104 is provided in Tables 9-40A (worms) and 9-40B (clams). The number of statistical exceedances for each channel versus the Ocean Reference Site is provided in Tables 9-41A (worms) and 9-41B (clams).

Based on the results of the means comparisons, a master list of COPCs was developed, consisting of every analyte in channel tissue that statistically exceeded at least one placement site/reference tissue-residue. COPCs for worm and clam tissue are provided in Table 9-42. COPCs were further evaluated to determine if the statistical exceedances were ecologically relevant.

9.3 TISSUE-RESIDUE EVALUATION PROCESS

The purpose of the bioaccumulation testing is to predict the potential for uptake of chemical contaminants in the dredged material by aquatic organisms. When tissue concentrations of contaminants of concern in dredged material statistically exceed those of organisms exposed to the reference material, the ITM (USEPA/USACE 1998) and Ocean Testing Manual (USEPA/USACE 1991) recommend coordination with the USEPA Regional Representatives, the USACE District Engineer, or other regional/state regulatory authorities to develop and agree upon case-specific evaluation criteria. These criteria should be based on technical evaluations made with local input and should emphasize factors deemed appropriate for each regional or geographic area with respect to open water or ocean placement.

An evaluation process for this project was developed based on guidance in the ITM (USEPA/USACE 1998), guidance in the Ocean Testing Manual (USEPA/USACE 1991), and input from USEPA Region III–Philadelphia (William Muir, USEPA–Region III, personal communications, 2000). The bioaccumulation evaluation process is depicted in Figure 9-2. Prior to initiating the evaluation, the chemical concentrations achieved after 28 days of exposure were converted to steady-state (Css) concentrations. The initial evaluation consisted of comparing steady-state concentrations of chemical constituents that statistically exceeded the placement site or reference concentrations (COPCs) to available fish tissue screening criteria for

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human consumption [i.e., USFDA Action Levels (USFDA 1998) and USEPA Tolerance/Guidance Levels (USFDA 1998)]. Based on guidance in the ITM and Ocean Testing Manual, if tissue-residue concentrations are not statistically lower than an FDA Action Level or USEPA Tolerance Value/Guidance Level, the dredged material is not suitable for open-water or ocean placement.

The remaining steps in this evaluation process provide additional weight-of-evidence to determine if placement of the dredged material has the potential to cause unacceptable adverse impacts. Following comparisons to FDA Action Levels and USEPA Tolerance/Guidance Levels, the Css for the COPCs were statistically compared to USEPA Fish Tissue Screening Values (USEPA 1995a), residue-effect data (ERED, Jarvinen and Ankley 1999; USEPA 2000d), and USEPA Region III fish tissue Risk–Based Concentrations (RBCs) (USEPA 2000a). In addition, Critical Body Residue (CBR) was calculated to assess the impact of PAH and pesticide body burden in aquatic organisms.

Following the statistical comparisons to screening criteria, the following factors were considered when evaluating the integrated results of the bioaccumulation testing (as recommended by the ITM (USEPA/USACE 1998):

- What is the toxicological importance of the contaminants whose bioaccumulation statistically exceeds that from the reference? (e.g., Do they biomagnify? Do they have effects at low concentrations?)

- By what magnitude does the bioaccumulation from the dredged material exceed bioaccumulation from the reference material?

- What is the propensity for the contaminants, with statistically significant bioaccumulation, to biomagnify within aquatic foodwebs? Contaminants that biomagnify include DDT, PCBs, methylmercury, and dioxin/furans.

- What is the magnitude by which contaminants whose bioaccumulation from the dredged material exceeds that from the reference material also exceeds the concentrations found in comparable species living in the vicinity of the proposed placement location?

- For how many contaminants is bioaccumulation from the dredged material statistically greater than bioaccumulation from the reference material?

For this project, the above evaluation process was used to assess the integrated effect of bioaccumulation and the ecological relevance of the results. The purpose of the evaluation was to provide decision-makers with scientifically valid information to facilitate dredged material placement determinations.

Each step of the COPC tissue-residue evaluation process is described in the following sections. The results of the evaluation are discussed in detail in Section 9.4.

9.3.1 Conversion of Tissue-Residues to Steady-State Concentrations

Uptake of individual contaminants from water or sediment into tissue tends to reach a steady-state concentration, after which continued accumulation is minimal. Most constituents, if they bioaccumulate, will be detectable in tissue after a 28-day exposure period, even if the steady-state has not been reached (USEPA/USACE 1998). Steady-state tissue residues (Css) were estimated from day 28 residues using the relationship described in USEPA/USACE (1998), that relates the proportion of Css reached in 28-day laboratory exposures as a function of the octanol-water coefficient (K_{OW}) for neutral organics. Log K_{ow}s for neutral organics are provided in Table 9-43 (also see Figure 9-3). The log K_{ow} indicates the proportion of the steady-state concentration that is expected within 28 days. The steady-state concentration of each chemical constituent was determined by applying a steady-state correction factor that was equivalent to the reciprocal of the decimal fraction of the expected Css at day 28 (USEPA/USACE 1998). Metals concentrations were assumed to reach steady-state during the 28-day exposure period.

9.3.2 Determination of 95% Upper Confidence Levels of the Mean (UCLM)

The UCLM was calculated using censored data as described in Section 9.1.5.3. The 95% UCLM was determined using the t-statistic as described in Sokal and Rohlf (1981):

$$UCLM = \bar{x} + t_{[0.95,df]}\sqrt{S^2/n} \quad \text{for normally distributed analytes, and}$$

$$UCLM = \exp(\bar{x} + t_{[0.95,df]}\sqrt{S^2/n}) \quad \text{for log-normally distributed analytes}$$

where

$\bar{x}$	=	sample mean of normal log-transformed data
S^2	=	sample variance of normal log-transformed data
n	=	number of sample replicates.
$t_{[0.95,df]}$	=	one-tailed Student's t statistic for $\alpha = 0.95$ and df degrees of freedom

If variances were not significantly different (Levene's test with $\alpha = 0.10$), the MSE was used in place of the sample variance S^2. The t-statistic was then evaluated for $df = N - k$ degrees of freedom, where N is the total number of observations ($\sum_{i=1}^{k} n_i$) and k is the number of sites. If variances were unequal, then the actual sample variance was used for S^2 and t was evaluated for $df = n - 1$ degrees of freedom.

9.3.3 Tissue Contaminant Concentrations Compared to USFDA Action Levels and USEPA Tolerance / Guidance Levels

The initial evaluation consisted of comparing steady-state concentrations of chemical constituents that statistically exceeded the placement site or reference concentrations (COPCs) to available fish tissue screening criteria for human consumption (i.e., USFDA Action Levels (USFDA 1998) and USEPA Tolerance/Guidance Levels (USFDA 1998). These values are derived from risk assessment evaluations for application as critical limits for determining the acceptability of aquatic organisms as food sources to humans. Food lots that exceed the USFDA Action Levels or USEPA Tolerance/Guidance Levels are removed from the market place, and are not considered safe for human consumption. The USFDA Action Levels and USEPA Tolerance/Guidance Levels (Table 9-44) are generally applicable to shellfish, as well as finfish. If two values were provided, the most conservative value was used in this evaluation.

For substances with FDA action levels (USFDA 1998), USEPA Tolerance / Guidance Levels (USFDA 1998), the criteria values were compared to the one-tailed 95% UCLM tissue-residue concentration for each channel. If the UCLM was below the criterion value (indicating a 95% probability that the population mean tissue-residue concentration for the channel is below the criterion value), it was concluded that the criterion value was not exceeded. As per USEPA/USACE (1998) guidance, all tissue-residue UCLMs for all channels were compared to FDA Action Levels and EPA Tolerance/Guidance Values. UCLM comparisons to FDA Action Levels and USEPA Tolerance/Guidance Levels are provided in Tables 9-45A/B and 9-46A/B, respectively.

9.3.4 Weight-of Evidence Comparisons

For chemical constituents that did not have USFDA Action Levels and USEPA Tolerance/Guidance Levels, more conservatively derived values for screening and evaluation of ecological health were reviewed in a weight-of-evidence assessment. Each parameter in the weight-of-evidence assessment is described in the following sections.

9.3.4.1 Tissue Contaminant Concentrations Compared to USEPA Fish Tissue Screening Values

The USEPA Office of Water has published Screening Values (SVs) for fish tissue in *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories* (1995). The USEPA SVs for fish tissue were developed based on average consumption rates and body weight for the general adult population. The published SVs reflect exposure as the oral reference dose (RfD) for non-carcinogens and as the 10^{-5} risk level for carcinogens. The SVs assume that an average adult (with a body weight of 70 kg) consumes 6.5 grams of fish per day over a lifetime. Application of the USEPA fish tissue SVs to the 95% UCLM steady-state channel tissue concentrations is inherently conservative.

For substances with USEPA Fish Tissue Screening Values (USEPA 1995a), the criteria values were compared to the one-tailed 95% UCLM tissue-residue concentration for each channel. If the UCLM was below the criterion value (indicating a 95% probability that the population mean tissue-residue concentration for the channel is below the criterion value), it was concluded that the criterion value was not exceeded. USEPA fish tissue SVs are provided in Table 9-47. UCLM comparisons were conducted only for individual channel concentrations that statistically exceeded at least one of the reference areas. UCLM comparisons to USEPA fish tissue SVs are provided in Tables 9-48A (worms) and 9-48B (clams).

9.3.4.2 Comparisons to Residue-Effects Data

To evaluate the ecological effects of bioaccumulation to organisms, several residue-effects databases and references were consulted to identify empirical residue-effects data in published literature:

- The Environmental Residue-Effects Database (ERED), maintained by USEPA and USACE–WES (USACE–WES 1999 and www.wes.army.mil/el/ered/index.html);
- *Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals* (Jarvinen and Ankley 1999); and
- *Appendix to Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs. Chemical-Specific Summary Tables* (USEPA 2000d).

ERED (USACE–WES 1999), Jarvinen and Ankley (1999), and USEPA (2000b) are compilations of data relating bioaccumulation of individual chemicals to measurable biological effects in particular aquatic organisms. ERED is maintained by USEPA and USACE and is updated regularly. The biological changes or endpoints in ERED, Jarvinen and Ankley (1999), and USEPA (2000d) include any endpoints reported in the peer-reviewed scientific literature in conjunction with appropriate bioaccumulation data. Some of these studies involve important physiological processes, but measure specific biological endpoints whose consequences, if any, at the organism or ecosystem level are not at all clear (e.g., reduced glucose content of the coelomic fluid). Other endpoints are of clear importance at the level of the organism (e.g., survival, growth) or ecosystem (e.g., various measures of reproduction). Data from ERED, Jarvinen and Ankley (1999), and USEPA (2000d) only provide information regarding effects of individual chemicals and do not consider synergistic effects related to accumulation of multiple constituents.

Because of the diversity of species and chemical constituents reported in the literature, the data sources may contain relatively few data points for the exact same species and chemicals tested in this evaluation. However, data for related species and chemicals are useful in evaluating potential bioaccumulation effects. For evaluation of this project, if data were not available for *Nereis* species, data for any annelid were considered potentially useful substitutes. If data were not available for *Macoma* species, data for any bivalve mollusk were considered potentially useful substitutes.

PAHs were evaluated by the critical body residue approach discussed in Section 9.3.4. The laboratory measurement considered most useful for this evaluation was "No Observed Effect Dose" (NOED), because this indicates that effects were not observed at a bioaccumulation concentration at least that high; and, therefore, the NOED is presumably a "safe" concentration in terms of those effects. If NOED data were not available, "Lowest Observed Effects Dose" (LOED) data were used. LOED is the lowest bioaccumulation level (concentration) studied at which the effects were observed, and implies that the effects may occur at a level lower by some unknown margin. The literature values that were most relevant for evaluation of bioaccumulation in *Nereis* (worms) and *Macoma* (clams) are provided in Appendix G.

Steady-state concentrations of COPCs were statistically compared to available residue-effects data from the literature following the procedure described in Section 9.3.2. Only those COPCs for which no USFDA Action Levels, USEPA Tolerance/Guidance Values, or USEPA Fish Tissue Screening values existed were statistically compared to residue-effects data (if available for individual COPCs). Specific residue-effect data (and the associated primary references) that were used in the statistical evaluation are provided in Table 9-49. UCLM comparisons for COPCs (for all channels) to relevant residue-effects data are provided in Tables 9-50A (worms) and 9-50B (clams).

9.3.4.3 Critical Body Residue

In addition to using the literature values established in the literature, Critical Body Residue (CBR) was used to evaluate the potential impact of neutral organic compound (PAHs and pesticides) bioaccumulation in the organism. CBR is useful for evaluating potential cumulative effects of multiple neutral organic contaminants. The CBR approach is based on the PAH (neutral oragnic) primary mode of lethality, which is narcosis (causing unconsciousness, immobility, or death). Studies have shown that narcosis occurs when the concentration of total PAH in tissues exceeds a critical threshold (McCarty and Mackay 1993).

The CBR is the sum of the tissue concentrations of neutral organics (PAHs or PAHs and pesticides) on a μmol/g wet weight basis. The mean concentration of each detected PAH and pesticide was converted to μmol/g, a total CBR for each channel was calculated by summing the μmol/g concentrations of neutral organics in each set of channel tissues. The CBR threshold for chronic narcosis is in the range of 0.2 to 0.8 umol/g wet weight for aquatic invertebrates (McCarty and Mackay 1993). That is, if the CBR is less than the threshold of 0.2 to 0.8 μmol/g wet weight, chronic narcosis is not expected from the total neutral organics body burden in the organism. The CBR threshold for acute narcosis is about ten times higher, in the range of 2 to 8 μmol/g wet weight for aquatic invertebrates (McCarty and Mackay 1993).

Critical body residues of neutral organics (PAHs and pesticides) for both *Macoma nasuta* and *Nereis virens* were compared to acute and chronic effect levels. Results of the calculations are provided in Table 9-51A (worms) and 9-51B (clams).

9.3.4.4 Comparisons with USEPA Region III Human Health RBCs for Fish Consumption

Analytes that were detected in tissue-residues and that statistically exceeded one of the placement or reference areas were compared to the USEPA Region III's human health RBCs for fish tissue consumption (USEPA 2000a). Like the fish tissue advisory guidelines, RBCs are based on risk assessment evaluations. The RBCs are developed as highly protective screening limits for managing Superfund sites. Consequently, the assumptions included in the risk evaluations (used to derive the RBCs) tend to be even more conservative than the fish tissue advisory guidelines. Thus, the RBC comparisons to channel tissue-residues are a conservative assessment.

If an RBC did not exist for a compound, the RBC for a closely related compound was substituted; these substitutions are footnoted on relevant tables. If a closely related compound could not be identified for substitution, the constituent was not screened against a numerical criterion. The upper 95% confidence level of the estimated mean tissue-residue concentration at steady-state was compared to the RBC (lifetime cancer risk of 10^{-6}) for carcinogenic constituents and one-tenth of the RBC (a hazard quotient of 0.1) for non-carcinogenic constituents, following recommended methodology described in USEPA (1993e). The 95% UCLM comparisons for COPCs (for all channels) to USEPA Region III fish tissue RBCs are provided in Tables 9-52A (worms) and 9-52B (clams).

9.4 DISCUSSION AND TIER III BIOACCUMULATION EVALUATION

9.4.1 Bioaccumulation Survival Rates

Survival rates in the three rounds of bioaccumulation testing with *Nereis virens* and *Macoma nasuta* indicated that all of the sediments were of sufficient quality to support test organisms throughout the 28-day test period (Table 9-53). These results, in combination with the results for the whole-sediment toxicity testing (Chapter 8), indicate that the sediments are of sufficient quality to support benthic communities post-placement.

9.4.2 Tissue-Residue Concentrations

Tissue-residues were evaluated in two phases. The first phase involved statistically comparing all tissue concentrations to USFDA Action Levels and USEPA Tolerance/Guidance Levels. The second phase involved statistical comparisons of chemical concentrations in channel test tissues to chemical concentrations in tissues exposed to placement site/reference sediments and comparisons to other ecological benchmarks.

9.4.2.1 USFDA Action Levels and USEPA Tolerance/Guidance Levels

According to the ITM (USEPA/USACE 1998), after tissue residues are compared to FDA levels, one of the following conclusions is reached:

1) Tissue concentrations of one or more contaminants are not statistically less than the FDA levels. Therefore, the dredged material is predicted to result in unacceptable benthic bioaccumulation of contaminants.

2) Tissue concentrations of all contaminants are either statistically less than FDA levels or there are no FDA levels for the contaminants. In this case, the information is insufficient to make a factual determination with respect to benthic bioaccumulation of contaminants. The

dredged material requires further evaluation under Tier III to make a factual determination under the Guidelines.

FDA Action Levels and USEPA Tolerance Levels exist only of the following constituents: mercury, total PCBs, aldrin+dieldrin, chlordane, DDD+DDE+DDT, mirex, and total heptachlor. Steady-state tissue-residue concentrations for these constituents were statistically compared to the USFDA Action Levels or USEPA Tolerance Level (Tables 9-45A and 9-45B). Results indicated that steady-state tissue-residue for all of these constituents were significantly lower than USFDA Action Levels.

USEPA Guidance Levels exist for arsenic, cadmium, chromium, lead, and nickel. Concentrations of these constituents were statistically compared to USEPA Guidance Levels (Tables 9-46A and 9-46B). Results indicated that the steady-state tissue-residue for all of the constituents were statistically lower than the criteria.

These findings lead to conclusion #2 above, indicating that the material may be acceptable for open water or ocean placement pending further analyses. The additional analyses are:

- Comparison of channel tissue-residues to placement site/reference tissue-residues (Section 9.4.2.2) and
- Comparison of channel tissue-residues that statistically exceed placement site/reference tissue-residues to other ecological benchmarks.

9.4.2.2 Comparison of Channel Tissue-Residues to Placement Site/Reference Tissue-Residues

According to the guidance in the ITM (USEPA/USACE 1998), contaminant concentrations in tissues exposed to dredged material, that are statistically lower than FDA levels (or for which no FDA levels exist), are compared to tissue contaminant concentrations for organisms exposed to reference sediment. One of the following conclusions is reached:

1) Tissue concentrations of contaminants of concern in organisms exposed to dredged material do not statistically exceed those of organisms exposed to reference sediment. Therefore, the dredged material is not predicted to result in unacceptable benthic bioaccumulation of contaminants. However, benthic toxicity tests must also be evaluated.

2) Tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to reference sediment. The final conclusion regarding benthic bioaccumulation of contaminants requires region-specific technical evaluation. Additional testing (Tier IV) may be required and benthic toxicity must be evaluated.

Statistical comparisons to reference tissue concentrations indicated that, for all channels combined, 32 constituents in worm tissue and 44 constituents in clam tissue exceeded tissue-residues for at least one of the placement/reference sites. Overall, for clams and worms combined, 41, 44, and 45 Contaminants Of Potential Concern (COPCs) were identified for Inside Site 104, Outside Site 104, and Ocean Reference, respectively (Table 9-42).

9.4.2.3 Comparison of Channel Tissue-Residues to Other Ecological Benchmarks

Following guidance provided by USEPA Region III-Philadelphia, COPCs were statistically compared to other available fish tissue criteria and residue-effects data to determine the ecological significance and relevance of the detected concentrations. A channel-by-channel summary of statistical comparisons for COPCs to relevant criteria/effect data is provided in Tables 9-52A (worms) and 9-52B (clams).

UCLM (95%) steady-state concentrations of dioxin (TEQ), arsenic, mercury, selenium, DDT, chlordane, dieldrin, endosulfan I and II, gamma-BHC, and total heptachlor were compared to USEPA Fish Tissue Screening Values (USEPA 1995a) (see Tables 9-52A and 9-52B). Results revealed that the 95% UCLM steady-state concentrations for dioxin (TEQ) and arsenic in clams exceeded the criteria for several channels, and the 95% UCLM steady-state concentration for dioxin and total heptachlor in worm tissue exceeded the criteria for several channels.

Comparisons to residue-effects data identified only one constituent, benzo(a)pyrene in clam tissue, with a 95%UCLM that exceeded relevant residue-effect data (Table 9-50B).

Calculation of CBR for PAHs and PAHs + pesticides indicated that the total body burdens for neutral organics in all channels were substantially below the concentrations that would be expected to cause either acute or chronic effects to aquatic organisms (Tables 9-51A and 9-51B).

When compared to USEPA Region III RBCs for fish tissue, the 95% UCLM for 19 constituents in clam tissue and 14 constituents in worm tissue exceeded the RBC (Tables 9-52A and 9-52B). UCLMs were compared to the whole RBC value for carcinogenic constituents and one-tenth of the RBC value for non-carcinogenic constituents.

9.4.3 Integrated Evaluation for Channel/Placement Options

Three placement options are evaluated for each of the thirteen channel reaches. COPCs for each channel/placement option are summarized in Table 9-54. When evaluating tissue-residue data, it is important to remember that bioaccumulation is a phenomenon, and does not necessarily produce an adverse effect to organism viability or ecological resources. The effects of bioaccumulation are dependent upon exposure (concentration and duration). Statistical exceedance of a placement site/reference tissue-residue does not imply ecological relevance or adverse effect. In the COPC evaluation process, fish tissue criteria were conservatively applied to tissue-residues for benthic invertebrates. In some cases there are significant differences between channel and placement site/reference tissue concentrations; however, the detected concentration varies little from that which is reported in the baseline pre-test tissue. In addition, in some cases, the tissue-residues of the COPCs are either below the recommended detection limits in *QA/QC Guidance for Dredged Material Evaluations* (USEPA/USACE 1995) or are detected in only one of five tested tissue replicates.

An integrated evaluation of all of the tissue-residue information is necessary to make an informed decision regarding the relevance of the statistical exceedances against both the placement site/reference tissues and against conservative criteria. In the following sections, the COPCs for each channel are assessed based on statistical analyses, numerical criteria, properties, and toxicological importance. COPCs were successively screened against available criteria: USFDA Action Levels, USEPA Tolerance/Guidance Levels, USEPA Fish Tissue Screening Values, Residue-Effect Data, and USEPA Region III RBCs. The screening started with the FDA Action Levels and ended with the RBCs. If the UCLM (95%) of a chemical constituent was less than the criterion in the first tier, the constituent was eliminated as a COPC. Only those constituents with no USFDA Action Levels, USEPA Tolerance/Guidance Levels, or USEPA Screening Values were screened against either available residue-effect data or the RBCs. In addition, if a constituent had an uptake ratio (UR) of less than 1 (i.e., concentration less than the pre-test tissue-residue) or if a constituent was detected in the laboratory method blank, it was eliminated as a COPC. A summary of the integrated evaluation for each channel is provided in Tables 9-55 through 9-67.

9.4.3.1 Brewerton Channel Eastern Extension

The integrated evaluation of COPCs for Brewerton Channel Eastern Extension is summarized in Tables 9-55A (worms) and 9-55B (clams).

Twelve COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean Reference tissue-residues. Of those 12 COPCs, the dioxin TEQ (ND=0, ND=1/2DL, and ND=DL) was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The 95% UCLM exceeded the USEPA fish tissue SV and it also exceeded the RBC. Both of the values are very conservative benchmarks used in the screening phase of risk analysis.

Twenty-three COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 23 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The 95% UCLM exceeded the USEPA fish tissue SV and it also exceeded the RBC. Both of the values are very conservative benchmarks used in the screening phase of risk analysis.

Dioxin is a relevant COPC for evaluating Brewerton Channel Eastern Extension sediments for Outside Site 104 and ocean placement.

9.4.3.2 C&D Approach (Surficial)

The integrated evaluation of COPCs for the C&D Approach channels (surficial sediment) is summarized in Tables 9-56A (worms) and 9-56B (clams).

Thirteen COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 13 COPCs, alpha-BHC and chlorbenside were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for alpha-BHC exceeded the USEPA Region III RBC. There are no published criteria for screening chlorbenside in fish tissues. Although detected in the tissue-residues, neither alpha-BHC nor chlorbenside was detected in the sediments collected in C&D Approach surficial sediments.

Twenty-four COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 24 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL), benzo[a]anthracene, and benzo[b]flouranthene were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The dioxin TEQ was not a COPC when ND=0 was used in the TEQ calculations. The 95% UCLM for dioxin exceeded the USEPA fish tissue SV and it also exceeded the RBC. Benzo[a]anthracene and benzo[b]flouranthene both exceeded the USEPA Region III RBC.

Dioxin, benz[a]anthracene, benzo[b]flouranthene, alpha-BHC, and chlorbenside are relevant COPCs for evaluating C&D Approach (surficial sediments) for placement at either Inside Site 104, Outside Site 104, or the Ocean placement site. Benzo[a]anthracene is only a relevant COPC for Inside Site 104 and Ocean placement. Dioxin is only a relevant COPC for Outside Site 104 and ocean placement.

9.4.3.3 C&D Approach (Cores)

The integrated evaluation of COPCs for C&D Approach channels (core sediment) is summarized in Tables 9-57A (worms) and 9-57B (clams).

Thirteen COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 13 COPCs, the dioxin TEQ (ND=1/2DL, and ND=DL) was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The dioxin TEQ was not a COPC when ND=0 was used in the TEQ calculations. The 95% UCLM exceeded the USEPA fish tissue SV and it also exceeded the RBC. Both of the values are very conservative benchmarks used in the screening phase of risk analysis.

Twenty-four COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 24 COPCs, alpha-BHC was the only constituent that was not eliminated as a COPC in the integrated evaluation process. Alpha-BHC exceeded the USEPA Region III RBC; however, it was not detected in the core sediments tested for the C&D Approach Channel.

Dioxin is a relevant COPC for C&D Approach (Cores) for placement Outside Site 104 and ocean placement. In addition, alpha-BHC is a relevant COPC for Inside Site 104, Outside Site 104, and ocean placement.

9.4.3.4 Craighill Channel

The integrated evaluation of COPCs for the Craighill Channel is summarized in Tables 9-58A (worms) and 9-58B (clams).

Seven COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 7 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The 95% UCLM exceeded the USEPA fish tissue SV and it also exceeded the RBC. Both of the values are very conservative benchmarks used in the screening phase of risk analysis. The dioxin TEQ was not a COPC when ND=0 was used in the TEQ calculations.

Twenty-one COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 21 COPCs, benzo[b]fluoranthene was the only constituent that was not eliminated as a COPC in the integrated evaluation process. Benzo[b]fluoranthene exceeded the USEPA Region III RBC; however, it was detected below the recommended TDL (USEPA/USACE 1995).

Dioxin is a relevant COPC for evaluating Craighill Channel sediments for Outside Site 104 and ocean placement. Benzo[b]fluoranthene is a relevant COPC for ocean placement only.

9.4.3.5 Craighill Angle East

The integrated evaluation of COPCs for Craighill Angle East is summarized in Tables 9-59A (worms) and 9-59B (clams).

Five COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 5 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The 95% UCLM exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ was not a COPC when ND=0 was used in the TEQ calculations.

Nineteen COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 19 COPCs, the dioxin TEQ (ND=1/2 DL and ND=DL) and beta-BHC were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM exceeded the

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USEPA fish tissue SV and it also exceeded the RBC. Beta-BHC exceeded the USEPA Region III RBC; however, beta-BHC was not detected in sediment tested from Craighill Angle East. The dioxin TEQ was not a COPC when ND=0 was used in the TEQ calculations.

Dioxin is a relevant COPC for evaluating Craighill Angle East sediment for Outside Site 104 and ocean placement. Beta-BHC is a relevant COPC for evaluating ocean placement only.

9.4.3.6 Craighill Angle West

The integrated evaluation of COPCs for Craighill Angle West is summarized in Tables 9-60A (worms) and 9-60B (clams).

Thirteen COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 13 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) and beta-BHC were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for the dioxin TEQ exceeded the USEPA fish tissue SV and it also exceeded the RBC. Beta-BHC exceeded the USEPA Region III RBC; however, beta-BHC was not detected in sediment tested from Craighill Angle West. The dioxin TEQ was not a COPC when ND=0 was used in the TEQ calculations.

Twenty-three COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 23 COPCs, benzo[a]anthracene, benzo[b]fluoranthene, and alpha-BHC were the only constituents that were not eliminated as COPCs in the integrated evaluation process. Tissue-residues of Benzo[a]anthracene and benzo[b]fluoranthene, and alpha-BHC exceeded the USEPA Region III RBC. In addition, both benzo[a]anthracene and benzo[b]fluoranthene were detected below the recommended TDL (USEPA/USACE 1995). Although detected in the tissue, alpha-BHC was not detected in sediment tested for Craighill Angle West.

Dioxin, benz[a]anthracene, benzo[b]flouranthene, alpha-BHC, and beta-BHC are relevant COPCs for evaluating Craighill Angle West sediments for either Inside Site 104, Outside Site 104, or the Ocean placement. Benz[a]anthracene is a relevant COPC only for Inside Site 104 and ocean placement; benzo[b]fluoranthene is a relevant COPC for ocean placement only; and alpha-BHC is a relevant COPC for placement Inside Site 104 only; dioxin is a relevant COPC for placement Outside Site 104; and beta-BHC is a relevant COPC for Inside Site 104, Outside Site 104, and ocean placement.

9.4.3.7 Craighill Entrance

The integrated evaluation of COPCs for Craighill Entrance is summarized in Tables 9-61A (worms) and 9-61B (clams).

Twelve COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 12 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) and chlorbenside were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for the dioxin TEQ exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ for ND=0 did not exceed the USEPA fish tissue screening value. Although detected in the worm tissue, chlorbenside was not detected in the sediment from Craighill Entrance. There are no fish tissue screening criteria for chlorbenside.

Twenty-one COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 21 COPCs, benzo[b]fluoranthene was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The 95% UCLM exceeded the USEPA Region III RBC; however, benzo[b]fluoranthene was detected below the recommended TDL (USEPA/USACE 1995).

Dioxin is a relevant COPC for evaluating Craighill Entrance sediment for Outside Site 104 placement. Chlorbenside is a relevant COPC for evaluating sediment for Outside Site 104 and ocean placement. Benzo[b]fluoranthene is a relevant COPC for ocean placement only.

9.4.3.8 Craighill Upper Range

The integrated evaluation of COPCs for Craighill Upper Range is summarized in Tables 9-62A (worms) and 9-62B (clams).

Ten COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Each of the ten constituents was eliminated as a COPC in the integrated evaluation process.

Twenty-four COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 24 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL), benzo[a]pyrene, and benzo[b]flouranthene were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for dioxin exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ was not a COPC, when ND=0 was used in the TEQ calculations. The 95% UCLM for benzo(a)pyrene exceeded residue-effect data and the RBC. Benzo[b]flouranthene exceeded the USEPA Region III RBC. Mean concentrations of both benzo(a)pyrene and benzo[b]flouranthene were less than the recommended TDL (USEPA/USACE 1995).

Dioxin, benzo[a]pyrene, and benzo[b]flouranthene are relevant COPCs for evaluating Craighill Upper Range sediments for ocean placement only.

9.4.3.9 Cutoff Angle

The integrated evaluation of COPCs for the Cutoff Angle is summarized in Tables 9-63A (worms) and 9-63B (clams).

Twelve COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 12 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) and chlorbenside were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for the dioxin TEQ exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ was not a COPC, when ND=0 was used in the TEQ calculations. Although detected in the worm tissue, chlorbenside was not detected in the sediment from the Cutoff Angle. There are no fish tissue screening criteria for chlorbenside.

Twenty-six COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 26 COPCs, benz[a]anthracene, benzo[a]pyrene, and benzo[b]flouranthene were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for benzo(a)pyrene exceeded residue-effect data and the RBC. Benz[a]anthracene and benzo[b]flouranthene both exceeded the USEPA Region III RBC. Mean concentrations of benz[a]anthracene, benzo[a]pyrene, and benzo[b]flouranthene were less than the recommended TDL (USEPA/USACE 1995).

Benz[a]anthracene, benzo[a]pyrene, benzo[b]flouranthene, and chlorbenside are relevant COPCs for evaluating Cutoff Angle sediments for ocean placement. Benz[a]anthracene is a relevant COPC for evaluating placement Inside Site 104. Dioxin and chlorbenside are relevant COPCs for evaluating Outside Site 104 and ocean placement.

9.4.3.10 Swan Point Channel

The integrated evaluation of COPCs for the Swan Point Channel is summarized in Tables 9-64A (worms) and 9-64B (clams).

Fifteen COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 15 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) and beta-BHC were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for the dioxin TEQ exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ was not a COPC when ND=0 was used in TEQ calculation. Beta-BHC exceeded the USEPA Region III RBC; however, beta-BHC was not detected in sediment tested from Swan Point Channel. In addition, it was only detected in two of the four replicate tissue samples.

Twenty-one COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Each of the 21 constituents was eliminated as a COPC in the integrated evaluation process.

Dioxin is a relevant COPC for evaluating Swan Point Channel sediments for Outside Site 104 and ocean placement. Beta-BHC is a relevant COPC for evaluating ocean placement.

9.4.3.11 Tolchester Channel - North

The integrated evaluation of COPCs for Tolchester Channel North is summarized in Tables 9-65A (worms) and 9-65B (clams).

Fifteen COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Each of the 15 constituents was eliminated as a COPC in the integrated evaluation process.

Twenty COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 20 COPCs, dioxin (ND=DL), benz[a]anthracene, and benzo[b]flouranthene were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for the dioxin TEQ exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ was not retained as COPC when either ND=1/2DL or ND=0 was used in TEQ calculation. The 95% UCLM for benz[a]anthracene and benzo[b]flouranthene both exceeded the USEPA Region III RBC. Mean concentrations of both benz[a]anthracene and benzo[b]flouranthene were less than the recommended TDL (USEPA/USACE 1995).

Dioxin, benz[a]anthracene and benzo[b]flouranthene are relevant COPCs for evaluating Tolchester Channel - North sediments for ocean placement. Benz[a]anthracene is also a relevant COPC for evaluating sediment proposed for placement Inside Site 104.

9.4.3.12 Tolchester Channel - South

The integrated evaluation of COPCs for Tolchester Channel - South is summarized in Tables 9-66A (worms) and 9-66B (clams).

Eleven COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Each of the 11 constituents was eliminated as a COPC in the integrated evaluation process.

Twenty-one COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 21 COPCs, benz[a]anthracene and benzo[b]flouranthene were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for benz(a)anthracene and benzo[b]flouranthene both exceeded the USEPA Region III RBC. Mean concentrations of both benz[a]anthracene and benzo[b]flouranthene were less than the recommended TDL (USEPA/USACE 1995).

Benz[a]anthracene and benzo[b]flouranthene are relevant COPCs for evaluating Tolchester Channel - South sediment for ocean placement. Benz[a]anthracene is also a relevant COPC for evaluating placement of Tolchester South sediment Inside Site 104.

9.4.3.13 Tolchester Straightening

The integrated evaluation of COPCs for the Tolchester Straightening is summarized in Tables 9-67A (worms) and 9-67B (clams).

Ten COPCs were identified in worm tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 10 COPCs, the dioxin TEQ (ND=1/2DL and ND=DL) was the only constituent that was not eliminated as a COPC in the integrated evaluation process. The 95% UCLM exceeded the USEPA fish tissue SV and it also exceeded the RBC. The dioxin TEQ was not a COPC, when ND=0 was used in the TEQ calculations.

Twenty-eight COPCs were identified in clam tissue based on the results of the statistical comparisons against Inside Site 104, Outside Site 104, and Ocean tissue-residues. Of those 28 COPCs, benz[a]anthracene, benzo[a]pyrene, and benzo[b]flouranthene were the only constituents that were not eliminated as COPCs in the integrated evaluation process. The 95% UCLM for benzo(a)pyrene exceeded residue-effect data and the RBC. Benz[a]anthracene and benzo[b]flouranthene both exceeded the USEPA Region III RBC. Mean concentrations of benz[a]anthracene, benzo[a]pyrene, and benzo[b]flouranthene were less than the recommended TDL (USEPA/USACE 1995).

Dioxin, benz[a]anthracene, benzo[b]flouranthene, benzo(a)pyrene, and chlorbenside are relevant COPCs for evaluating Tolchester Straightening sediments for open water or ocean placement. Benzo[b]flouranthene is a relevant COPC for evaluating Inside Site 104, Outside Site 104, and ocean placement. Dioxin is a relevant COPC for evaluating placement Outside Site 104. Benz[a]anthracene is a relevant COPC for evaluating placement Inside Site 104 and ocean placement. Benzo(a) pyrene is a relevant COPC for evaluating ocean placement only.

9.5 SUMMARY OF BIOACCUMULATION STUDIES

The results of the integrated bioaccumulation evaluation yield a total of seven COPCs in the 13 channel reaches (Table 9-68). Dioxin is COPC in 12 of the 13 channel reaches; benzo[b]fluoranthene is a COPC in 9 of the 13 channel reaches; benz[a]anthracene is a COPC in 6 of 13 channel reaches; chlorbenside is a COPC in 4 of 13 channel reaches; and benzo(a)pyrene, alpha-BHC, and beta-BHC are COPCs in 3 of 13 channel reaches. Benzo(a)pyrene is a relevant COPC for ocean placement only. Benz[a]anthracene is a relevant COPC for Inside Site 104 and ocean placement only.

Seven of the 13 channel reaches contained at least one COPC for placement Inside Site 104. Brewerton Channel Eastern Extension, Craighill Channel, Craighill Angle East, Craighill Entrance, Craighill Upper Range, and Swan Point Channel contained no COPCs that would be relevant to placement Inside Site 104.

Ten of the 13 channel reaches contained at least one COPC for placement outside Site 104. Dioxin is one of the COPCs relevant to placement Outside Site 104 for each of those ten channels. Craighill Upper Range, Tolchester Channel - North, and Tolchester Channel - South had no COPCs that would be relevant to placement Outside Site 104.

All 13 channels contained at least one COPC that would relevant for ocean placement.

The results of the statistical comparisons to placement site/reference tissues and the results of the integrated evaluation for each channel are summarized as follows:

- Although a total of 53 COPCs was identified as a result of the statistical comparisons against the placement site/reference tissue-residues, the integrated evaluation revealed only seven COPCs that warrant further consideration (Table 9-68).
- Although not detected in many of the sediments, pesticides, such as alpha-BHC, beta-BHC, and chlorbenside were detected in the channel tissues at concentrations that statistically exceeded one or more placement site/reference tissue-residues.
- Dioxin tended to be a COPC only when the TEQ was calculated using ND=1/2 DL and ND=DL. Dioxin was a COPC in both worm and clam tissue.
- PAHs (particularly benz[a]anthracene, benzo(a)pyrene, and benzo[b]fluoranthene) were detected in the channel clam tissues at concentrations that statistically exceeded one or more placement site/reference tissue-residues; however, the mean detected concentrations were less than the recommended TDL (USEPA/USACE 1995). The Critical Body Residue (CBR) for Total PAHs was not exceeded, however, in any of the channel tissues.
- Chlorbenside was retained as a COPC for worm tissue because there are no fish-tissue criteria to screen the tissue-residues.

The remaining COPCs were retained based on comparisons to conservative screening values which indicates that a potential for risk cannot be ruled out. Further evaluation in Tier IV with respect to more realistic exposure scenarios at each placement site is necessary to determine whether the potential for risk is significant.

Prepare Data Set for Evaluation

(1) Substitute Values for Censored Data
- If < 40% of Values are ND → ND=DL
- If > 40% < 100% of Values are ND → ND=1/2 DL
- If 100% of Values are ND → ND=0

↓

Characterize Data Distribution for Each Analyte

- Shapiro-Wilkes Test for Normal Distribution
- Determine Which Case Applies:
  (1) Data are Normally Distributed
  (2) Log-Transformed Data are Normally Distributed
  (3) Log-Transformed Data are not Normally Distributed; Transform to Rankits

↓

Identify Cases Where Channel Tissue-Residue > Placement Site/Reference Tissue-Residue

Test for Equality of Variance (Levene's Test)

→ If Variances are Equal, Perform T-Test on Mean Square Error from ANOVA

→ If Variances are not Equal, Perform T-Test with Satterwaite Approximation

Figure 9-1. Protocol for Comparing Bioaccumulation in Channel Tissue to Bioaccumulation in Placement Site/Reference Tissue.

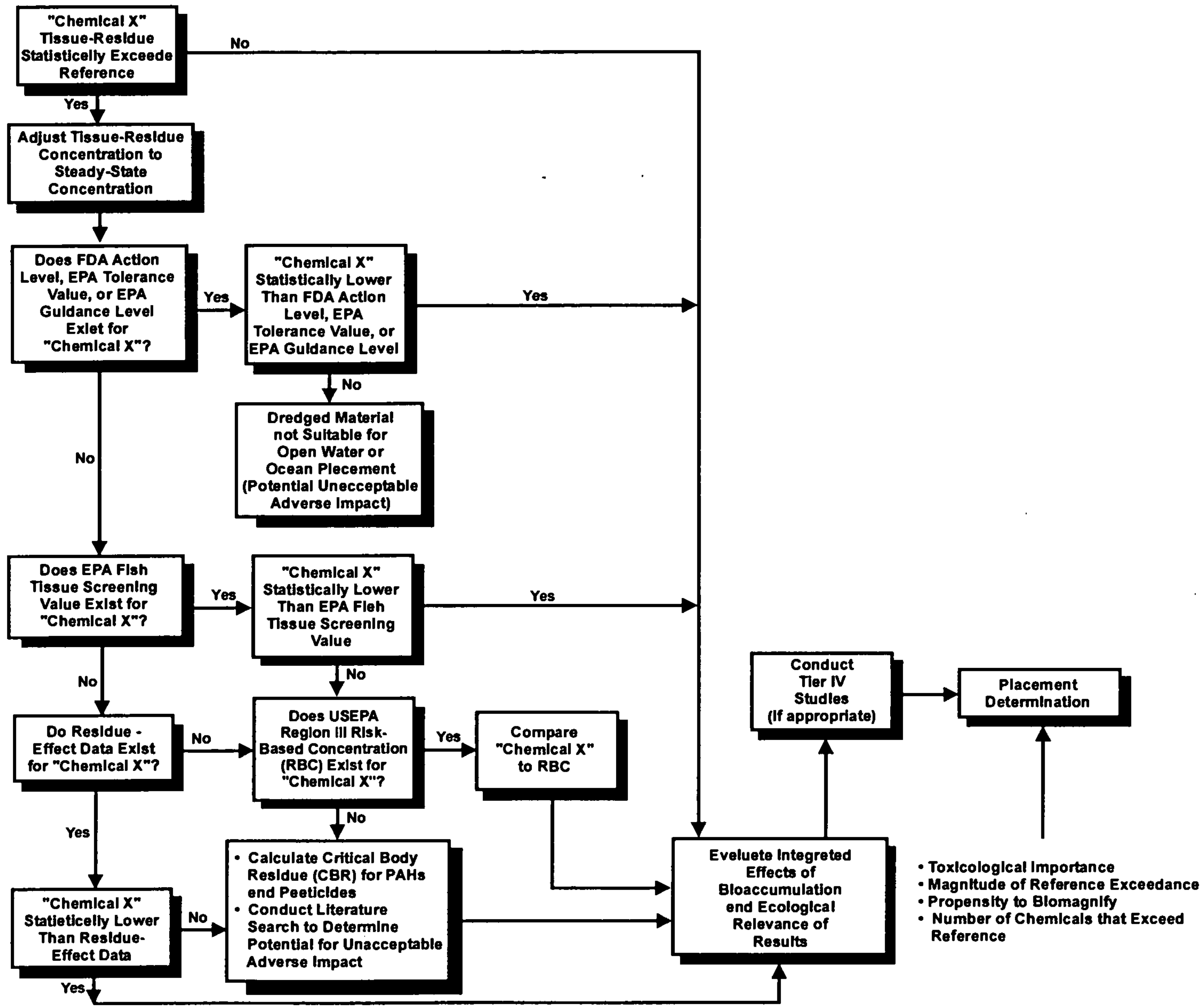
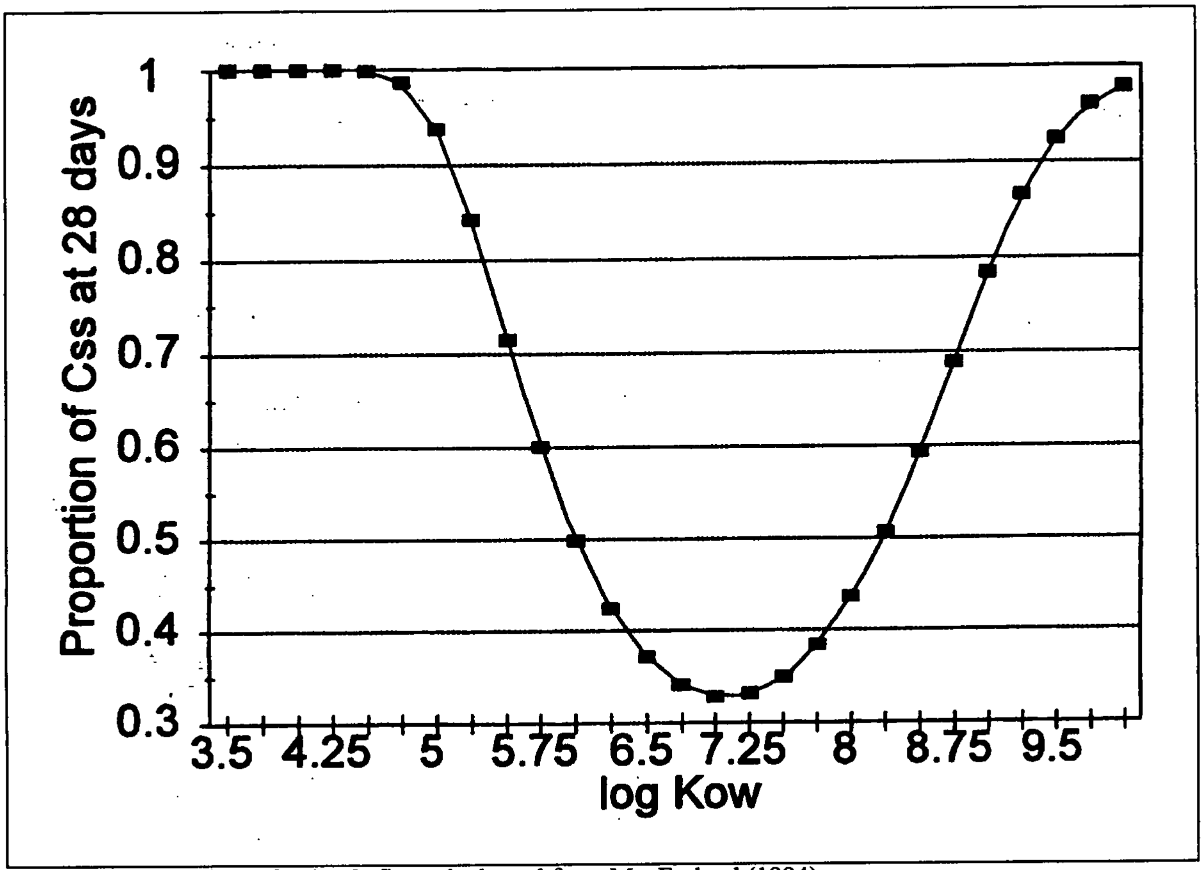


Figure 9-2. Bioaccumulation Evaluation for Channel Tissue-Residues that Statistically Exceed Placement Site/Reference Tissue Residues.



Source: USEPA/USACE 1998; figured adapted from MacFarland (1994)

Figure 9-3. Proportion of steady-state concentration (Css) of neutral organic compounds expected to be reached in 28-day laboratory exposure. Log K_{ow} values for tested constituents are provided in Table 9-43.

TABLE 9-1 SUMMARY OF BIOACCUMULATION TESTING SCHEDULE

TEST ROUND	DATES	TEST SEDIMENT	TEST SPECIES		ANALYTES TESTED						
			Sand Worm *Nereis virens*	Blunt-Nose Clam *Macoma nasuta*	Metals	Pesticides	PAHs	PCB Congeners	SVOCs	Dioxin and Furan Congeners	Lipids and Percent Moisture
1	November–December 1999	Inside Site 104	X	X	X	X	X	X	X		X
		Approach Channels	X	X	X	X	X	X	X		X
2	January–February 2000	Inside Site 104	X	X	X	X	X	X	X	X	X
		Outside Site 104	X	X	X	X	X	X	X	X	X
		Approach Channels	X[(a)]	X[(a)]						X	X
3	February – March 2000	Ocean Reference	X	X	X	X	X	X	X	X	X

(a) tested for dioxin/furan congeners, lipids, and percent moisture only.

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TABLE 9-2A WATER QUALITY PARAMETERS MEASURED DURING 28-DAY BIOACCUMULATION TESTING WITH *Nereis virens* (SAND WORM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: 5 November – 3 December 1999)

Test Sediment	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control	19.6 (±0.5)	7.9 (±0.1)	6.2 (±0.9)	30.5 (±0.4)
Inside Site 104	19.2 (±0.6)	7.9 (±0.1)	6.3 (±0.7)	30.3 (±0.7)
Brewerton Channel Eastern Extension	19.5 (±0.4)	7.9 (±0.1)	6.3 (±0.7)	30.2 (±0.8)
C&D Approaches – Surface Grabs	18.6 (±0.5)	8.0 (±0.1)	6.6 (±0.5)	30.1 (±0.8)
C&D Approaches - Cores	19.1 (±0.6)	7.9 (±0.1)	6.5 (±0.6)	30.1 (±0.9)
Craighill Channel	19.5 (±0.5)	8.0 (±0.1)	6.4 (±0.7)	30.4 (±0.6)
Craighill Angle East	19.5 (±0.5)	7.9 (±0.1)	6.4 (±0.7)	30.2 (±0.7)
Craighill Angle West	19.4 (±0.4)	7.9 (±0.1)	6.2 (±0.9)	30.2 (±0.5)
Craighill Entrance	19.5 (±0.6)	7.9 (±0.1)	6.2 (±0.8)	30.3 (±0.7)
Craighill Upper Range	19.3 (±0.5)	8.0 (±0.1)	6.6 (±0.6)	30.3 (±0.5)
Cutoff Angle	18.7 (±0.6)	7.9 (±0.1)	6.6 (±0.5)	30.1 (±0.8)
Swan Point Channel	19.3 (±0.5)	7.9 (±0.1)	6.4 (±0.8)	30.3 (±0.7)
Tolchester Channel North	18.9 (±0.5)	7.9 (±0.1)	6.6 (±0.6)	30.5 (±0.7)
Tolchester Channel South	18.6 (±0.4)	7.9 (±0.1)	6.6 (±0.6)	30.2 (±0.7)
Tolchester Straightening	18.8 (±0.4)	7.9 (±0.1)	6.6 (±0.5)	30.2 (±0.8)

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TABLE 9-2B WATER QUALITY PARAMETERS MEASURED DURING 28-DAY BIOACCUMULATION TESTING WITH *Nereis virens* (SAND WORM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: 13 January – 10 February 2000)

Test Sediment	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control	17.9 (±0.7)	8.0 (±0.1)	6.8 (±0.9)	30.8 (±0.6)
Inside Site 104	18.1 (±0.6)	8.0 (±0.1)	6.6 (±0.8)	30.7 (±0.8)
Outside Site 104	18.0 (±0.7)	8.0 (±0.1)	6.5 (±0.7)	30.5 (±0.9)
Brewerton Channel Eastern Extension	19.9 (±0.5)	8.0 (±0.1)	6.5 (±0.6)	30.5 (±1.0)
C&D Approaches – Surface Grabs	19.0 (±0.6)	8.0 (±0.1)	6.4 (±1.0)	30.6 (±0.8)
C&D Approaches - Cores	18.8 (±0.6)	7.9 (±0.1)	6.4 (±0.6)	30.6 (±0.9)
Craighill Channel	19.8 (±0.4)	8.1 (±0.2)	6.6 (±0.7)	30.6 (±1.1)
Craighill Angle East	19.5 (±0.6)	7.9 (±0.1)	6.4 (±0.8)	30.4 (±1.2)
Craighill Angle West	18.9 (±0.4)	8.0 (±0.2)	6.5 (±0.9)	30.4 (±1.2)
Craighill Entrance	19.9 (±0.5)	7.9 (±0.1)	6.3 (±1.0)	30.5 (±1.1)
Craighill Upper Range	18.6 (±0.4)	8.0 (±0.1)	6.5 (±1.1)	30.4 (±1.3)
Cutoff Angle	18.0 (±0.5)	7.9 (±0.1)	6.6 (±0.7)	30.4 (±0.9)
Swan Point Channel	19.1 (±0.6)	8.0 (±0.1)	6.5 (±0.7)	30.7 (±0.8)
Tolchester Channel North	18.6 (±1.4)	7.9 (±0.1)	6.6 (±0.7)	30.4 (±1.0)
Tolchester Channel South	17.6 (±0.6)	8.0 (±0.1)	7.1 (±0.6)	30.5 (±0.9)
Tolchester Straightening	20.0 (±0.5)	8.0 (±0.1)	6.5 (±0.7)	30.6 (±0.6)

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TABLE 9-2C WATER QUALITY PARAMETERS MEASURED DURING 28-DAY BIOACCUMULATION TESTING WITH *Nereis virens* (SAND WORM) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL REFERENCE SITE (Round 3: 10 February – 8 March 2000)

Test Sediment	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control	19.8 (±0.5)	8.0 (±0.2)	7.2 (±0.9)	30.5 (±0.7)
Ocean Reference	19.7 (±0.3)	8.2 (±0.2)	7.0 (±1.0)	30.4 (±0.6)

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TABLE 9-3A WATER QUALITY PARAMETERS MEASURED DURING 28-DAY BIOACCUMULATION TESTING WITH *Macoma nasuta* (BLUNT-NOSE CLAM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: 4 November – 2 December 1999)

Test Sediment	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control	11.4 (±0.4)	8.0 (±0.1)	8.1 (±0.8)	30.6 (±0.6)
Inside Site 104	11.9 (±0.3)	8.0 (±0.1)	8.0 (±0.6)	30.2 (±0.6)
Brewerton Channel Eastern Extension	11.5 (±0.4)	8.0 (±0.1)	8.0 (±0.6)	30.2 (±0.6)
C&D Approaches-Surface Grabs	11.7 (±0.4)	7.9 (±0.1)	7.9 (±1.0)	30.1 (±0.7)
C&D Approaches - Cores	11.4 (±0.4)	7.9 (±0.1)	7.9 (±0.8)	30.1 (±0.7)
Craighill Channel	11.5 (±0.4)	8.0 (±0.1)	8.1 (±0.7)	30.4 (±0.6)
Craighill Angle East	11.5 (±0.4)	7.9 (±0.1)	7.9 (±0.7)	30.1 (±0.4)
Craighill Angle West	11.5 (±0.4)	7.9 (±0.1)	7.9 (±0.8)	30.1 (±0.4)
Craighill Entrance	10.9 (±0.6)	8.0 (±0.1)	8.3 (±0.8)	30.5 (±0.7)
Craighill Upper Range	11.5 (±0.4)	8.0 (±0.1)	7.9 (±1.0)	30.4 (±0.6)
Cutoff Angle	12.1 (±0.4)	8.0 (±0.1)	8.0 (±0.7)	30.3 (±0.6)
Swan Point Channel	11.3 (±0.3)	7.9 (±0.1)	8.1 (±0.7)	30.2 (±0.4)
Tolchester Channel North	11.8 (±0.4)	8.0 (±0.1)	8.0 (±0.7)	30.2 (±0.7)
Tolchester Channel South	12.3 (±0.3)	8.0 (±0.1)	8.1 (±0.6)	30.2 (±0.6)
Tolchester Straightening	11.3 (±0.4)	7.9 (±0.1)	8.1 (±0.7)	30.2 (±0.7)

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TABLE 9-3B WATER QUALITY PARAMETERS MEASURED DURING 28-DAY BIOACCUMULATION TESTING WITH *Macoma nasuta* (BLUNT NOSE CLAM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: 12 January – 9 February 2000)

Test Sediment	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control	13.5 (±0.2)	8.1 (±0.1)	8.2 (±0.7)	30.9 (±0.4)
Inside Site 104	13.0 (±0.2)	8.1 (±0.1)	8.2 (±0.8)	30.3 (±0.4)
Outside Site 104	13.0 (±0.2)	8.1 (±0.1)	8.0 (±0.8)	30.3 (±0.5)
Brewerton Channel Eastern Extension	12.8 (±0.4)	8.1 (±0.1)	8.3 (±0.7)	30.4 (±0.6)
C&D Approaches – Surface Grabs	12.9 (±0.2)	8.1 (±0.1)	8.4 (±0.7)	30.2 (±0.5)
C&D Approaches - Cores	13.0 (±0.2)	8.0 (±0.1)	8.3 (±0.6)	30.1 (±0.6)
Craighill Channel	12.3 (±0.3)	8.1 (±0.1)	8.5 (±0.6)	30.6 (±0.4)
Craighill Angle East	12.9 (±0.3)	8.0 (±0.1)	8.1 (±0.7)	30.3 (±0.6)
Craighill Angle West	12.6 (±0.2)	8.0 (±0.1)	8.1 (±0.9)	30.4 (±0.5)
Craighill Entrance	12.8 (±0.2)	8.0 (±0.1)	8.1 (±0.7)	30.5 (±0.5)
Craighill Upper Range	12.6 (±0.2)	8.1 (±0.1)	8.0 (±1.2)	30.4 (±0.5)
Cutoff Angle	13.0 (±0.2)	8.0 (±0.1)	8.0 (±0.6)	30.4 (±0.5)
Swan Point Channel	13.1 (±0.3)	8.0 (±0.1)	8.1 (±0.7)	30.5 (±0.5)
Tolchester Channel North	12.7 (±0.3)	8.0 (±0.1)	8.0 (±1.0)	30.3 (±0.6)
Tolchester Channel South	12.8 (±0.2)	8.0 (±0.1)	8.1 (±0.9)	30.4 (±0.5)
Tolchester Straightening	13.0 (±0.2)	8.1 (±0.1)	8.2 (±1.1)	30.3 (±0.5)

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TABLE 9-3C WATER QUALITY PARAMETERS MEASURED DURING 28-DAY BIOACCUMULATION TESTING WITH *Macoma nasuta* (BLUNT NOSE CLAM) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL REFERENCE SITE (Round 3: 8 February – 7 March 2000)

Test Sediment	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
Laboratory Control	12.1 (±0.9)	8.0 (±0.2)	8.2 (±1.3)	30.2 (±0.6)
Ocean Reference	11.5 (±0.7)	8.1 (±0.1)	8.5 (±0.5)	30.5 (±0.5)

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TABLE 9-4 REQUIRED CONTAINERS, PRESERVATION TECHNIQUE, AND HOLDING TIMES FOR TISSUE SAMPLES

Parameter	Mass Required (grams)	Container[a]	Preservative	Holding Time [b]
Inorganics				
Mercury	5	G	Frozen, ≤ -20°C	28 days
Other Metals	5	G	Frozen, ≤ -20°C	6 months
Organics				
Lipids	5	G	Frozen, ≤ -20°C	Up to 1 year if frozen (14 days after thaw) to analysis
Organotins	10	G	Frozen, ≤ -20°C	Up to 1 year if frozen (14 days after thaw) to extraction, 7 days from extraction to derivatization, 40 days after extraction
Dioxins/Furans	30	G	Frozen, ≤ -20°C	Up to 1 year if frozen (30 days after thaw) to extraction, 40 days after extraction
Pesticides (Organochlorine), PCBs (Aroclors and Congeners), Semivolatile Organics, Polynuclear Aromatic Hydrocarbons	110	G	Frozen, ≤ -20°C	Up to 1 year if frozen (14 days after thaw) to extraction, 40 days after extraction

(a) P = plastic; G = glass.
(b) From time of sample collection.

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TABLE 9-5A RESULTS OF 28-DAY BIOACCUMULATION TESTING (SURVIVAL) WITH *Nereis virens* (SAND WORM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: 5 November – 3 December 1999)

Test Sediment	No. Alive/ No. Exposed*	28-Day Percent Survival (mean)
Laboratory Control Sediment	74/78	95
Inside Site 104	116/130	89
Brewerton Channel Eastern Extension	107/130	82
C&D Approaches - Cores	123/130	95
C&D Approaches – Surface Grabs	103/130	79
Craighill Channel	123/130	95
Craighill Angle East	122/130	94
Craighill Angle West	128/130	98
Craighill Entrance	124/130	95
Craighill Upper Range	118/130	91
Cutoff Angle	121/130	93
Swan Point Channel	110/130	85
Tolchester Channel North	127/130	98
Tolchester Channel South	123/130	95
Tolchester Straightening	115/130	88

*Total for 5 replicates of 26 animals each, except for 3 replicates of 26 for the laboratory control sediment

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TABLE 9-5B RESULTS OF 28-DAY BIOACCUMULATION TESTING (SURVIVAL) WITH *Nereis virens* (SAND WORM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: 13 January – 10 February 2000)

Test Sediment	No. Alive/ No. Exposed*	28-Day Percent Survival (mean)
Laboratory Control Sediment	58/60	97
Inside Site 104	111/125	89
Outside Site 104	104/125	83
Brewerton Channel Eastern Extension	91/100	91
C&D Approaches - Cores	93/100	93
C&D Approaches – Surface Grabs	96/100	96
Craighill Channel	95/100	95
Craighill Angle East	88/100	88
Craighill Angle West	89/100	89
Craighill Entrance	89/100	89
Craighill Upper Range	96/100	96
Cutoff Angle	98/100	98
Swan Point Channel	94/100	94
Tolchester Channel North	94/100	94
Tolchester Channel South	94/100	94
Tolchester Straightening	95/100	95

* Total for 3 replicates of 20 animals for laboratory control sediment, 5 replicates of 25 animals each for inside & outside site 104, 5 replicates of 20 animals for all other test sediments.

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TABLE 9-5C RESULTS OF 28-DAY BIOACCUMULATION TESTING (SURVIVAL) WITH *Nereis virens* (SAND WORM) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL REFERENCE SITE (Round 3: 10 February – 8 March 2000)

Test Sediment	No. Alive/ No. Exposed*	28-Day Percent Survival (mean)
Laboratory Control Sediment	72/75	96
Ocean Reference	120/125	96

*Total for 3 replicates of 25 animals each for laboratory control sediment and 5 replicates of 25 animals each for ocean reference.

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TABLE 9-6A RESULTS OF 28-DAY BIOACCUMULATION TESTING (SURVIVAL) WITH *Macoma nasuta* (BLUNT-NOSE CLAM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 1: 4 November – 3 December 1999)

Test Sediment	No. Alive/ No. Exposed*	28-Day Percent Survival (mean)
Laboratory Control Sediment	139/150	93
Inside Site 104	239/250	96
Brewerton Eastern Extension	240/250	96
C&D Approaches - Cores	242/250	97
C&D Approaches – Surface Grabs	242/250	97
Craighill Channel	243/250	97
Craighill Angle East	243/250	97
Craighill Angle West	241/250	96
Craighill Entrance	239/250	96
Craighill Upper Range	246/250	98
Cutoff Angle	235/250	94
Swan Point Channel	237/250	95
Tolchester Channel North	235/250	94
Tolchester Channel South	233/250	93
Tolchester Straightening	234/250	94

*Total for 5 replicates of 50 animals each; except for laboratory control sediment 3 replicates of 50 animals each.

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TABLE 9-6B RESULTS OF 28-DAY BIOACCUMULATION TESTING (SURVIVAL) WITH *Macoma nasuta* (BLUNT-NOSE CLAM) ON SAMPLES FROM BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104 (Round 2: 12 January – 9 February 2000)

Test Sediment	No. Alive/ No. Exposed*	28-Day Percent Survival (mean)
Laboratory Control Sediment	83/90	92
Inside Site 104	139/150	93
Outside Site 104	138/150	92
Brewerton Channel Eastern Extension	137/150	91
C&D Approaches – Cores	131/150	87
C&D Approaches – Surface Grabs	138/150	92
Craighill Channel	143/150	95
Craighill Angle East	118/150	79 [(a)]
Craighill Angle West	132/150	88
Craighill Entrance	121/150	81[(a)]
Craighill Upper Range	148/152	97
Cutoff Angle	142/150	95
Swan Point Channel	130/150	87
Tolchester Channel North	129/150	86
Tolchester Channel South	130/150	87
Tolchester Straightening	137/150	91

*Survival was statistically (P=0.05) lower than Inside and Outside Site 104

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TABLE 9-6C RESULTS OF 28-DAY BIOACCUMULATION TESTING (SURVIVAL) WITH *Macoma nasuta* (BLUNT-NOSE CLAM) ON SAMPLES FROM THE NORFOLK OCEAN DISPOSAL REFERENCE SITE (Round 3: 8 February – 7 March 2000)

Test Sediment	No. Alive/ No. Exposed*	28-Day Percent Survival (mean)
Laboratory Control Sediment	119/120	99
Ocean Reference	199/200	99

TABLE 9-7A RESULTS OF REFERENCE TOXICANT BIOACCUMULATION TESTING – BALTIMORE HARBOR APPROACH CHANNELS AND SITE 104

Test Species	Reference Toxicant	Testing Date	Endpoint	Acceptable Control Chart Limits
Nereis virens	Sodium dodecyl sulfate (SDS)	November 1999 January 2000	48-hour LC50: 13.0 mg/L SDS 48-hour LC50: 17.7 mg/L SDS	2.6 – 64.1 mg/L SDS 0 – 61.6 mg/L SDS
Macoma nasuta	Sodium dodecyl sulfate (SDS)	November 1999 January 2000	48-hour LC50: 90.0 mg/L SDS 48-hour LC50: 68.0 mg/L SDS	20.4 – 97.3 mg/L SDS 20.5 – 101.4 mg/L SDS

TABLE 9-7B RESULTS OF REFERENCE TOXICANT BIOACCUMULATION TESTING – NORFOLK OCEAN DISPOSAL SITE REFERENCE AREA

Test Species	Reference Toxicant	Endpoint	Acceptable Control Chart Limits
Nereis virens	Sodium dodecyl sulfate (SDS)	(Lot NV-020) 48-hour LC50: 19.1 mg/L SDS (Lot NV-021) 48-hour LC50: 14.5 mg/L SDS	0 – 60.1 mg/L SDS 0 – 58.6 mg/L SDS
Macoma nasuta	Sodium dodecyl sulfate (SDS)	(Lot MA-013) 48-hour LC50: 77.3 mg/L SDS (Lot MA-014) 48-hour LC50: 77.3 mg/L SDS	20.5 – 101.4 mg/L SDS 22.1 – 101.9 mg/L SDS

TABLE 9-8A *Nereis virens* (SAND WORM): MEAN METAL CONCENTRATIONS (MG/KG) COMPARED TO INSIDE SITE 104

Analyte (mg/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	8.61	8.54	19.20**	8.35	14.60*	8.30	9.66	8.80	20.88*	8.16	12.20*	32.92**	8.75	10.96**	12.34**	11.28**
ANTIMONY	0.05	0.05	0.14**	0.09	ND	0.13**	0.05	0.05	0.11*	0.06	0.09	0.09	0.16*	0.15**	0.16**	0.08
ARSENIC	1.96	1.94	4.28**	1.70	1.70	1.55	2.18	1.50	1.67	1.62	1.83	1.70	1.26	1.56	1.70	1.47
BERYLLIUM	ND	ND	ND	0.07**	ND	0.07**	ND	ND	0.03**	ND	0.03**	0.03**	0.07**	0.03**	0.03**	0.03**
CADMIUM	0.03	0.04*	0.06**	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	0.15	ND	1.36**	0.53**	0.15	0.45**	0.22	0.18	0.32**	0.13	0.49**	0.50**	0.47**	0.44**	0.79**	0.44**
COPPER	1.36	0.88	1.64	1.68*	1.86*	1.58	1.54	1.48	1.52	1.44	1.58	1.50	1.55	1.64	1.54	1.38
IRON	72.64	67.66	102.46	59.22	82.34	61.74	69.84	65.86	57.12	68.08	55.90	113.68	56.65	58.26	64.90	57.46
LEAD	0.32	0.30	0.43*	ND	0.28	0.17	ND	ND	ND	ND	0.19	0.20	0.18	ND	ND	ND
MANGANESE	1.00	0.66	1.20	1.18	3.78**	2.90*	1.05	1.46	ND	1.40	ND	8.92*	1.25	ND	ND	ND
MERCURY	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL	0.49	ND	1.26**	1.00**	0.65	1.11**	0.92**	0.62	0.61	0.52	0.87**	0.94**	0.73	0.85**	0.82*	0.90**
SELENIUM	0.42	0.45	0.52	ND	0.42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER	0.08	0.09	ND	0.13	0.05	0.09	ND	ND	0.10	ND	0.06	0.07	0.15	0.10	0.09	0.11
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	20.32	13.10	18.32	20.77	26.76	38.98	33.00	35.50	12.32	19.00	25.23	13.12	16.40	30.86	41.66	20.44

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-8B *Nereis virens* (SAND WORM): MEAN METAL CONCENTRATIONS (MG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (mg/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	8.54	8.61	**19.20****	8.35	14.6	8.3	9.66	8.8	20.88	8.16	**12.20***	**32.92***	8.75	**10.96****	**12.34****	**11.28****
ANTIMONY	0.05	0.05	**0.14****	0.09	ND	**0.13****	0.05	0.05	**0.11***	0.06	0.09	0.09	**0.16***	**0.15****	**0.16****	0.08
ARSENIC	1.94	1.96	**4.28****	1.7	1.7	1.55	2.18	1.5	1.67	1.62	1.83	1.7	1.26	1.56	1.7	1.47
BERYLLIUM	ND	ND	ND	**0.07****	ND	**0.07****	ND	ND	**0.03****	ND	**0.03****	**0.03****	**0.07****	**0.03****	**0.03****	**0.03****
CADMIUM	0.04	0.03	0.06	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	ND	**0.15***	**1.36****	**0.53****	**0.15****	**0.45****	**0.22***	**0.18****	**0.32****	**0.13****	**0.49****	**0.50****	**0.47****	**0.44****	**0.79****	**0.44****
COPPER	0.88	**1.36****	**1.64****	**1.68****	**1.86****	**1.58****	**1.54****	**1.48****	**1.52****	**1.44****	**1.58****	**1.50****	**1.55***	**1.64****	**1.54****	**1.38***
IRON	67.66	72.64	102.46	59.22	82.34	61.74	69.84	65.86	57.12	68.08	55.9	113.68	56.65	58.26	64.9	57.46
LEAD	. 0.3	0.32	**0.43***	ND	0.28	0.17	ND	ND	ND	ND	0.19	0.2	0.18	ND	ND	ND
MANGANESE	0.66	1	1.2	1.18	**3.78****	**2.90****	1.05	**1.46***	ND	**1.40***	ND	**8.92****	**1.25***	ND	ND	ND
MERCURY	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL	ND	**0.49***	**1.26****	**1.00****	**0.65****	**1.11****	**0.92****	**0.62***	**0.61***	**0.52***	**0.87****	**0.94****	**0.73****	**0.85****	**0.82****	**0.90****
SELENIUM	0.45	0.42	0.52	ND	0.42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER	0.09	0.08	ND	0.13	0.05	0.09	ND	ND	0.1	ND	0.06	0.07	0.15	0.1	0.09	0.11
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	13.1	**20.32***	18.32	20.77	**26.76***	38.98	**33.00****	35.5	12.32	19	25.23	13.12	16.4	30.86	**41.66***	20.44

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were significantly higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

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TABLE 9-8C *Nereis virens* (SAND WORM): MEAN METAL CONCENTRATIONS (MG/KG) COMPARED TO OCEAN REFERENCE

Analyte (mg/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	19.20	8.54	8.61	8.35	14.60	8.30	9.66	8.80	20.88	8.16	12.20	32.92	8.75	10.96	12.34	11.28
ANTIMONY	0.14	0.05	0.05	0.09	ND	0.13	0.05	0.05	0.11	0.06	0.09	0.09	0.16	0.15	0.16	0.08
ARSENIC	4.28	1.94	1.96	1.70	1.70	1.55	2.18	1.50	1.67	1.62	1.83	1.70	1.26	1.56	1.70	1.47
BERYLLIUM	ND	ND	ND	**0.07****	ND	**0.07****	ND	ND	**0.03****	ND	**0.03****	**0.03****	**0.07****	**0.03****	**0.03****	**0.03****
CADMIUM	0.06	0.04	0.03	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	1.36	ND	0.15	0.53	0.15	0.45	0.22	0.18	0.32	0.13	0.49	0.50	0.47	0.44	0.79	0.44
COPPER	1.64	0.88	1.36	1.68	1.86	1.58	1.54	1.48	1.52	1.44	1.58	1.50	1.55	1.64	1.54	1.38
IRON	102.46	67.66	72.64	59.22	82.34	61.74	69.84	65.86	57.12	68.08	55.90	113.68	56.65	58.26	64.90	57.46
LEAD	0.43	0.30	0.32	ND	0.28	0.17	ND	ND	ND	ND	0.19	0.20	0.18	ND	ND	ND
MANGANESE	1.20	0.66	1.00	1.18	**3.78***	2.90	1.05	1.46	ND	1.40	ND	8.92	1.25	ND	ND	ND
MERCURY	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL	1.26	ND	0.49	1.00	0.65	1.11	0.92	0.62	0.61	0.52	0.87	0.94	0.73	0.85	0.82	0.9
SELENIUM	0.52	0.45	0.42	ND	0.42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER	ND	0.09	0.08	**0.13***	0.05	0.09	ND	ND	0.10	ND	0.06	0.07	**0.15***	**0.10***	0.09	0.11
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	18.32	13.10	20.32	20.77	26.76	38.98	**33.00***	35.50	12.32	19.00	25.23	13.12	16.40	30.86	41.66	20.44

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

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TABLE 9-9 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR METALS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	**0.13**	0.41	0.28	0.17	**0.30**	0.17	0.2	0.18	**0.43**	0.17	**0.25**	**0.68**	0.18	**0.23**	**0.25**	**0.23**
ANTIMONY	**0.99**	0.69	0.73	1.61	ND	**2.22**	0.81	0.88	**1.89**	0.97	1.57	1.52	**2.78**	**2.65**	**2.75**	1.41
ARSENIC	**2.47**	1.16	1.27	1.18	1.18	1.08	1.51	1.04	1.15	1.12	1.26	1.18	0.87	1.08	1.18	1.02
BERYLLIUM	ND	ND	ND	**6.75**	ND	**7.00**	ND	ND	**3.00**	ND	**2.75**	**3.40**	**7.00**	**3.00**	**3.00**	**3.00**
CADMIUM	**2.17**	**1.65**	1.43	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	**2.15**	ND	**0.84**	**1.84**	**0.53**	**1.56**	**0.75**	**0.64**	**1.12**	**0.46**	**1.70**	**1.74**	**1.62**	**1.53**	**2.76**	**1.54**
COPPER	**0.85**	1.39	**1.39**	**1.28**	**1.42**	**1.21**	**1.18**	**1.13**	**1.16**	**1.10**	**1.21**	**1.15**	**1.19**	**1.26**	**1.18**	**1.06**
IRON	0.3	0.81	0.66	0.41	0.57	0.43	0.49	0.46	0.4	0.47	0.39	0.79	0.39	0.41	0.45	0.4
LEAD	**0.25**	0.87	1.35	ND	1.47	0.9	ND	ND	ND	ND	0.98	1.04	0.95	ND	ND	ND
MANGANESE	0.24	0.62	0.5	0.44	**1.43**	**1.09**	0.4	**0.55**	ND	**0.53**	ND	**3.37**	**0.47**	ND	ND	ND
MERCURY	ND	1.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL	**2.94**	ND	**3.63**	**8.85**	**5.70**	**9.79**	**8.10**	**5.51**	**5.36**	**4.62**	**7.70**	**8.28**	**6.44**	**7.54**	**7.25**	**7.92**
SELENIUM	1.62	1.84	1.22	ND	0.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER	ND	0.78	0.68	**1.00**	0.42	0.69	ND	ND	0.75	ND	0.42	0.57	**1.17**	**0.75**	0.72	0.83
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	1.69	0.58	**1.33**	1.64	**2.11**	3.08	**2.61**	2.8	0.97	1.5	1.99	1.04	1.29	2.44	**3.29**	1.61

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

TABLE 9-10A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN METAL CONCENTRATIONS (MG/KG) COMPARED TO INSIDE SITE 104

Analyte (mg/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	32.36	30.40	32.86	67.44*	41.12	42.12	48.42**	45.82**	51.42	38.34*	36.02	30.08	38.10	36.94	27.08	47.2
ANTIMONY	0.04	0.10	0.17**	0.11**	ND	0.14**	0.19**	0.18**	ND	0.13*	ND	ND	0.10**	0.13**	0.16**	0.13**
ARSENIC	2.39	2.13	4.28**	2.60	2.58	2.26	2.78**	2.54	2.58	2.80*	2.48	2.78	2.54	2.40	2.30	2.44
BERYLLIUM	0.05	ND	ND	0.03	0.08**	0.03	ND	ND	0.03	ND	0.03	0.03	0.03	0.04	0.04	0.04
CADMIUM	0.02	0.01	0.07**	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	0.45	ND	1.70**	0.76*	0.58	0.66	2.51*	2.24**	0.84**	1.61*	0.82**	0.57	0.60	0.46	0.40	0.43
COPPER	2.47	2.55	4.06**	2.66	2.56	2.04	2.72	2.38	2.50	2.78	2.74	2.32	2.36	2.48	1.94	2.14
IRON	174.47	119.25	120.80	172.60	200.20	196.00	232.00**	222.40*	219.80	188.20	173.00	187.40	161.60	161.20	121.60	167.4
LEAD	0.65	0.95*	0.51	0.35	0.38	0.17	ND	0.18	0.28	0.19	0.29	0.19	ND	ND	ND	0.25
MANGANESE	7.39	6.23	2.48	22.46**	12.30**	10.86*	14.90**	21.28**	21.10**	16.66**	11.36**	16.32**	11.34**	10.04**	8.98	4.52
MERCURY	0.08	0.06	ND	0.12*	0.12*	0.12	ND	ND	ND	ND	ND	ND	0.11	ND	ND	ND
NICKEL	0.73	0.30	1.44**	1.08*	1.14**	0.97	2.54**	2.36**	1.06*	1.72**	1.14*	0.87	0.87	0.86	0.72	0.93
SELENIUM	0.42	0.36	0.71**	0.80**	0.45	0.65**	0.83**	0.82**	0.62**	0.74**	0.62**	0.57*	0.67**	0.73**	0.69**	0.83**
SILVER	0.10	0.14	0.05	0.13	0.23	0.11	0.13	0.08	0.05	0.11	0.06	0.18	0.10	0.11	0.18	0.13
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	14.33	12.43	22.78**	17.14*	15.42	14.30	16.94*	15.04	18.54**	17.06*	16.98*	19.62	14.30	15.22	14.16	14.08

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

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TABLE 9-10B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN METAL CONCENTRATIONS (MG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (mg/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	30.40	32.36	32.86	67.44*	41.12	42.12	48.42**	45.82*	51.42	38.34	36.02	30.08	38.10	36.94	27.08	47.20*
ANTIMONY	0.10	0.04	0.17	0.11	ND	0.14	0.19*	0.18*	ND	0.13	ND	ND	0.10	0.13	0.16	0.13
ARSENIC	2.13	2.39*	4.28**	2.60**	2.58*	2.26	2.78**	2.54**	2.58**	2.80**	2.48*	2.78*	2.54*	2.40	2.30	2.44**
BERYLLIUM	ND	0.05	ND	0.03**	0.08**	0.03**	ND	ND	0.03**	ND	0.03**	0.03**	0.03*	0.04**	0.04**	0.04**
CADMIUM	0.01	0.02*	0.07**	ND	0.04**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	ND	0.45*	1.70**	0.76**	0.58**	0.66**	2.51**	2.24**	0.84**	1.61**	0.82**	0.57**	0.60**	0.46**	0.40**	0.43**
COPPER	2.55	2.47	4.06**	2.66	2.56	2.04	2.72	2.38	2.50	2.78	2.74	2.32	2.36	2.48	1.94	2.14
IRON	119.25	174.47*	120.80	172.60*	200.20**	196.00**	232.00**	222.40**	219.80*	188.20**	173.00*	187.40**	161.60*	161.20*	121.60	167.40*
LEAD	0.95	0.65	0.51	0.35	0.38	0.17	ND	0.18	0.28	0.19	0.29	0.19	ND	ND	ND	0.25
MANGANESE	6.23	7.39	2.48	22.46**	12.30**	10.86**	14.90**	21.28**	21.10**	16.66**	11.36**	16.32**	11.34**	10.04**	8.98*	4.52
MERCURY	0.06	0.08	ND	0.12*	0.12*	0.12*	ND	ND	ND	ND	ND	ND	0.11*	ND	ND	ND
NICKEL	0.30	0.73**	1.44**	1.08**	1.14**	0.97**	2.54**	2.36**	1.06**	1.72**	1.14**	0.87**	0.87**	0.86**	0.72**	0.93**
SELENIUM	0.36	0.42	0.71**	0.80**	0.45	0.65**	0.83**	0.82**	0.62**	0.74**	0.62**	0.57*	0.67**	0.73**	0.69**	0.83**
SILVER	0.14	0.10	0.05	0.13	0.23	0.11	0.13	0.08	0.05	0.11	0.06	0.18	0.10	0.11	0.18	0.13
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	12.43	14.33*	22.78**	17.14**	15.42**	14.30*	16.94**	15.04*	18.54**	17.06**	16.98**	19.62*	14.30	15.22*	14.16	14.08*

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-10C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN METAL CONCENTRATIONS (MG/KG) COMPARED TO OCEAN REFERENCE

Analyte (mg/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	32.86	30.40	32.36	67.44*	41.12	42.12	48.42	45.82	51.42	38.34	36.02	30.08	38.10	36.94	27.08	47.2
ANTIMONY	0.17	0.10	0.04	0.11	ND	0.14	0.19*	0.18	ND	0.13	ND	ND	0.10	0.13	0.16	0.13
ARSENIC	4.28	2.13	2.39	2.60	2.58	2.26	2.78	2.54	2.58	2.80	2.48	2.78	2.54	2.40	2.30	2.44
BERYLLIUM	ND	ND	0.05	0.03**	0.08**	0.03**	ND	ND	0.03**	ND	0.03**	0.03**	0.03*	0.04**	0.04**	0.04**
CADMIUM	0.07	0.01	0.02	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	1.70	ND	0.45	0.76	0.58	0.66	2.51	2.24*	0.84	1.61	0.82	0.57	0.60	0.46	0.40	0.43
COPPER	4.06	2.55	2.47	2.66	2.56	2.04	2.72	2.38	2.50	2.78	2.74	2.32	2.36	2.48	1.94	2.14
IRON	120.80	119.25	174.47*	172.60**	200.20**	196.00**	232.00**	222.40**	219.80*	188.20**	173.00*	187.40**	161.60*	161.20**	121.60	167.40**
LEAD	0.51	0.95**	0.65	0.35	0.38	0.17	ND	0.18	0.28	0.19	0.29	0.19	ND	ND	ND	0.25
MANGANESE	2.48	6.23**	7.39**	22.46**	12.30**	10.86**	14.90**	21.28**	21.10**	16.66**	11.36**	16.32**	11.34**	10.04**	8.98**	4.52*
MERCURY	ND	0.06	0.08*	0.12**	0.12**	0.12**	ND	ND	ND	ND	ND	ND	0.11**	ND	ND	ND
NICKEL	1.44	0.30	0.73	1.08	1.14	0.97	2.54	2.36**	1.06	1.72	1.14	0.87	0.87	0.86	0.72	0.93
SELENIUM	0.71	0.36	0.42	0.80	0.45	0.65	0.83	0.82*	0.62	0.74	0.62	0.57	0.67	0.73	0.69	0.83*
SILVER	0.05	0.14	0.10	0.13	0.23*	0.11*	0.13*	0.08	0.05	0.11	0.06	0.18	0.10	0.11	0.18*	0.13
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	22.78	12.43	14.33	17.14	15.42	14.30	16.94	15.04	18.54	17.06	16.98	19.62	14.30	15.22	14.16	14.08

ND = not detected in any of five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

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TABLE 9-11 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR METALS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ALUMINUM	1.74	3.28	3.57	**7.59**	4.63	4.74	**5.45**	**5.16**	5.79	**4.32**	4.06	3.39	4.29	4.16	3.05	**5.32**
ANTIMONY	**2.93**	1.54	0.88	**3.03**	ND	**4.00**	**5.49**	**5.09**	ND	**3.74**	ND	ND	**2.91**	**3.66**	**4.57**	**3.66**
ARSENIC	**1.48**	0.77	**0.93**	**1.07**	**1.07**	0.93	**1.15**	**1.05**	**1.07**	**1.16**	**1.02**	**1.15**	**1.05**	0.99	0.95	**1.01**
BERYLLIUM	ND	ND	0.99	**0.47**	**1.06**	**0.44**	ND	ND	**0.47**	ND	**0.47**	**0.47**	**0.42**	**0.50**	**0.53**	**0.50**
CADMIUM	**4.08**	0.54	**0.63**	ND	**0.76**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	**17.00**	ND	**1.80**	**1.92**	**1.48**	**1.69**	**6.38**	**5.69**	**2.13**	**4.08**	**2.08**	**1.44**	**1.52**	**1.16**	**1.02**	**1.09**
COPPER	**0.88**	0.8	1.09	1.48	1.42	1.13	1.51	1.32	1.39	1.54	1.52	1.29	1.31	1.38	1.08	1.19
IRON	1.41	2.14	**2.84**	**2.63**	**3.05**	**2.98**	**3.53**	**3.39**	**3.35**	**2.87**	**2.63**	**2.85**	**2.46**	**2.45**	1.85	**2.55**
LEAD	1.07	**3.02**	2.94	1.96	2.16	0.99	ND	1.02	1.57	1.06	1.65	1.1	ND	ND	ND	1.44
MANGANESE	2.48	**6.22**	**5.93**	**14.97**	**8.20**	**7.24**	**9.93**	**14.19**	**14.07**	**11.11**	**7.57**	**10.88**	**7.56**	**6.69**	**5.99**	**3.01**
MERCURY	ND	1.34	**0.99**	**0.97**	**0.95**	**0.95**	ND	ND	ND	ND	ND	ND	**0.93**	ND	ND	ND
NICKEL	**4.70**	1.03	**1.45**	**1.69**	**1.79**	**1.52**	**3.99**	**3.71**	**1.67**	**2.70**	**1.79**	**1.36**	**1.36**	**1.35**	**1.13**	**1.47**
SELENIUM	**1.58**	0.63	0.9	**1.93**	1.09	**1.56**	**1.99**	**1.97**	**1.50**	**1.77**	**1.50**	**1.38**	**1.61**	**1.76**	**1.65**	**1.99**
SILVER	0.81	0.69	0.81	2.63	**4.88**	**2.25**	**2.75**	1.63	1.04	2.33	1.33	3.67	2.13	2.29	**3.71**	2.67
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	**1.36**	0.88	**0.94**	**1.05**	**0.94**	**0.87**	**1.03**	**0.92**	**1.13**	**1.04**	**1.04**	**1.20**	0.87	**0.93**	0.86	**0.86**

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

TABLE 9-12A *Nereis virens* (SAND WORM): MEAN CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	2.50	ND	2.05	ND	**5.88****	ND	2.23	1.65	1.11	2.39	1.55	2.75	ND	**13.74****	**10.32***	**10.73****
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	5.72	ND	ND	ND	1.00	ND	ND	ND	ND	**2.20***	1.28	ND
ALDRIN	13.83	ND	4.90	ND	**28.60***	ND	0.43	0.35	3.35	0.57	2.87	ND	ND	ND	ND	ND
ALPHA-BHC	2.01	0.48	0.91	ND	**3.54***	0.87	0.56	0.51	0.49	0.48	ND	ND	1.90	ND	0.66	ND
BETA-BHC	0.87	0.74	ND	0.63	ND	0.69	0.97	1.55	**4.86****	1.07	1.72	2.31	1.22	3.71	ND	2.14
CHLORBENSIDE	14.92	ND	4.84	3.32	**35.20****	ND	9.07	2.37	8.60	15.40	8.35	14.80	ND	9.22	15.66	13.4
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	25.21	ND	25.25	50.60	**116.80****	**41.00***	4.84	10.46	45.46	ND	**40.00***	**76.00****	37.50	**44.00****	**41.20***	**50.50****
DELTA-BHC	ND	ND	**2.82**B**	**2.02****	1.64	**2.70****	1.66	ND	0.79	**1.80**B**	ND	ND	**2.63****	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	1.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.55	0.56
ENDOSULFAN I	2.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.60	1.52	ND
ENDOSULFAN II	7.91	**55.25****	**15.28****	**17.68****	8.09	**16.78****	ND	3.65	1.52	2.61	2.12	3.16	**24.25****	**9.88***	7.20	6.59
ENDOSULFAN SULFATE	ND	ND	1.36	ND	0.70	ND	ND	ND	ND	ND	ND	0.70	ND	0.74	ND	ND
ENDRIN	ND	ND	1.54	ND	ND	ND	0.79	ND	ND	ND	**1.27***	0.65	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	0.82	ND	0.74	ND	ND	0.88	1.00	ND	ND	0.93	ND	ND	ND
GAMMA-BHC	1.37	ND	**3.00****	0.57	**3.16***	ND	0.79	ND	1.80	1.04	1.58	**2.00***	ND	ND	ND	ND
HEPTACHLOR	1.17	**1.73***	ND	**3.37***	ND	**4.59***	ND	ND	ND	ND	ND	ND	**5.27****	ND	ND	ND
HEPTACHLOR EPOXIDE	0.73	0.48	2.92	**2.04****	ND	**3.52****	ND	ND	ND	ND	ND	ND	**2.45****	**2.45***	1.36	1.57
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-12B *Nereis virens* (SAND WORM): MEAN CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	ND	2.5	2.05	ND	5.88**	ND	2.23	1.65	1.11	2.39*	1.55	2.75*	ND	13.74**	10.32**	10.73**
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	5.72	ND	ND	ND	1	ND	ND	ND	ND	2.2	1.28	ND
ALDRIN	ND	13.83*	4.90**	ND	28.60**	ND	0.43	0.35	3.35*	0.57*	2.87*	ND	ND	ND	ND	ND
ALPHA-BHC	0.48	2.01*	0.91	ND	3.54**	0.87	0.56	0.51	0.49	0.48	ND	ND	1.9	ND	0.66	ND
BETA-BHC	0.74	0.87	ND	0.63	ND	0.69	0.97	1.55	4.86**	1.07	1.72	2.31	1.22	3.71	ND	2.14
CHLORBENSIDE	ND	14.92*	4.84*	3.32	35.20**	ND	9.07*	2.37	8.60**	15.40**	8.35**	14.80**	ND	9.22	15.66	13.40**
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	25.21	25.25**	50.60*	116.80**	41.00**	4.84	10.46	45.46	ND	40.00**	76.00**	37.50**	44.00**	41.20**	50.50**
DELTA-BHC	ND	ND	2.82**B	2.02**	1.64	2.70**	1.66	ND	0.79	1.80**B	ND	ND	2.63**	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	1.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.55	0.56
ENDOSULFAN I	ND	2.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	1.52	ND
ENDOSULFAN II	55.25	7.91	15.28	17.68	8.09	16.78	ND	3.65	1.52	2.61	2.12	3.16	24.25	9.88	7.2	6.59
ENDOSULFAN SULFATE	ND	ND	1.36	ND	0.7	ND	ND	ND	ND	ND	ND	0.7	ND	0.74	ND	ND
ENDRIN	ND	ND	1.54	ND	ND	ND	0.79	ND	ND	ND	1.27*	0.65	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	0.82	ND	0.74	ND	ND	0.88	1	ND	ND	0.93	ND	ND	ND
GAMMA-BHC	ND	1.37	3.00**	0.57	3.16**	ND	0.79	ND	1.80*	1.04*	1.58**	2.00**	ND	ND	ND	ND
HEPTACHLOR	1.73	1.17	ND	3.37	ND	4.59	ND	ND	ND	ND	ND	ND	5.27*	ND	ND	ND
HEPTACHLOR EPOXIDE	0.48	0.73	2.92	2.04**	ND	3.52**	ND	ND	ND	ND	ND	ND	2.45**	2.45*	1.36	1.57
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

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TABLE 9-12C *Nereis virens* (SAND WORM): MEAN CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	2.05	ND	2.50	ND	**5.88***	ND	2.23	1.65	1.11	2.39	1.55	2.75	ND	**13.74****	**10.32***	**10.73****
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	5.72	ND	ND	ND	1.00	ND	ND	ND	ND	2.20	1.28	ND
ALDRIN	4.90	ND	13.83	ND	**28.60****	ND	0.43	0.35	3.35	0.57	2.87	ND	ND	ND	ND	ND
ALPHA-BHC	0.91	0.48	2.01	ND	**3.54***	0.87	0.56	0.51	0.49	0.48	ND	ND	1.90	ND	0.66	ND
BETA-BHC	ND	0.74	0.87	0.63	ND	0.69	0.97	1.55	**4.86****	1.07	1.72	2.31	**1.22***	3.71	ND	2.14
CHLORBENSIDE	4.84	ND	14.92	3.32	**35.20****	ND	9.07	2.37	8.60	**15.40***	8.35	**14.80***	ND	9.22	15.66	**13.40***
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	25.25	ND	25.21	50.60	**116.80****	**41.00***	4.84	10.46	45.46	ND	40.00	**76.00****	37.50	**44.00****	**41.20***	**50.50****
DELTA-BHC	2.82	ND	ND	2.02	1.64	2.70	1.66	ND	0.79	1.80	ND	ND	2.63	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	1.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.55	0.56
ENDOSULFAN I	ND	ND	2.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.60	1.52	ND
ENDOSULFAN II	15.28	**55.25****	7.91	17.68	8.09	16.78	ND	3.65	1.52	2.61	2.12	3.16	24.25	9.88	7.20	6.59
ENDOSULFAN SULFATE	1.36	ND	ND	ND	0.70	ND	ND	ND	ND	ND	ND	0.70	ND	0.74	ND	ND
ENDRIN	1.54	ND	ND	ND	ND	ND	0.79	ND	ND	ND	1.27	0.65	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	0.82	ND	0.74	ND	ND	0.88	1.00	ND	ND	0.93	ND	ND	ND
GAMMA-BHC	3.00	ND	1.37	0.57	3.16	ND	0.79	ND	1.80	1.04	1.58	2.00	ND	ND	ND	ND
HEPTACHLOR	ND	**1.73****	1.17	**3.37***	ND	**4.59***	ND	ND	ND	ND	ND	ND	**5.27****	ND	ND	ND
HEPTACHLOR EPOXIDE	2.92	0.48	0.73	2.04	ND	3.52	ND	ND	ND	ND	ND	ND	2.45	2.45	1.36	1.57
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

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TABLE 9-13 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR CHLORINATED PESTICIDES

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	2.8	ND	3.33	ND	**7.84**	ND	2.97	2.2	1.48	**3.19**	2.07	**3.67**	ND	**18.32**	**13.76**	**14.30**
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	2.77	ND	ND	ND	0.48	ND	ND	ND	ND	**1.06**	0.62	ND
ALDRIN	**4.88**	ND	**2.11**	ND	**2.25**	ND	0.03	0.03	**0.26**	**0.04**	**0.23**	ND	ND	ND	ND	ND
ALPHA-BHC	1.65	0.12	**4.12**	ND	**9.83**	2.41	1.54	1.41	1.36	1.33	ND	ND	5.26	ND	1.82	ND
BETA-BHC	ND	0.54	1.49	1.63	ND	1.79	2.51	4.03	**12.62**	2.78	4.46	6	**3.17**	9.63	ND	5.56
CHLORBENSIDE	**2.03**	ND	**2.15**	0.34	**3.60**	ND	**0.93**	0.24	**0.88**	**1.57**	**0.85**	**1.51**	ND	0.94	1.6	**1.37**
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	**0.79**	ND	0.97	**1.64**	**3.80**	**1.33**	0.16	0.34	1.48	ND	**1.30**	**2.47**	**1.22**	**1.43**	**1.34**	**1.64**
DELTA-BHC	**2.76**	ND	ND	**0.36**	0.29	**0.49**	0.3	ND	0.14	**0.32**	ND	ND	**0.47**	ND	ND	ND
DIELDRIN	ND	ND	ND	ND	0.93	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	0.34
ENDOSULFAN I	ND	ND	8.36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.53	4.99	ND
ENDOSULFAN II	**8.93**	**64.24**	8.72	**3.17**	1.45	**3.01**	ND	0.66	0.27	0.47	0.38	0.57	**4.35**	**1.77**	1.29	1.18
ENDOSULFAN SULFATE	2.96	ND	ND	ND	0.79	ND	ND	ND	ND	ND	ND	0.79	ND	0.84	ND	ND
ENDRIN	2.15	ND	ND	ND	ND	ND	0.11	ND	ND	ND	**0.17**	0.09	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	1.37	ND	1.23	ND	ND	1.47	1.67	ND	ND	1.54	ND	ND	ND
GAMMA-BHC	**7.56**	ND	0.9	0.22	**1.20**	ND	0.3	ND	**0.68**	**0.40**	**0.60**	**0.76**	ND	ND	ND	ND
HEPTACHLOR	ND	**0.70**	0.95	**9.91**	ND	**13.49**	ND	ND	ND	ND	ND	ND	**15.51**	ND	ND	ND
HEPTACHLOR EPOXIDE	2.96	0.62	1.43	**5.59**	ND	**9.64**	ND	ND	ND	ND	ND	ND	**6.71**	**6.72**	3.72	4.29
METHOXYCHLOR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

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TABLE 9-14A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	0.96	1.04	ND	1.49	ND	**2.02****	ND	1.31	1.12	1.10	**1.76****	**1.99***	1.47	ND	ND	ND
4,4'-DDE	0.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	1.47	ND	ND	**3.64****	0.94	**1.96***	0.78	1.88	**4.12***	1.48	**3.32****	**3.02****	**3.08****	ND	ND	ND
ALDRIN	2.69	1.64	0.71	ND	3.13	1.66	2.15	3.16	1.52	1.89	2.87	1.67	1.44	1.22	0.86	0.8
ALPHA-BHC	ND	ND	ND	ND	ND	**10.32****	ND	0.55	**1.94***	0.51	0.63	ND	1.05	ND	ND	ND
BETA-BHC	8.27	7.29	0.99	4.57	4.32	3.78	3.25	8.40	5.98	6.79	2.01	1.77	ND	2.48	1.00	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.78	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	3.54	ND	ND	ND	ND	ND	ND	ND	ND	2.71	3.70	4.13	ND	2.49	ND	ND
DELTA-BHC	1.45	2.57	**2.84**B**	ND	ND	ND	0.62	ND	ND	ND	ND	ND	ND	1.07	1.85	ND
DIELDRIN	0.58	0.48	**0.93***	ND	ND	0.53	0.73	1.15	0.93	1.15	ND	ND	ND	0.81	**1.20***	**1.20***
ENDOSULFAN I	2.01	**5.88****	ND	1.56	0.88	3.59	0.50	ND	ND	1.18	ND	ND	0.90	ND	ND	ND
ENDOSULFAN II	0.81	ND	ND	**4.44****	1.44	**2.13***	ND	ND	ND	ND	ND	ND	**3.25***	ND	ND	ND
ENDOSULFAN SULFATE	0.61	ND	0.62	2.83	1.26	1.26	1.11	ND	1.36	1.58	ND	ND	ND	ND	ND	ND
ENDRIN	ND	0.61	ND	ND	ND	ND	ND	ND	0.63	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	0.73	ND	0.86	0.90	1.16	ND	0.74	1.20	ND	1.02	1.38	0.82	ND	0.80	0.76	0.8
GAMMA-BHC	ND	ND	0.72	ND	ND	ND	0.51	ND	0.57	ND	**1.48****	**2.00****	ND	0.55	0.59	0.55
HEPTACHLOR	2.58	ND	2.00	1.78	3.86	2.58	ND	ND	2.48	ND	3.88	**4.20*B**	3.73	ND	ND	0.79
HEPTACHLOR EPOXIDE	1.29	**3.00****	0.82	ND	ND	0.49	ND	ND	2.31	ND	1.11	ND	ND	0.49	1.02	0.56
METHOXYCHLOR	2.45	7.20	ND	ND	ND	ND	ND	ND	2.06	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

B = detected in laboratory blank in at least one of five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-14B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	1.04	0.96	ND	1.49	ND	**2.02****	ND	1.31	1.12	1.10	**1.76***	**1.99***	1.47	ND	ND	ND
4,4'-DDE	ND	0.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	1.47	ND	**3.64****	0.94	**1.96****	0.78	1.88	**4.12****	1.48	**3.32****	**3.02****	**3.08****	ND	ND	ND
ALDRIN	1.64	2.69	0.71	ND	3.13	1.66	2.15	3.16	1.52	1.89	2.87	1.67	1.44	1.22	0.86	0.8
ALPHA-BHC	ND	ND	ND	ND	ND	**10.32****	ND	0.55	1.94	0.51	0.63	ND	1.05	ND	ND	ND
BETA-BHC	7.29	8.27	0.99	4.57	4.32	3.78	3.25	8.40	5.98	6.79	2.01	1.77	ND	2.48	1.00	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.78	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	3.54	ND	ND	ND	ND	ND	ND	ND	2.71	3.70	4.13	ND	2.49	ND	ND
DELTA-BHC	2.57	1.45	2.84	ND	ND	ND	0.62	ND	ND	ND	ND	ND	ND	1.07	1.85	ND
DIELDRIN	0.48	0.58	**0.93***	ND	ND	0.53	0.73	1.15	0.93	1.15	ND	ND	ND	0.81	**1.20***	**1.20***
ENDOSULFAN I	5.88	2.01	ND	1.56	0.88	3.59	0.50	ND	ND	1.18	ND	ND	0.90	ND	ND	ND
ENDOSULFAN II	ND	0.81	ND	**4.44****	1.44	**2.13***	ND	ND	ND	ND	ND	ND	**3.25***	ND	ND	ND
ENDOSULFAN SULFATE	ND	0.61	0.62	2.83	1.26	1.26	1.11	ND	1.36	1.58	ND	ND	ND	ND	ND	ND
ENDRIN	0.61	ND	ND	ND	ND	ND	ND	ND	0.63	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	ND	0.73	0.86	0.90	1.16	ND	0.74	1.20	ND	1.02	1.38	0.82	ND	0.80	0.76	0.8
GAMMA-BHC	ND	ND	0.72	ND	ND	ND	0.51	ND	0.57	ND	**1.48***	**2.00****	ND	0.55	0.59	0.55
HEPTACHLOR	ND	**2.58*B**	2.00	1.78	**3.86**B**	2.58	ND	ND	2.48	ND	**3.88**B**	**4.20**B**	**3.73*B**	ND	ND	0.79
HEPTACHLOR EPOXIDE	3.00	1.29	0.82	ND	ND	0.49	ND	ND	2.31	ND	1.11	ND	ND	0.49	1.02	0.56
METHOXYCHLOR	7.20	2.45	ND	ND	ND	ND	ND	ND	2.06	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 (p < 0.05*, p < 0.01).**

TABLE 9-14C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	ND	1.04	0.96	1.49	ND	2.02**	ND	1.31	1.12	1.10	1.76**	1.99*	1.47	ND	ND	ND
4,4'-DDE	ND	ND	0.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	1.47	3.64**	0.94	1.96**	0.78	1.88	4.12**	1.48	3.32**	3.02**	3.08**	ND	ND	ND
ALDRIN	0.71	1.64**	2.69**	ND	3.13*	1.66	2.15*	3.16**	1.52	1.89*	2.87	1.67	1.44	1.22	0.86	0.8
ALPHA-BHC	ND	ND	ND	ND	ND	10.32**	ND	0.55	1.94	0.51	0.63	ND	1.05	ND	ND	ND
BETA-BHC	0.99	7.29*	8.27**	4.57	4.32	3.78	3.25*	8.40**	5.98**	6.79	2.01	1.77	ND	2.48	1.00	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.78	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	ND	3.54*	ND	ND	ND	ND	ND	ND	2.71	3.70	4.13	ND	2.49	ND	ND
DELTA-BHC	2.84	2.57	1.45	ND	ND	ND	0.62	ND	ND	ND	ND	ND	ND	1.07	1.85	ND
DIELDRIN	0.93	0.48	0.58	ND	ND	0.53	0.73	1.15	0.93	1.15	ND	ND	ND	0.81	1.20	1.2
ENDOSULFAN I	ND	5.88**	2.01**	1.56	0.88	3.59*	0.50	ND	ND	1.18	ND	ND	0.90	ND	ND	ND
ENDOSULFAN II	ND	ND	0.81	4.44**	1.44	2.13*	ND	ND	ND	ND	ND	ND	3.25*	ND	ND	ND
ENDOSULFAN SULFATE	0.62	ND	0.61	2.83	1.26	1.26	1.11	ND	1.36	1.58	ND	ND	ND	ND	ND	ND
ENDRIN	ND	0.61	ND	ND	ND	ND	ND	ND	0.63	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	0.86	ND	0.73	0.90	1.16	ND	0.74	1.20	ND	1.02	1.38	0.82	ND	0.80	0.76	0.8
GAMMA-BHC	0.72	ND	ND	ND	ND	ND	0.51	ND	0.57	ND	1.48	2.00**	ND	0.55	0.59	0.55
HEPTACHLOR	2.00	ND	2.58	1.78	3.86	2.58	ND	ND	2.48	ND	3.88	4.20	3.73	ND	ND	0.79
HEPTACHLOR EPOXIDE	0.82	3.00**	1.29	ND	ND	0.49	ND	ND	2.31	ND	1.11	ND	ND	0.49	1.02	0.56
METHOXYCHLOR	ND	7.20	2.45	ND	ND	ND	ND	ND	2.06	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

TABLE 9-15 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR CHLORINATED PESTICIDES

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
4,4'-DDD	ND	1.39	0.73	0.34	ND	**0.46**	ND	0.29	0.25	0.25	**0.40**	**0.45**	0.33	ND	ND	ND
4,4'-DDE	ND	ND	1.15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	0.75	**1.48**	0.38	**0.80**	0.32	0.76	**1.67**	0.6	**1.35**	**1.23**	**1.25**	ND	ND	ND
ALDRIN	0.33	**1.44**	**4.39**	ND	**5.90**	3.13	**4.05**	**5.96**	2.86	**3.56**	5.42	3.15	2.71	2.3	1.63	1.52
ALPHA-BHC	ND	ND	ND	ND	ND	**28.67**	ND	1.52	**5.40**	1.41	1.74	ND	2.91	ND	ND	ND
BETA-BHC	0.18	**5.04**	**4.43**	0.6	0.57	0.5	**0.43**	**1.11**	**0.79**	0.9	0.27	0.23	ND	0.33	0.13	ND
CHLORBENSIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.08	ND	ND	ND
CHLORDANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DACTHAL	ND	ND	**1.13**	ND	ND	ND	ND	ND	ND	1.64	2.24	2.5	ND	1.51	ND	ND
DELTA-BHC	**8.23**	7.45	4.21	ND	ND	ND	1.79	ND	ND	ND	ND	ND	ND	3.09	5.36	ND
DIELDRIN	**2.42**	0.12	0.83	ND	ND	1.37	1.89	3	2.42	3	ND	ND	ND	2.11	**3.11**	**3.11**
ENDOSULFAN I	ND	**11.84**	**4.76**	5.12	2.9	**11.75**	1.65	ND	ND	3.88	ND	ND	2.96	ND	ND	ND
ENDOSULFAN II	ND	ND	1.07	**4.28**	1.39	**2.05**	ND	ND	ND	ND	ND	ND	**3.13**	ND	ND	ND
ENDOSULFAN SULFATE	0.67	ND	0.73	3.92	1.76	1.76	1.53	ND	1.89	2.2	ND	ND	ND	ND	ND	ND
ENDRIN	ND	1.25	ND	ND	ND	ND	ND	ND	1.29	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	0.66	ND	0.82	0.32	0.41	ND	0.26	0.43	ND	0.36	0.49	0.29	ND	0.28	0.27	0.28
GAMMA-BHC	1.77	ND	ND	ND	ND	ND	0.14	ND	0.15	ND	**0.40**	**0.54**	ND	0.15	0.16	0.15
HEPTACHLOR	0.96	ND	**2.17**	0.21	**0.45**	0.3	ND	ND	0.29	ND	**0.45**	**0.48**	**0.43**	ND	ND	0.09
HEPTACHLOR EPOXIDE	0.87	**3.04**	1.62	ND	ND	1.35	ND	ND	6.34	ND	3.04	ND	ND	1.34	2.79	1.54
METHOXYCHLOR	ND	4.8	1.63	ND	ND	ND	ND	ND	1.37	ND	ND	ND	ND	ND	ND	ND
MIREX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected

Shaded and bolded values = uptake ratios for tissue-residues that statistically exceeded at least one of the placement site/reference tissue-residues

TABLE 9-16A *Nereis virens* (SAND WORM): MEAN PAH CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ACENAPHTHYLENE*	121.13	184.00	**117.00***	5680.25	2515.75	2618.90	701.90	ND	62.60	ND	ND	ND	1216.80	3224.20	932.60	ND
ANTHRACENE	0.72	ND	ND	ND	1.31	ND	ND	ND	1.16	ND	ND	1.18	ND	ND	ND	ND
BENZ[A]ANTHRACENE	ND	ND	ND	ND	1.29	ND	ND	ND	1.18	ND	ND	1.22	ND	ND	ND	ND
BENZO[A]PYRENE	1.52	2.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[B]FLUORANTHENE	1.89	ND	ND	ND	2.39	ND	ND	ND	1.26	ND	ND	1.55	1.48	1.66	ND	ND
BENZO[G,H,I]PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[K]FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.65	ND	ND	ND
CHRYSENE	1.64	0.43	ND	ND	2.64	ND	ND	ND	1.42	ND	ND	0.85	1.58	1.42	0.81	ND
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	4.56	2.00	1.97	ND	2.38	2.71	ND	ND	2.08	ND	ND	3.54	ND	5.80	ND	ND
FLUORENE	2.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.80	ND	ND	ND	ND
INDENO[1,2,3-CD]PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	11.63	**26.33****	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.08	8.28	ND	ND	ND
PHENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.26	ND	ND	ND	ND
PYRENE	7.19	8.13	1.63	0.98	1.01	1.36	1.58	1.68	1.01	1.32	0.93	1.27	0.94	1.03	ND	0.89
TOTAL PAH (ND=0)	27.9	39	3	0.98	9.21	3.36	1.58	1.68	5.65	1.32	0.744	14.9	8.57	8.95	0.62	0.184
TOTAL PAH (ND=1/2DL)	39.7	49.3	17.8	16	22.9	19.7	16.5	16.6	20	16.3	15.9	28	22.7	23	16	15.5
TOTAL PAH (ND=DL)	51.5	59.7	32.6	31	36.5	36	31.5	31.6	34.3	31.3	31.1	41.1	36.8	37	31.4	30.9

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

* not included in Total PAH calculations

TABLE 9-16B *Nereis virens* (SAND WORM): MEAN PAH CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ACENAPHTHYLENE*	184	121.13	117	5680.25	2515.75	2618.9	701.9	ND	62.6	ND	ND	ND	1216.8	3224.2	932.6	ND
ANTHRACENE	ND	0.72	ND	ND	1.31	ND	ND	ND	1.16	ND	ND	1.18	ND	ND	ND	ND
BENZ[A]ANTHRACENE	ND	ND	ND	ND	1.29	ND	ND	ND	1.18	ND	ND	1.22	ND	ND	ND	ND
BENZO[A]PYRENE	2.5	1.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[B]FLUORANTHENE	ND	1.89	ND	ND	2.39	ND	ND	ND	1.26	ND	ND	1.55	1.48	1.66	ND	ND
BENZO[G,H,I]PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[K]FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.65	ND	ND	ND
CHRYSENE	0.43	1.64	ND	ND	2.64	ND	ND	ND	1.42	ND	ND	0.85	1.58	1.42	0.81	ND
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	2	4.56	1.97	ND	2.38	2.71	ND	ND	2.08	ND	ND	3.54	ND	5.8	ND	ND
FLUORENE	ND	2.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.8	ND	ND	ND	ND
INDENO[1,2,3-CD]PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	26.33	11.63	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.08	8.28	ND	ND	ND
PHENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.26	ND	ND	ND	ND
PYRENE	8.13	7.19	1.63	0.98	1.01	1.36	1.58	1.68	1.01	1.32	0.93	1.27	0.94	1.03	ND	0.89
Total PAH (ND=0)	39	27.9	3	0.98	9.21	3.36	1.58	1.68	5.65	1.32	0.744	14.9	8.57	8.95	0.62	0.184
Total PAH (ND=1/2DL)	49.3	39.7	17.8	16	22.9	19.7	16.5	16.6	20	16.3	15.9	28	22.7	23	16	15.5
Total PAH (ND=DL)	59.7	51.5	32.6	31	36.5	36	31.5	31.6	34.3	31.3	31.1	41.1	36.8	37	31.4	30.9

ND = not detected in any of the five tested replicates.

Asterisks indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

* not included in total PAH calculations

TABLE 9-16C *Nereis virens* (SAND WORM): MEAN PAH CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ACENAPHTHYLENE*	117.00	184.00	121.13	5680.25	2515.75	2618.90	701.90	ND	62.60	ND	ND	ND	1216.80	3224.20	932.60	ND
ANTHRACENE	ND	ND	0.72	ND	1.31	ND	ND	ND	1.16	ND	ND	1.18	ND	ND	ND	ND
BENZ[A]ANTHRACENE	ND	ND	ND	ND	1.29	ND	ND	ND	1.18	ND	ND	1.22	ND	ND	ND	ND
BENZO[A]PYRENE	ND	**2.50** **	1.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[B]FLUORANTHENE	ND	ND	1.89	ND	2.39	ND	ND	ND	1.26	ND	ND	1.55	1.48	1.66	ND	ND
BENZO[G,H,I]PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[K]FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.65	ND	ND	ND
CHRYSENE	ND	0.43	**1.64***	ND	**2.64***	ND	ND	ND	1.42	ND	ND	0.85	1.58	1.42	0.81	ND
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	1.97	2.00	**4.56***	ND	2.38	2.71	ND	ND	2.08	ND	ND	3.54	ND	**5.80***	ND	ND
FLUORENE	ND	ND	2.96	ND	ND	ND	ND	ND	ND	ND	ND	2.80	ND	ND	ND	ND
INDENO[1,2,3-CD]PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	ND	**26.33** **	11.63	ND	ND	ND	ND	ND	ND	ND	ND	8.08	8.28	ND	ND	ND
PHENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.26	ND	ND	ND	ND
PYRENE	1.63	**8.13**B**	**7.19**B**	0.98	1.01	1.36	1.58	1.68	1.01	1.32	0.93	1.27	0.94	1.03	ND	0.89
TOTAL PAH (ND=0)	3	**39** **	**27.9** **	0.98	9.21	3.36	1.58	1.68	5.65	1.32	0.744	14.9	8.57	**8.95** **	0.62	0.184
TOTAL PAH (ND=1/2DL)	17.8	**49.3** **	**39.7** **	16	22.9	19.7	16.5	16.6	20	16.3	15.9	28	22.7	**23***	16	15.5
TOTAL PAH (ND=DL)	32.6	**59.7** **	**51.5** **	31	36.5	36	31.5	31.6	34.3	31.3	31.1	41.1	36.8	**37***	31.4	30.9

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statitically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

* not included in Total PAH calculation

TABLE 9-17 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR PAHs

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill I Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ACENAPHTHYLENE	**0.37**	0.16	2.07	270.49	119.8	124.71	33.42	ND	2.98	ND	ND	ND	57.94	153.53	44.41	ND
ANTHRACENE	ND	ND	0.8	ND	2.39	ND	ND	ND	2.11	ND	ND	2.15	ND	ND	ND	ND
BENZ[A]ANTHRACENE	ND	ND	ND	ND	0.19	ND	ND	ND	0.18	ND	ND	0.18	ND	ND	ND	ND
BENZO[A]PYRENE	ND	**0.95**	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[B]FLUORANTHENE	ND	ND	1.07	ND	0.92	ND	ND	ND	0.48	ND	ND	0.6	0.57	0.64	ND	ND
BENZO[G,H,I]PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO[K]FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.49	ND	ND	ND
CHRYSENE	ND	0.47	**0.62**	ND	**0.12**	ND	ND	ND	0.06	ND	ND	0.04	0.07	0.06	0.04	ND
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	0.12	0.58	**0.80**	ND	0.27	0.3	ND	ND	0.23	ND	ND	0.4	ND	**0.65**	ND	ND
FLUORENE	ND	ND	2.56	ND	ND	ND	ND	ND	ND	ND	ND	2.8	ND	ND	ND	ND
INDENO[1,2,3-CD]PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	ND	**0.83**	0.33	ND	ND	ND	ND	ND	ND	ND	ND	0.22	0.22	ND	ND	ND
PHENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.94	ND	ND	ND	ND
PYRENE	0.1	**1.51**	**2.49**	0.59	0.61	0.82	0.95	1.01	0.6	0.79	0.56	0.76	0.56	0.62	ND	0.53
TOTAL PAH (ND=0)	0.01	**0.79**	**0.43**	0.01	0.12	0.04	0.02	0.02	0.07	0.02	0.01	0.19	0.11	**0.11**	0.01	0
TOTAL PAH (ND=1/2DL)	0.04	**0.84**	**0.54**	0.18	0.26	0.22	0.19	0.19	0.22	0.18	0.18	0.32	0.26	**0.26**	0.18	0.17
TOTAL PAH (ND=DL)	0.08	**0.87**	**0.63**	0.32	0.37	0.37	0.32	0.32	0.35	0.32	0.32	0.42	0.38	**0.38**	0.32	0.32

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

TABLE 9-18A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PAH CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	25.49	39.75	5.44	ND	ND	3.40	4.26	6.92	3.14	5.98	3.96	ND	4.44	ND	ND	ND
ACENAPHTHYLENE*	495.20	ND	ND	548.40	208.00	526.20	ND	ND	400.00	52.80	494.00	630.20	602.40	**784.00***	512.40	**546.00***
ANTHRACENE	3.50	2.75	ND	2.44	2.44	1.83	1.18	1.85	3.21	1.87	2.72	3.86	3.11	1.81	2.46	4.1
BENZ[A]ANTHRACENE	1.15	**3.38***	ND	1.81	**3.29***	1.48	1.67	2.30	**3.91***	1.18	**3.44****	**3.52****	2.29	**3.24****	**3.14****	**3.74****
BENZO[A]PYRENE	4.45	6.85	ND	0.64	0.89	0.65	ND	0.57	1.04	ND	0.96	0.95	1.50	0.50	ND	1.1
BENZO[B]FLUORANTHENE	11.28	9.57	2.76	7.44	**16.20***	9.44	7.66	7.74	6.84	6.40	7.92	7.44	10.86	11.40	10.22	**16.40***
BENZO[G,H,I]PERYLENE	1.24	**2.48****	ND	ND	ND	ND	ND	ND	1.38	ND	ND	ND	1.74	ND	ND	ND
BENZO[K]FLUORANTHENE	2.10	2.01	0.96	0.54	0.65	0.57	ND	0.54	0.82	ND	0.82	0.79	0.91	ND	ND	0.63
CHRYSENE	8.43	1.90	3.22	4.52	4.90	3.78	ND	1.81	5.06	1.24	3.80	3.94	3.13	3.70	3.74	4.64
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	16.09	7.58	7.48	9.32	9.60	9.34	10.18	9.20	9.78	11.12	16.52	12.80	10.10	8.66	16.86	9.74
FLUORENE	10.61	30.15	ND	7.88	10.64	9.80	10.02	9.94	11.00	10.18	9.40	9.80	8.22	10.50	10.10	**18.00****
INDENO[1,2,3-CD]PYRENE	1.14	**2.70****	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	33.62	35.75	13.16	16.32	ND	10.76	36.00	37.80	32.60	44.00	32.80	35.40	23.48	39.60	41.40	**48.60***
PHENANTHRENE	3.58	3.13	2.28	2.70	2.94	3.16	2.18	2.24	3.08	2.52	3.62	2.80	4.04	2.18	2.28	**4.64***
PYRENE	43.40	57.50	3.20	4.38	5.70	4.94	4.22	4.46	5.14	4.86	6.06	6.14	6.62	3.24	5.12	5.42
TOTAL PAH (ND=0)	162	204	30.5	51.6	56.1	49.4	74	81.8	83.5	87.1	89.5	86.8	72.5	83	93.5	117
TOTAL PAH (ND=1/2DL)	166	206	40.9	60.8	66.1	58.8	80.7	87.4	88.7	92.4	94.4	92.6	80.2	90.1	101	122
TOTAL PAH (ND=DL)	170	207	51.4	70.1	76.1	68.2	87.3	93	93.9	97.7	99.4	98.5	88	97.2	108	128

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

* not included in Total PAH calculation

TABLE 9-18B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PAH CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	39.75	25.49	5.44	ND	ND	3.40	4.26	6.92	3.14	5.98	3.96	ND	4.44	ND	ND	ND
ACENAPHTHYLENE*	ND	495.20	ND	548.40	**208.00****	**526.20***	ND	ND	**400.00****	52.80	**494.00****	**630.20***	602.40	**784.00****	512.40	**546.00****
ANTHRACENE	2.75	3.50	ND	2.44	2.44	1.83	1.18	1.85	3.21	1.87	2.72	**3.86***	3.11	1.81	2.46	**4.10****
BENZ[A]ANTHRACENE	3.38	1.15	ND	1.81	3.29	1.48	1.67	2.30	3.91	1.18	3.44	3.52	2.29	3.24	3.14	3.74
BENZO[A]PYRENE	6.85	4.45	ND	0.64	0.89	0.65	ND	0.57	1.04	ND	0.96	0.95	1.50	0.50	ND	1.1
BENZO[B]FLUORANTHENE	9.57	11.28	2.76	7.44	**16.20****	9.44	7.66	7.74	6.84	6.40	7.92	7.44	10.86	11.40	10.22	**16.40****
BENZO[G,H,I]PERYLENE	2.48	1.24	ND	ND	ND	ND	ND	ND	1.38	ND	ND	ND	1.74	ND	ND	ND
BENZO[K]FLUORANTHENE	2.01	2.10	0.96	0.54	0.65	0.57	ND	0.54	0.82	ND	0.82	0.79	0.91	ND	ND	0.63
CHRYSENE	1.90	**8.43****	**3.22****	**4.52**B**	**4.90****	3.78	ND	1.81	**5.06****	1.24	**3.80****	**3.94****	3.13	**3.70****	**3.74****	**4.64****
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	7.58	16.09	7.48	9.32	9.60	9.34	10.18	9.20	9.78	11.12	16.52	**12.80***	10.10	8.66	16.86	9.74
FLUORENE	30.15	10.61	ND	7.88	10.64	9.80	10.02	9.94	11.00	10.18	9.40	9.80	8.22	10.50	10.10	18
INDENO[1,2,3-CD]PYRENE	2.70	1.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	35.75	33.62	13.16	16.32	ND	10.76	36.00	37.80	32.60	44.00	32.80	35.40	23.48	39.60	41.40	**48.60***
PHENANTHRENE	3.13	3.58	2.28	2.70	2.94	3.16	2.18	2.24	3.08	2.52	3.62	2.80	4.04	2.18	2.28	4.64
PYRENE	57.50	43.40	3.20	4.38	5.70	4.94	4.22	4.46	5.14	4.86	6.06	6.14	6.62	3.24	5.12	5.42
Total PAH (ND=0)	204	162	30.5	51.6	56.1	49.4	74	81.8	83.5	87.1	89.5	86.8	72.5	83	93.5	117
Total PAH (ND=1/2DL)	206	166	40.9	60.8	66.1	58.8	80.7	87.4	88.7	92.4	94.4	92.6	80.2	90.1	101	122
Total PAH (ND=DL)	207	170	51.4	70.1	76.1	68.2	87.3	93	93.9	97.7	99.4	98.5	88	97.2	108	128

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

* not included in total PAH calculation

TABLE 9-18C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PAH CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	5.44	**39.75****	**25.49****	ND	ND	3.40	4.26	6.92	3.14	5.98	3.96	ND	4.44	ND	ND	ND
ACENAPHTHYLENE*	ND	ND	495.20	548.40	**208.00****	**526.20***	ND	ND	**400.00****	52.80	**494.00****	**630.20***	602.40	**784.00****	512.40	**546.00****
ANTHRACENE	ND	**2.75****	**3.50****	2.44	2.44	1.83	1.18	1.85	**3.21***	1.87	2.72	**3.86****	**3.11*B**	1.81	2.46	**4.10****
BENZ[A]ANTHRACENE	ND	**3.38***	1.15	1.81	**3.29***	1.48	1.67	2.30	**3.91***	1.18	**3.44****	**3.52****	2.29	**3.24****	**3.14****	**3.74****
BENZO[A]PYRENE	ND	**6.85****	**4.45****	0.64	0.89	0.65	ND	0.57	1.04	ND	**0.96***	**0.95***	1.50	0.50	ND	**1.10***
BENZO[B]FLUORANTHENE	2.76	**9.57****	**11.28****	**7.44**B**	**16.20****	**9.44**B**	**7.66****	**7.74****	**6.84****	**6.40***	**7.92****	**7.44****	**10.86**B**	**11.40****	**10.22****	**16.40****
BENZO[G,H,I]PERYLENE	ND	**2.48****	1.24	ND	ND	ND	ND	ND	1.38	ND	ND	ND	1.74	ND	ND	ND
BENZO[K]FLUORANTHENE	0.96	2.01	2.10	0.54	0.65	0.57	ND	0.54	0.82	ND	0.82	0.79	0.91	ND	ND	0.63
CHRYSENE	3.22	1.90	**8.43***	**4.52**B**	**4.90****	3.78	ND	1.81	**5.06****	1.24	**3.80***	**3.94****	3.13	**3.70***	**3.74****	**4.64****
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	7.48	7.58	**16.09***	**9.32**B**	**9.60****	**9.34*B**	**10.18***	**9.20****	**9.78****	**11.12***	**16.52****	**12.80****	**10.10*B**	8.66	**16.86***	**9.74****
FLUORENE	ND	**30.15***	**10.61***	**7.88*B**	**10.64****	**9.80**B**	**10.02****	**9.94****	**11.00****	**10.18****	**9.40****	**9.80****	**8.22*B**	**10.50****	**10.10****	**18.00****
INDENO[1,2,3-CD]PYRENE	ND	**2.70****	1.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	13.16	**35.75***	**33.62***	16.32	ND	10.76	**36.00***	**37.80***	32.60	**44.00****	**32.80***	**35.40***	23.48	**39.60****	**41.40****	**48.60****
PHENANTHRENE	2.28	3.13	3.58	2.70	2.94	3.16	2.18	2.24	**3.08***	2.52	3.62	2.80	4.04	2.18	2.28	**4.64****
PYRENE	3.20	**57.50****	**43.40****	**4.38*B**	**5.70****	**4.94**B**	**4.22***	4.46	**5.14***	4.86	**6.06****	**6.14****	**6.62*B**	3.24	**5.12***	**5.42****
TOTAL PAH (ND=0)	30.5	**204****	**162****	51.6	**56.1***	49.4	**74****	**81.8****	**83.5****	**87.1****	**89.5****	**86.8****	**72.5***	**83****	**93.5****	**117****
TOTAL PAH (ND=1/2DL)	40.9	**206****	**166****	**60.8***	**66.1****	**58.8***	**80.7****	**87.4****	**88.7****	**92.4****	**94.4****	**92.6****	**80.2***	**90.1****	**101****	**122****
TOTAL PAH (ND=DL)	51.4	**207****	**170****	**70.1***	**76.1****	**68.2***	**87.3****	**93****	**93.9****	**97.7****	**99.4****	**98.5****	**88***	**97.2****	**108****	**128****

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site (p < 0.05*, p < 0.01).**

* not included in Total PAH calculation

TABLE 9-19 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR PAHs

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ACENAPHTHENE	0.74	**1.08**	**5.94**	ND	ND	1.21	1.52	2.47	1.12	2.14	1.41	ND	1.59	ND	ND	ND
ACENAPHTHYLENE	ND	ND	2.04	1.97	**0.75**	**1.89**	ND	ND	**1.43**	0.19	**1.77**	**2.26**	2.16	**2.81**	1.84	**1.96**
ANTHRACENE	ND	**5.00**	**3.94**	1.97	1.97	1.48	0.95	1.49	**2.59**	1.51	2.19	**3.11**	**2.51**	1.46	1.98	**3.31**
BENZ[A]ANTHRACENE	ND	**4.50**	1.53	2.41	**4.39**	1.97	2.23	3.07	**5.21**	1.57	**4.59**	**4.69**	3.05	**4.32**	**4.19**	**4.99**
BENZO[A]PYRENE	ND	**2.89**	**6.70**	1.57	2.18	1.58	ND	1.39	2.55	ND	**2.34**	**2.32**	3.66	1.21	ND	**2.69**
BENZO[B]FLUORANTHENE	0.57	**5.98**	**5.91**	**3.61**	**7.86**	**4.58**	**3.72**	**3.76**	**3.32**	**3.11**	**3.84**	**3.61**	**5.27**	**5.53**	**4.96**	**7.96**
BENZO[G,H,I]PERYLENE	ND	**2.75**	1.38	ND	ND	ND	ND	ND	1.53	ND	ND	ND	1.93	ND	ND	ND
BENZO[K]FLUORANTHENE	0.89	4.57	4.76	1.24	1.48	1.3	ND	1.23	1.87	ND	1.85	1.79	2.07	ND	ND	1.43
CHRYSENE	**6.71**	2.29	**5.68**	**2.47**	**2.68**	2.07	ND	0.99	**2.77**	0.68	**2.08**	**2.16**	1.71	**2.02**	**2.05**	**2.54**
DIBENZ[A,H]ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	0.43	1.76	**2.44**	**1.06**	**1.10**	**1.07**	**1.16**	**1.05**	**1.12**	**1.27**	**1.89**	**1.46**	**1.15**	0.99	**1.92**	**1.11**
FLUORENE	ND	**2.56**	**1.05**	**0.87**	**1.17**	**1.08**	**1.10**	**1.09**	**1.21**	**1.12**	**1.04**	**1.08**	**0.91**	**1.16**	**1.11**	**1.98**
INDENO[1,2,3-CD]PYRENE	ND	**3.37**	1.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	0.09	**1.07**	**1.24**	0.77	ND	0.51	**1.71**	**1.79**	1.55	**2.09**	**1.56**	**1.68**	1.11	**1.88**	**1.96**	**2.31**
PHENANTHRENE	0.38	1.56	1.54	1.07	1.17	1.25	0.87	0.89	**1.22**	1	1.44	1.11	1.6	0.87	0.9	**1.84**
PYRENE	0.29	**14.26**	**14.05**	**1.58**	**2.06**	**1.78**	**1.52**	1.61	**1.86**	1.76	**2.19**	**2.22**	**2.39**	1.17	**1.85**	**1.96**
TOTAL PAH (ND=0)	0.13	**2.19**	**2.93**	1.17	**1.27**	1.12	**1.68**	**1.86**	**1.90**	**1.98**	**2.03**	**1.97**	**1.65**	**1.89**	**2.13**	**2.65**
TOTAL PAH (ND=1/2DL)	0.17	**2.07**	**2.53**	**1.13**	**1.23**	**1.09**	**1.50**	**1.62**	**1.65**	**1.72**	**1.75**	**1.72**	**1.49**	**1.67**	**1.87**	**2.27**
TOTAL PAH (ND=DL)	0.2	**1.96**	**2.25**	**1.10**	**1.19**	**1.07**	**1.37**	**1.46**	**1.47**	**1.53**	**1.56**	**1.54**	**1.38**	**1.52**	**1.69**	**2.01**

ND = not detected

Shaded and bolded values = uptake ratios for tissue-residues that statistically exceeded at least one of the placement site/reference tissue-residues

TABLE 9-20A *Nereis virens* (SAND WORM): MEAN PCB AROCLOR CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of five tested replicates.

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TABLE 9-20B *Nereis virens* (SAND WORM): MEAN PCB AROCLOR CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of the five tested replicates.

Asterisks indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p<0.05$*, $p<0.01$**).

TABLE 9-20C *Nereis virens* (SAND WORM): MEAN PCB AROCLOR CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of the five tested replicates.

TABLE 9-21 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR PCB AROCLORS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

TABLE 9-22A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PCB AROCLOR CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of the five tested replicates.

TABLE 9-22B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PCB AROCLOR CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of the five tested replicates.

Asterisks indicate sites where mean tissue residues were statistically higher than Outside Site 104 (p<0.05*, p<0.01**).

TABLE 9-22C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PCB AROCLOR CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected in any of five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p<0.05$*, $p<0.01$).**

TABLE 9-23 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR PCB AROCLORS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
AROCLOR 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected

Shaded and bolded values = uptake ratios for tissue-residues that statistically exceeded at least one of the placement site/reference tissue-residues

TABLE 9-24A *Nereis virens* (SAND WORM): MEAN PCB CONGENER[(a)] AND TOTAL PCB CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	ND	ND	ND	ND	ND	ND	ND	17.7	ND	3.1	3.55	ND	15.1	1.58	ND
BZ# 18	0.238	0.823	ND	ND	ND	ND	ND	ND	0.177	ND	0.164	0.153	ND	ND	ND	ND
BZ# 28	1.36	1.67	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.179	ND	ND	ND	ND
BZ# 44	0.232	ND	ND	ND	ND	ND	0.146	ND	ND	0.164	ND	0.157	0.15	ND	0.128	ND
BZ# 49	0.399	0.645	ND	0.364	ND	ND	ND	ND	ND	0.252	0.697	1.21	ND	ND	0.294	ND
BZ# 52	1.27	0.835	3.15	ND	ND	ND	ND	ND	ND	ND	ND	0.183	ND	ND	ND	ND
BZ# 66	ND	ND	ND	ND	1.59	ND	ND	ND	ND	ND	ND	0.449	ND	ND	ND	ND
BZ# 77	1.88	0.404	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.622	ND	ND	ND	0.281
BZ# 87	0.416	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.201	0.11	ND	ND	ND
BZ# 101	1.14	ND	ND	0.484	0.802	0.454	0.864	0.258	0.307	0.354	0.443	0.806	0.246	0.586	0.266	0.308
BZ# 105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.173	ND	ND	ND	ND
BZ# 118	0.273	ND	ND	ND	ND	ND	10	8.06	0.743	6.38	ND	2.48	ND	5.28	ND	ND
BZ# 126	0.229	ND	ND	0.32	0.506	ND	ND	ND	ND	2.88	ND	5.88	ND	ND	0.44	ND
BZ# 128	0.206	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.125	ND	ND	ND	ND
BZ# 138	0.92	0.818	ND	0.728	0.54	0.896	0.824	0.282	0.436	0.752	0.886	0.834	0.31	0.288	0.886	0.58
BZ# 153	2.11	1.92	ND	1.78	1.02	1.9	1.7	1.28	1.78	1.96	1.94	2.38	1.58	1.52	2.24	1.75
BZ# 156	ND	ND	ND	0.103	ND	ND	ND	0.0992	ND	ND	ND	0.122	ND	ND	0.109	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.133	ND	ND	ND	ND
BZ# 170	0.333	0.34	ND	0.195	ND	0.084	ND	0.088	0.0876	0.084	0.098	0.268	0.084	0.171	0.15	0.159
BZ# 180	0.691	0.568	ND	0.65	0.391	0.642	0.612	0.411	0.478	0.622	0.64	0.75	0.472	0.418	0.768	0.525
BZ# 183	0.107	ND	ND	ND	ND	0.127	0.159	ND	0.078	0.102	0.0788	0.0877	0.0844	ND	0.137	ND
BZ# 184	0.856	ND	ND	0.172	0.32	0.108	ND	0.116	0.13	0.242	0.417	0.876	0.11	0.512	0.81	1.7
BZ# 187	0.649	0.887	ND	0.518	ND	0.57	1.51	1.5	0.876	1.17	0.862	0.946	0.462	0.41	0.686	0.512
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.251	ND	ND	ND	ND
BZ# 206	0.158	0.525	ND	0.399	ND	0.526	0.177	0.116	ND	0.215	0.172	0.199	0.237	0.112	0.439	0.532
BZ# 209	0.294	0.486	ND	0.279	0.495	0.53	ND	0.625	ND	ND	ND	0.159	0.408	ND	0.445	0.75
TOTAL PCBs (ND=0)	21.4	16	5.6	9.01	8.82	8.96	31.2	23	44.3	28.1	15.8	38.4	6	46.8	13.6	7.8
TOTAL PCBs (ND=1/2)	24.5	21.6	33.3	11.2	11.2	11.2	33.2	25.5	46.5	30.2	18	40.1	8.43	49	15.8	10.1
TOTAL PCBs (ND=DL)	27.5	27.2	**61****	13.4	13.6	13.4	35.3	27.9	48.7	32.4	20.2	41.8	10.9	51.3	18	12.3

ND = not detected in any of five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for total PCB congeners only.

Total PCBs determined by summing congeners as specified in ITM (Table 9-3) and multiplying total hy a facor of 2 as per NOAA 1993 guidance.

Note that the mean of total PCB for individual tissue replicates is not equivalent to the sum of mean congeners for ND=0 and ND=1/2DL.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-24B *Nereis virens* (SAND WORM): MEAN PCB CONGENER[a] AND TOTAL PCB CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	ND	ND	ND	ND	ND	ND	ND	17.7	ND	3.1	3.55	ND	15.1	1.58	ND
BZ# 18	0.823	0.238	ND	ND	ND	ND	ND	ND	0.177	ND	0.164	0.153	ND	ND	ND	ND
BZ# 28	1.67	1.36	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.179	ND	ND	ND	ND
BZ# 44	ND	0.232	ND	ND	ND	ND	0.146	ND	ND	0.164	ND	0.157	0.15	ND	0.128	ND
BZ# 49	0.645	0.399	ND	0.364	ND	ND	ND	ND	ND	0.252	0.697	1.21	ND	ND	0.294	ND
BZ# 52	0.835	1.27	3.15	ND	ND	ND	ND	ND	ND	ND	ND	0.183	ND	ND	ND	ND
BZ# 66	ND	ND	ND	ND	1.59	ND	ND	ND	ND	ND	ND	0.449	ND	ND	ND	ND
BZ# 77	0.404	1.88	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.622	ND	ND	ND	0.281
BZ# 87	ND	0.416	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.201	0.11	ND	ND	ND
BZ# 101	ND	1.14	ND	0.484	0.802	0.454	0.864	0.258	0.307	0.354	0.443	0.806	0.246	0.586	0.266	0.308
BZ# 105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.173	ND	ND	ND	ND
BZ# 118	ND	0.273	ND	ND	ND	ND	10	8.06	0.743	6.38	ND	2.48	ND	5.28	ND	ND
BZ# 126	ND	0.229	ND	0.32	0.506	ND	ND	ND	ND	2.88	ND	5.88	ND	ND	0.44	ND
BZ# 128	ND	0.206	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.125	ND	ND	ND	ND
BZ# 138	0.818	0.92	ND	0.728	0.54	0.896	0.824	0.282	0.436	0.752	0.886	0.834	0.31	0.288	0.886	0.58
BZ# 153	1.92	2.11	ND	1.78	1.02	1.9	1.7	1.28	1.78	1.96	1.94	2.38	1.58	1.52	2.24	1.75
BZ# 156	ND	ND	ND	0.103	ND	ND	ND	0.0992	ND	ND	ND	0.122	ND	ND	0.109	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.133	ND	ND	ND	ND
BZ# 170	0.34	0.333	ND	0.195	ND	0.084	ND	0.088	0.0876	0.084	0.098	0.268	0.084	0.171	0.15	0.159
BZ# 180	0.568	0.691	ND	0.65	0.391	0.642	0.612	0.411	0.478	0.622	0.64	0.75	0.472	0.418	0.768	0.525
BZ# 183	ND	0.107	ND	ND	ND	0.127	0.159	ND	0.078	0.102	0.0788	0.0877	0.0844	ND	0.137	ND
BZ# 184	ND	0.856	ND	0.172	0.32	0.108	ND	0.116	0.13	0.242	0.417	0.876	0.11	0.512	0.81	1.7
BZ# 187	0.887	0.649	ND	0.518	ND	0.57	1.51	1.5	0.876	1.17	0.862	0.946	0.462	0.41	0.686	0.512
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.251	ND	ND	ND	ND
BZ# 206	0.525	0.158	ND	0.399	ND	0.526	0.177	0.116	ND	0.215	0.172	0.199	0.237	0.112	0.439	0.532
BZ# 209	0.486	0.294	ND	0.279	0.495	0.53	ND	0.625	ND	ND	ND	0.159	0.408	ND	0.445	0.75
TOTAL PCBs (ND=0)	16	21.4	5.6	9.01	8.82	8.96	31.2	23	44.3	28.1	15.8	38.4	6	46.8	13.6	7.8
TOTAL PCBs (ND=1/2)	21.6	24.5	**33.3***	11.2	11.2	11.2	33.2	25.5	46.5	30.2	18	40.1	8.43	49	15.8	10.1
TOTAL PCBs (ND=DL)	27.2	27.5	**61****	13.4	13.6	13.4	35.3	27.9	48.7	32.4	20.2	41.8	10.9	51.3	18	12.3

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for total PCB congeners only

Total PCBs determined by summing congeners as specified in ITM (Table 9-3) and multiplying total by a facor of 2 as per NOAA 1993 guidance.

Note that the mean of total PCB for individual tissue replicates is not equivalent to the sum of mean congeners for ND=0 and ND=1/2DL.

TABLE 9-24C *Nereis virens* (SAND WORM): MEAN PCB CONGENER[(a)] AND TOTAL PCB CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	ND	ND	ND	ND	ND	ND	ND	17.7	ND	3.1	3.55	ND	15.1	1.58	ND
BZ# 18	ND	0.823	0.238	ND	ND	ND	ND	ND	0.177	ND	0.164	0.153	ND	ND	ND	ND
BZ# 28	ND	1.67	1.36	ND	ND	ND	ND	ND	ND	ND	ND	0.179	ND	ND	ND	ND
BZ# 44	ND	ND	0.232	ND	ND	ND	0.146	ND	ND	0.164	ND	0.157	0.15	ND	0.128	ND
BZ# 49	ND	0.645	0.399	0.364	ND	ND	ND	ND	ND	0.252	0.697	1.21	ND	ND	0.294	ND
BZ# 52	3.15	0.835	1.27	ND	ND	ND	ND	ND	ND	ND	ND	0.183	ND	ND	ND	ND
BZ# 66	ND	ND	ND	ND	1.59	ND	ND	ND	ND	ND	ND	0.449	ND	ND	ND	ND
BZ# 77	ND	0.404	1.88	ND	ND	ND	ND	ND	ND	ND	ND	0.622	ND	ND	ND	0.281
BZ# 87	ND	ND	0.416	ND	ND	ND	ND	ND	ND	ND	ND	0.201	0.11	ND	ND	ND
BZ# 101	ND	ND	1.14	0.484	0.802	0.454	0.864	0.258	0.307	0.354	0.443	0.806	0.246	0.586	0.266	0.308
BZ# 105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.173	ND	ND	ND	ND
BZ# 118	ND	ND	0.273	ND	ND	ND	10	8.06	0.743	6.38	ND	2.48	ND	5.28	ND	ND
BZ# 126	ND	ND	0.229	0.32	0.506	ND	ND	ND	ND	2.88	ND	5.88	ND	ND	0.44	ND
BZ# 128	ND	ND	0.206	ND	ND	ND	ND	ND	ND	ND	ND	0.125	ND	ND	ND	ND
BZ# 138	ND	0.818	0.92	0.728	0.54	0.896	0.824	0.282	0.436	0.752	0.886	0.834	0.31	0.288	0.886	0.58
BZ# 153	ND	1.92	2.11	1.78	1.02	1.9	1.7	1.28	1.78	1.96	1.94	2.38	1.58	1.52	2.24	1.75
BZ# 156	ND	ND	ND	0.103	ND	ND	ND	0.0992	ND	ND	ND	0.122	ND	ND	0.109	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.133	ND	ND	ND	ND
BZ# 170	ND	0.34	0.333	0.195	ND	0.084	ND	0.088	0.0876	0.084	0.098	0.268	0.084	0.171	0.15	0.159
BZ# 180	ND	0.568	0.691	0.65	0.391	0.642	0.612	0.411	0.478	0.622	0.64	0.75	0.472	0.418	0.768	0.525
BZ# 183	ND	ND	0.107	ND	ND	0.127	0.159	ND	0.078	0.102	0.0788	0.0877	0.0844	ND	0.137	ND
BZ# 184	ND	ND	0.856	0.172	0.32	0.108	ND	0.116	0.13	0.242	0.417	0.876	0.11	0.512	0.81	1.7
BZ# 187	ND	0.887	0.649	0.518	ND	0.57	1.51	1.5	0.876	1.17	0.862	0.946	0.462	0.41	0.686	0.512
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.251	ND	ND	ND	ND
BZ# 206	ND	0.525	0.158	0.399	ND	0.526	0.177	0.116	ND	0.215	0.172	0.199	0.237	0.112	0.439	0.532
BZ# 209	ND	0.486	0.294	0.279	0.495	0.53	ND	0.625	ND	ND	ND	0.159	0.408	ND	0.445	0.75
TOTAL PCBs (ND=0)	5.6	**16***	21.4	9.01	8.82	8.96	**31.2***	23	44.3	**28.1***	15.8	**38.4***	6	46.8	13.6	7.8
TOTAL PCBs (ND=1/2)	33.3	21.6	24.5	11.2	11.2	11.2	33.2	25.5	46.5	30.2	18	40.1	8.43	49	15.8	10.1
TOTAL PCBs (ND=DL)	61	27.2	27.5	13.4	13.6	13.4	35.3	27.9	48.7	32.4	20.2	41.8	10.9	51.3	18	12.3

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for total PCB congeners only

Total PCBs determined by summing congeners as specified in ITM (Table 9-3) and multiplying total by a facor of 2 as per NOAA 1993 guidance.

Note that the mean of total PCB for individual tissue replicates is not equivalent to the sum of mean congeners for ND=0 and ND=1/2DL.

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TABLE 9-25 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR PCB CONGENERS AND TOTAL PCBs

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	ND	ND	ND	ND	ND	ND	ND	19.49	ND	3.42	3.92	ND	16.65	1.74	ND
BZ# 18	ND	4.57	1.69	ND	ND	ND	ND	ND	2.95	ND	2.73	2.55	ND	ND	ND	ND
BZ# 28	ND	1.74	1.93	ND	ND	ND	ND	ND	ND	ND	ND	2.98	ND	ND	ND	ND
BZ# 44	ND	ND	2.59	ND	ND	ND	2.65	ND	ND	2.98	ND	2.85	2.73	ND	2.33	ND
BZ# 49	ND	0.33	0.4	1.19	ND	ND	ND	ND	ND	0.82	2.27	3.95	ND	ND	0.96	ND
BZ# 52	0.93	1.24	1.87	ND	ND	ND	ND	ND	ND	ND	ND	0.26	ND	ND	ND	ND
BZ# 66	ND	ND	ND	ND	1.82	ND	ND	ND	ND	ND	ND	0.51	ND	ND	ND	ND
BZ# 77	ND	1.28	2.76	ND	ND	ND	ND	ND	ND	ND	ND	0.09	ND	ND	ND	0.04
BZ# 87	ND	ND	1.16	ND	ND	ND	ND	ND	ND	ND	ND	0.44	0.24	ND	ND	ND
BZ# 101	ND	ND	3.12	1.01	1.67	0.95	1.8	0.54	0.64	0.74	0.92	1.68	0.51	1.22	0.55	0.64
BZ# 105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.16	ND	ND	ND	ND
BZ# 118	ND	ND	1.24	ND	ND	ND	95.64	76.79	7.08	60.78	ND	23.64	ND	50.32	ND	ND
BZ# 126	ND	ND	1.13	3.2	5.06	ND	ND	ND	ND	28.8	ND	58.78	ND	ND	4.4	ND
BZ# 128	ND	ND	1.35	ND	ND	ND	ND	ND	ND	ND	ND	1.79	ND	ND	ND	ND
BZ# 138	ND	1.21	1.56	1.56	1.16	1.92	1.77	0.6	0.93	1.61	1.9	1.79	0.66	0.62	1.9	1.24
BZ# 153	ND	1.38	1.89	2.39	1.38	2.56	2.29	1.73	2.39	2.64	2.61	3.20	2.13	2.04	3.01	2.35
BZ# 156	ND	ND	ND	2.35	ND	ND	ND	2.25	ND	ND	ND	2.78	ND	ND	2.48	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.42	ND	ND	ND	ND
BZ# 170	ND	2.17	2.55	5.2	ND	2.24	ND	2.35	2.34	2.24	2.61	7.15	2.24	4.56	4.01	4.23
BZ# 180	ND	1.52	1.81	1.62	0.97	1.6	1.52	1.02	1.19	1.55	1.59	1.87	1.18	1.04	1.91	1.31
BZ# 183	ND	ND	1.3	ND	ND	3.34	4.19	ND	2.05	2.69	2.07	2.31	2.22	ND	3.6	ND
BZ# 184	ND	ND	5.08	0.69	1.28	0.43	ND	0.46	0.52	0.97	1.67	3.50	0.44	2.05	3.24	6.80
BZ# 187	ND	1.69	1.69	5.89	ND	6.48	17.16	17.07	9.95	13.34	9.8	10.75	5.25	4.66	7.8	5.82
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.86	ND	ND	ND	ND
BZ# 206	ND	3.18	1.33	7.25	ND	9.56	3.22	2.11	ND	3.91	3.13	3.62	4.31	2.04	7.98	9.68
BZ# 209	ND	2.16	1.55	1.66	2.94	3.15	ND	3.71	ND	ND	ND	0.94	2.42	ND	2.64	4.46
TOTAL PCB ND=0	0.06	**1.51**	1.73	0.39	0.39	0.39	**1.37**	1.01	1.94	**1.23**	0.69	**1.68**	0.26	2.05	0.59	0.34
TOTAL PCB ND=1/2DL	**0.36**	1.32	1.35	0.45	0.45	0.45	1.34	1.03	1.87	1.22	0.72	1.62	0.34	1.98	0.64	0.41
TOTAL PCB ND=DL	**0.64**	1.22	1.18	0.5	0.51	0.5	1.32	1.04	1.82	1.21	0.75	1.56	0.41	1.91	0.67	0.46

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

TABLE 9-26A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PCB CONGENER[(a)] AND TOTAL PCB CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	0.282	ND	ND	ND	ND	ND	ND	ND	0.28	0.276	ND	0.254	ND	0.288	0.28	ND
BZ# 18	0.817	ND	ND	ND	2.68	0.476	0.308	0.2	ND	0.42	ND	ND	ND	ND	ND	ND
BZ# 28	0.31	ND	ND	ND	0.302	ND	0.49	0.142	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 44	0.204	ND	ND	0.212	0.226	0.746	0.114	0.12	ND	0.15	0.182	ND	0.717	ND	ND	ND
BZ# 49	0.695	0.608	ND	0.988	1.07	ND	ND	ND	ND	ND	ND	ND	1.67	ND	ND	ND
BZ# 52	1.02	0.757	ND	3.62	0.68	3.5	1.87	1.77	0.25	2.76 B	0.296	ND	3.9	0.242	ND	0.256
BZ# 66	0.47	ND	ND	0.911	ND	0.751	0.984	0.539	ND	0.559	ND	ND	0.726	ND	ND	ND
BZ# 77	0.863	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 87	ND	ND	ND	0.695	ND	0.848	0.154	0.144	0.436	0.172	ND	ND	0.773	0.365	ND	ND
BZ# 101	0.663	ND	ND	ND	ND	0.642	ND	0.404	0.26	0.48	0.452	ND	0.754	0.264	ND	ND
BZ# 105	0.192	0.978	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 118	0.251	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 128	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 138	0.344	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 153	0.469	ND	ND	ND	ND	0.186	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 156	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	0.112	ND	ND	ND	ND	ND	0.128	ND
BZ# 170	0.0985	ND	1.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 180	0.15	ND	ND	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 183	ND	ND	ND	ND	ND	ND	0.114	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 184	0.366	ND	ND	0.208	ND	0.158	ND	0.102	ND	ND	0.114	ND	ND	ND	ND	ND
BZ# 187	0.158	ND	ND	0.105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.972	ND	ND	ND	ND	ND
BZ# 206	ND	ND	ND	ND	ND	ND	ND	ND	0.198	ND	0.264	ND	ND	ND	ND	0.114
BZ# 209	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.178
TOTAL PCBs (ND=0)	9.25	3.47	0.96	9.76	7.49	12.3	7.28	5.74	1.27	8.67	1.52	0.316	11.9	1.14	0.536	0.4
TOTAL PCBs (ND=1/2)	13.5	11.1	**46.2****	12.1	10.1	14.4	9.56	8.2	3.97	11	4.27	3.11	14.3	3.87	3.3	3.21
TOTAL PCBs (ND=DL)	17.7	18.7	**91.5****	14.5	12.8	16.6	11.8	10.6	6.68	13.3	7.02	5.9	16.6	6.59	6.07	6.02

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for total PCB congeners only

Total PCBs determined by summing congeners as specified in ITM (Table 9-3) and multiplying total by a facor of 2 as per NOAA 1993 guidance.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 (p < 0.05*, p < 0.01).**

Note that the mean of total PCB for individual tissue replicates is not equivalent to the sum of mean congeners for ND=0 and ND=1/2DL.

TABLE 9-26B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PCB CONGENER[a] AND TOTAL PCB CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	0.282	ND	ND	ND	ND	ND	ND	0.28	0.276	ND	0.254	ND	0.288	0.28	ND
BZ# 18	ND	0.817	ND	ND	2.68	0.476	0.308	0.2	ND	0.42	ND	ND	ND	ND	ND	ND
BZ# 28	ND	0.31	ND	ND	0.302	ND	0.49	0.142	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 44	ND	0.204	ND	0.212	0.226	0.746	0.114	0.12	ND	0.15	0.182	ND	0.717	ND	ND	ND
BZ# 49	0.608	0.695	ND	0.988	1.07	ND	ND	ND	ND	ND	ND	ND	1.67	ND	ND	ND
BZ# 52	0.757	1.02	ND	3.62	0.68	3.5	1.87	1.77	0.25	2.76 B	0.296	ND	3.9	0.242	ND	0.256
BZ# 66	ND	0.47	ND	0.911	ND	0.751	0.984	0.539	ND	0.559	ND	ND	0.726	ND	ND	ND
BZ# 77	ND	0.863	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 87	ND	ND	ND	0.695	ND	0.848	0.154	0.144	0.436	0.172	ND	ND	0.773	0.365	ND	ND
BZ# 101	ND	0.663	ND	ND	ND	0.642	ND	0.404	0.26	0.48	0.452	ND	0.754	0.264	ND	ND
BZ# 105	0.978	0.192	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 118	ND	0.251	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 128	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 138	ND	0.344	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 153	ND	0.469	ND	ND	ND	0.186	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 156	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	0.112	ND	ND	ND	ND	ND	0.128	ND
BZ# 170	ND	0.0985	1.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 180	ND	0.15	ND	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 183	ND	ND	ND	ND	ND	ND	0.114	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 184	ND	0.366	ND	0.208	ND	0.158	ND	0.102	ND	ND	0.114	ND	ND	ND	ND	ND
BZ# 187	ND	0.158	ND	0.105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.972	ND	ND	ND	ND	ND
BZ# 206	ND	ND	ND	ND	ND	ND	ND	ND	0.198	ND	0.264	ND	ND	ND	ND	0.114
BZ# 209	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.178
TOTAL PCBs (ND=0)	3.47	**9.25***	0.96	**9.76****	7.49	**12.3****	7.28	5.74	1.27	**8.67****	1.52	0.316	**11.9****	1.14	0.536	0.4
TOTAL PCBs (ND=1/2)	11.1	13.5	**46.2****	12.1	10.1	14.4	9.56	8.2	3.97	11	4.27	3.11	14.3	3.87	3.3	3.21
TOTAL PCBs (ND=DL)	18.7	17.7	**91.5****	14.5	12.8	16.6	11.8	10.6	6.68	13.3	7.02	5.9	16.6	6.59	6.07	6.02

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for total PCB congeners only

Total PCBs determined by summing congeners as specified in ITM (Table 9-3) and multiplying total by a facor of 2 as per NOAA 1993 guidance.

Note that the mean of total PCB for individual tissue replicates is not equivalent to the sum of mean congeners for ND=0 and ND=1/2DL.

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TABLE 9-26C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN PCB CONGENER[a] AND TOTAL PCB CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (µg/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	ND	0.282	ND	ND	ND	ND	ND	0.28	0.276	ND	0.254	ND	0.288	0.28	ND
BZ# 18	ND	ND	0.817	ND	2.68	0.476	0.308	0.2	ND	0.42	ND	ND	ND	ND	ND	ND
BZ# 28	ND	ND	0.31	ND	0.302	ND	0.49	0.142	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 44	ND	ND	0.204	0.212	0.226	0.746	0.114	0.12	ND	0.15	0.182	ND	0.717	ND	ND	ND
BZ# 49	ND	0.608	0.695	0.988	1.07	ND	ND	ND	ND	ND	ND	ND	1.67	ND	ND	ND
BZ# 52	ND	0.757	1.02	3.62	0.68	3.5	1.87	1.77	0.25	2.76 B	0.296	ND	3.9	0.242	ND	0.256
BZ# 66	ND	ND	0.47	0.911	ND	0.751	0.984	0.539	ND	0.559	ND	ND	0.726	ND	ND	ND
BZ# 77	ND	ND	0.863	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 87	ND	ND	ND	0.695	ND	0.848	0.154	0.144	0.436	0.172	ND	ND	0.773	0.365	ND	ND
BZ# 101	ND	ND	0.663	ND	ND	0.642	ND	0.404	0.26	0.48	0.452	ND	0.754	0.264	ND	ND
BZ# 105	ND	0.978	0.192	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 118	ND	ND	0.251	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 128	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 138	ND	ND	0.344	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 153	ND	ND	0.469	ND	ND	0.186	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 156	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	0.112	ND	ND	ND	ND	ND	0.128	ND
BZ# 170	1.01	ND	0.0985	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 180	ND	ND	0.15	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 183	ND	ND	ND	ND	ND	ND	0.114	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 184	ND	ND	0.366	0.208	ND	0.158	ND	0.102	ND	ND	0.114	ND	ND	ND	ND	ND
BZ# 187	ND	ND	0.158	0.105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.972	ND	ND	ND	ND	ND
BZ# 206	ND	ND	ND	ND	ND	ND	ND	ND	0.198	ND	0.264	ND	ND	ND	ND	0.114
BZ# 209	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.178
TOTAL PCBs (ND=0)	0.96	**3.47***	**9.25****	**9.76****	**7.49****	**12.3****	**7.28****	**5.74***	1.27	**8.67****	1.52	0.316	**11.9****	1.14	0.536	0.4
TOTAL PCBs (ND=1/2DL)	46.2	11.1	13.5	12.1	10.1	14.4	9.56	8.2	3.97	11	4.27	3.11	14.3	3.87	3.3	3.21
TOTAL PCBs (ND=DL)	91.5	18.7	17.7	14.5	12.8	16.6	11.8	10.6	6.68	13.3	7.02	5.9	16.6	6.59	6.07	6.02

ND = not detected in any of five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for total PCB congeners only

Total PCBs determined by summing congeners as specified in ITM (Table 9-3) and multiplying total by a facor of 2 as per NOAA 1993 guidance.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

Note that the mean of total PCB for individual tissue replicates is not equivalent to the sum of mean congeners for ND=0 and ND=1/2DL.

TABLE 9-27 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR PCB CONGENERS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
BZ# 8	ND	ND	1.12	ND	ND	ND	ND	ND	2.33	2.3	ND	2.12	ND	2.4	2.33	ND
BZ# 18	ND	ND	1.09	ND	0.63	0.11	0.07	0.05	ND	0.1	ND	ND	ND	ND	ND	ND
BZ# 28	ND	ND	1.08	ND	0.36	ND	0.58	0.17	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 44	ND	ND	0.61	0.19	0.2	0.67	0.1	0.11	ND	0.13	0.16	ND	0.64	ND	ND	ND
BZ# 49	ND	1.08	0.84	0.72	0.78	ND	ND	ND	ND	ND	ND	ND	1.22	ND	ND	ND
BZ# 52	ND	1.43	1.9	6.68	1.25	6.46	3.46	3.27	0.46	5.09	0.55	ND	7.20	0.45	ND	0.47
BZ# 66	ND	ND	1.85	5.52	ND	4.55	5.96	3.27	ND	3.39	ND	ND	4.4	ND	ND	ND
BZ# 77	ND	ND	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 87	ND	ND	ND	10.69	ND	13.05	2.37	2.22	6.71	2.65	ND	ND	11.89	5.62	ND	ND
BZ# 101	ND	ND	2.3	ND	ND	2.01	ND	1.26	0.81	1.5	1.41	ND	2.36	0.83	ND	ND
BZ# 105	ND	1.78	0.78	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 118	ND	ND	1.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 128	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 138	ND	ND	1.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 153	ND	ND	3.88	ND	ND	3.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 156	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 169	ND	ND	ND	ND	ND	ND	ND	ND	2.04	ND	ND	ND	ND	ND	2.33	ND
BZ# 170	8.74	ND	1.59	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 180	ND	ND	2.02	4.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 183	ND	ND	ND	ND	ND	ND	3.01	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 184	ND	ND	4.04	4.16	ND	3.16	ND	2.04	ND	ND	2.28	ND	ND	ND	ND	ND
BZ# 187	ND	ND	1.97	2.39	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14.95	ND	ND	ND	ND	ND
BZ# 206	ND	ND	ND	ND	ND	ND	ND	ND	3.6	ND	4.8	ND	ND	ND	ND	2.07
BZ# 209	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.37
TOTAL PCB ND=0	0.51	**1.87**	**2.79**	**0.70**	**0.54**	**0.88**	**0.52**	**0.41**	0.09	**0.62**	0.11	0.02	**0.85**	0.08	0.04	0.03
TOTAL PCB ND=1/2DL	**4.70**	1.13	1.14	0.74	0.62	0.88	0.58	0.5	0.24	0.67	0.26	0.19	0.87	0.24	0.2	0.2
TOTAL PCB ND=DL	**5.15**	1.06	0.98	0.78	0.68	0.89	0.63	0.57	0.36	0.71	0.38	0.32	0.89	0.35	0.32	0.32

ND = not detected

Shaded and bolded values = uptake ratios for tissue-residues that statistically exceeded at least one of the placement site/reference tissue-residues

TABLE 9-28A *Nereis virens* (SAND WORM): MEAN SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	ND	ND
2-METHYLPHENOL	75	85	93	**196****	78	**254****	73	79	80	57	73	106	**214****	65	94	64
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZOIC ACID	284	223	272	268	220	141	101	152	198	150	143	95	207	176	178	162
BENZYL ALCOHOL	ND	ND	ND	59	56	ND	ND	ND	54	ND	ND	ND	65	ND	51	ND
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	496	543	608	366	560	246	164	146	224	ND	176	152	302	128	232	128
DI-N-BUTYL PHTHALATE	ND	ND	54	ND	ND	ND	ND	ND	**68***	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**196****
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	124	ND	ND	ND	ND	**142****	**144****	ND	ND	ND	ND	ND	ND
PHENOL	ND	ND	ND	54	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	**54****	ND

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-28B *Nereis virens* (SAND WORM): MEAN SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	ND	ND
2-METHYLPHENOL	85	75	93	**196****	78	**254****	73	79	80	57	73	106	**214****	65	94	64
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZOIC ACID	223	284	272	268	220	141	101	152	198	150	143	95	207	176	178	162
BENZYL ALCOHOL	ND	ND	ND	59	56	ND	ND	ND	54	ND	ND	ND	65	ND	51	ND
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	543	496	608	366	560	246	164	146	224	ND	176	152	302	128	232	128
DI-N-BUTYL PHTHALATE	ND	ND	54	ND	ND	ND	ND	ND	68	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**196****
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	124	ND	ND	ND	ND	**142***	**144***	ND	ND	ND	ND	ND	ND
PHENOL	ND	ND	ND	54	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	**54***	ND

ND = not detected in any of the five tested replicates

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 (p < 0.05*, p < 0.01**).

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TABLE 9-28C *Nereis virens* (SAND WORM): MEAN SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	ND	ND
2-METHYLPHENOL	93	85	75	**196****	78	**254****	73	79	80	57	73	106	**214****	65	94	64
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZOIC ACID	272	223	284	268	220	141	101	152	198	150	143	95	207	176	178	162
BENZYL ALCOHOL	ND	ND	ND	59	56	ND	ND	ND	54	ND	ND	ND	65	ND	51	ND
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	608	543	496	366	560	246	164	146	224	ND	176	152	302	128	232	128
DI-N-BUTYL PHTHALATE	54	ND	ND	ND	ND	ND	ND	ND	**68***	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**196****
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	124	ND	ND	ND	ND	**142****	**144****	ND	ND	ND	ND	ND	ND
PHENOL	ND	ND	ND	54	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	**54****	ND

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

TABLE 9-29 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR SEMIVOLATILE ORGANIC COMPOUNDS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.51
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.36	ND	ND	ND	ND
2-METHYLPHENOL	1.3	0.96	0.84	**2.17**	0.87	**2.81**	0.81	0.87	0.88	0.63	0.81	1.18	**2.37**	0.72	1.04	0.71
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZOIC ACID	0.56	0.49	1.61	2.44	2	1.28	0.92	1.38	1.8	1.37	1.3	0.86	1.88	1.6	1.62	1.47
BENZYL ALCOHOL	ND	ND	ND	1.22	1.15	ND	ND	ND	1.1	ND	ND	ND	1.34	ND	1.05	ND
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	1.2	0.79	1.77	2	3.05	1.34	0.89	0.8	1.22	ND	0.96	0.83	1.65	0.7	1.27	0.7
DI-N-BUTYL PHTHALATE	0.98	ND	ND	ND	ND	ND	ND	ND	**1.24**	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.02**
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	1.14	ND	ND	ND	ND	**1.31**	**1.33**	ND	ND	ND	ND	ND	ND
PHENOL	ND	ND	ND	1.08	0.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.09**	ND

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

TABLE 9-30A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS (UG/KG) COMPARED TO INSIDE SITE 104

Analyte (ug/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	12	ND	ND	20	ND	ND	8	ND	11	14	ND	ND	ND	11	16	16
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	14	17	ND	ND	6	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	9
2-METHYLPHENOL	54	ND	42	ND	45	ND	ND	ND	ND	**79***	52	51	ND	**81****	**77***	**77****
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	129	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	66	49	ND	109	**351***	**189***	69	39	80	**91***	ND	45	**734****	36	45	52
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	**134****	ND	ND	ND	ND	ND	ND
BENZOIC ACID	4411	3050	5170	2560	4500	1740	3440	1500	3080	4580	3100	3600	2000	**5980***	**6940***	5040
BENZYL ALCOHOL	170	**373****	63	97	94	58	48	ND	ND	64	ND	ND	64	128	95	89
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	303	**445**B**	**884**B**	278	170	376	394	296	202	322	300	224	436	107	115	160
DI-N-BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	192	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PHENOL	124	69	56	100	ND	53	53	48	ND	60	ND	ND	69	44	55	48

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-30B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS (UG/KG) COMPARED TO OUTSIDE SITE 104

Analyte (ug/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	12	ND	20	ND	ND	8	ND	11	14	ND	ND	ND	11	16*	16*
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	17	14	ND	ND	6	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	9
2-METHYLPHENOL	ND	54	42	ND	45	ND	ND	ND	ND	79*	52	51	ND	81**	77*	77**
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	49	66	ND	109	351*	189*	69	39	80	91	ND	45	734**	36	45	52
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	134**	ND	ND	ND	ND	ND	ND
BENZOIC ACID	3050	4411*	5170	2560	4500*	1740	3440	1500	3080	4580**	3100	3600	2000	5980**	6940**	5040**
BENZYL ALCOHOL	373	170	63	97	94	58	48	ND	ND	64	ND	ND	64	128	95	89
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	445	303	884**B	278	170	376	394	296	202	322	300	224	436	107	115	160
DI-N-BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	192	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PHENOL	69	124	56	100	ND	53	53	48	ND	60	ND	ND	69	44	55	48

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

TABLE 9-30C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS (UG/KG) COMPARED TO OCEAN REFERENCE

Analyte (ug/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	ND	**12***	20	ND	ND	8	ND	11	14	ND	ND	ND	11	**16***	**16***
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	ND	**17****	**14***	ND	6	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	9
2-METHYLPHENOL	42	ND	54	ND	45	ND	ND	ND	ND	**79****	**52***	**51***	ND	**81****	**77****	**77****
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	129	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	ND	**49****	**66****	**109****	**351****	**189****	**69****	**39****	**80****	**91****	ND	**45****	**734****	**36****	**45****	**52****
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	**134****	ND	ND	ND	ND	ND	ND
BENZOIC ACID	5170	3050	4411	2560	4500	1740	3440	1500	3080	4580	3100	3600	2000	5980	6940	5040
BENZYL ALCOHOL	63	**373****	170	97	94	58	48	ND	ND	64	ND	ND	64	**128***	95	89
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	884	445	303	278	170	376	394	296	202	322	300	224	436	107	115	160
DI-N-BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	192	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PHENOL	56	**69***	**124***	**100***	ND	53	53	48	ND	60	ND	ND	69	44	55	48

ND = not detected in any of five tested replicates.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

TABLE 9-31 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR SEMIVOLATILE ORGANIC COMPOUNDS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-METHYLNAPHTHALENE	ND	ND	**1.30**	4.15	ND	ND	1.63	ND	2.31	2.94	ND	ND	ND	2.39	**3.41**	**3.33**
2,2'-OXYBIS(1-CHLOROPROPANE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-TRICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DICHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DIMETHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-CHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-4,6-DINITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLNAPHTHALENE	ND	**2.74**	**2.69**	ND	1.35	ND	ND	ND	ND	ND	ND	ND	1.31	ND	ND	1.88
2-METHYLPHENOL	0.34	ND	1.22	ND	1.02	ND	ND	ND	ND	**1.79**	**1.19**	**1.15**	ND	**1.83**	**1.74**	**1.75**
2-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND	ND	ND	0.92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,4-METHYLPHENOL	ND	**0.70**	**0.54**	**0.58**	**1.85**	**1.00**	**0.36**	**0.20**	**0.42**	**0.48**	ND	**0.24**	**3.88**	**0.19**	**0.24**	**0.27**
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLORO-3-METHYLPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-NITROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.91**	ND	ND	ND	ND	ND	ND
BENZOIC ACID	1.04	0.66	**0.93**	0.53	**0.93**	0.36	0.71	0.31	0.64	**0.95**	0.64	0.74	0.41	**1.24**	**1.43**	**1.04**
BENZYL ALCOHOL	0.31	**7.45**	3.05	0.73	0.7	0.43	0.36	ND	ND	0.48	ND	ND	0.48	**0.96**	0.71	0.66
BENZYL BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	**1.11**	**0.84**	1.14	1.95	1.19	2.64	2.76	2.08	1.42	2.26	2.1	1.57	3.06	0.75	0.81	1.12
DI-N-BUTYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND	ND	ND	1.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZOFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHANAMINE, N-METHYL-N-NITROSO	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NITROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PENTACHLOROPHENOL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PHENOL	0.64	**0.40**	**1.44**	**1.37**	ND	0.72	0.73	0.66	ND	0.83	ND	ND	0.94	0.61	0.75	0.65

ND = not detected

Shaded and bolded values = uptake ratios for tissue-residues that statistically exceeded at least one of the placement site/reference tissue-residues

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TABLE 9-32A *Nereis virens* (SAND WORM): MEAN DIOXIN AND FURAN CONCENTRATIONS (NG/KG) COMPARED TO INSIDE SITE 104[(a)]

Analyte (ng/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	0.0783	0.0712	0.102	ND	0.0602	ND	ND	0.132	0.0819	ND	0.118	ND	0.0861	ND	ND	ND
1,2,3,7,8-PECDD	0.139	0.272	0.364B	0.148	0.279	0.132	0.187	0.154	0.131	0.318	0.27	0.573B	0.224	0.177	0.302B	0.0831
1,2,3,4,7,8-HXCDD	0.0707	0.0479	0.111	0.167	0.0608	ND	ND	0.174	0.0742	0.0843	0.108	ND	0.0691	ND	ND	0.125
1,2,3,6,7,8-HXCDD	0.266	0.258	0.399	0.417	0.267	0.295	0.39	0.318	0.245	0.304	0.307	0.255	0.264	0.26	0.206	0.223
1,2,3,7,8,9-HXCDD	0.147	0.139	0.196B	0.228	0.139	0.105	0.121	0.133	0.138	0.202	0.163	ND	0.114	0.101	ND	0.107
1,2,3,4,6,7,8-HPCDD	1.48	1.48	2.83	1.95	1.31	1.24	1.76	1.47	1.57	1.35	1.51	1.46	1.3	1.31	1.07	1.04
OCDD	7.31	7.05	7.44	7.78	6.56	6.95	7.51	8.42	10.4B	6.45	7.54	7.44	7.91	8.03	7.56	5.5
2,3,7,8-TCDF	0.742	0.712	0.844	0.828	0.54	0.598	0.729	0.814	0.665	0.692	0.954	0.894	0.724	0.703	0.716	0.609
1,2,3,7,8-PECDF	0.101	0.0944	0.152B	0.0814	0.104	0.0844	ND	0.105	0.0962	0.115	0.178B	0.115	0.088	0.1	0.0535	0.0717
2,3,4,7,8-PECDF	0.489	0.192	0.249	0.231	0.167	0.199	0.212	0.223	0.194	0.202	0.249	0.2	0.194	0.207	0.16	0.141
1,2,3,4,7,8-HXCDF	0.112	0.0749	0.104	0.0931	0.12	ND	0.0857	0.0841	0.115	0.0829	0.169	0.109	0.0978	0.121	0.0881	0.0942
1,2,3,6,7,8-HXCDF	0.0829	0.0694	0.103	ND	0.0853	ND	0.084	0.0612	0.0799	0.0992	0.108	ND	0.0626	0.0872	ND	0.061
2,3,4,6,7,8-HXCDF	0.0772	0.0918	0.119B	ND	0.0889	ND	0.121	0.0667	0.0838	0.0775	0.117	0.0629	0.0773	0.0783	ND	0.0687
1,2,3,7,8,9-HXCDF	ND	ND	ND	ND	0.0639	ND	ND	ND	ND	0.0968	0.0775	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.245	0.229	0.432	0.357	0.224	0.251	0.318	0.273	0.248	0.243	0.304	0.245	0.231	0.247	0.199	0.225
1,2,3,4,7,8,9-HPCDF	ND	ND	ND	ND	0.0452	ND	ND	0.0917	0.0472	ND	0.0817	ND	ND	ND	ND	ND
OCDF	0.251	0.216	0.333B	ND	0.22	ND	ND	0.207	0.205	0.201	0.363	0.285	0.213	0.246	ND	ND
DIOXINS TEQ (ND=0)	0.37	0.153	0.251	0.273	0.159	0.151	0.211	0.211	0.218	0.187	0.205	0.121	0.22	0.103	0.1	0.147
DIOXINS TEQ (ND=1/2DL)	0.436	0.176	0.256	0.427	0.167	0.33	0.437	0.358	0.263	0.302	0.225	0.258	0.301	0.229	0.204	0.26
DIOXINS TEQ (ND=DL)	0.501	0.199	0.261	0.581	0.175	0.51	0.663	0.506	0.307	0.417	0.245	0.396	0.381	0.354	0.308	0.373

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for TEQs only.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

Note that the mean of the TEQ for individual replicates is not equivalent to TEQs calculated using the mean congener concentrations for ND=0 and ND=1/2DL.

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TABLE 9-32B *Nereis virens* (SAND WORM): MEAN DIOXIN AND FURAN CONCENTRATIONS (NG/KG) COMPARED TO OUTSIDE SITE 104[(a)]

Analyte (ng/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	0.0712	0.0783	0.102	ND	0.0602	ND	ND	0.132	0.0819	ND	0.118	ND	0.0861	ND	ND	ND
1,2,3,7,8-PECDD	0.272	0.139	0.364	0.148	0.279	0.132	0.187	0.154	0.131	0.318	0.27	0.573	0.224	0.177	0.302	0.0831
1,2,3,4,7,8-HXCDD	0.0479	0.0707	0.111	0.167	0.0608	ND	ND	0.174	0.0742	0.0843	0.108	ND	0.0691	ND	ND	0.125
1,2,3,6,7,8-HXCDD	0.258	0.266	0.399	0.417	0.267	0.295	0.39	0.318	0.245	0.304	0.307	0.255	0.264	0.26	0.206	0.223
1,2,3,7,8,9-HXCDD	0.139	0.147	0.196	0.228	0.139	0.105	0.121	0.133	0.138	0.202	0.163	ND	0.114	0.101	ND	0.107
1,2,3,4,6,7,8-HPCDD	1.48	1.48	2.83	1.95	1.31	1.24	1.76	1.47	1.57	1.35	1.51	1.46	1.3	1.31	1.07	1.04
OCDD	7.05	7.31	7.44	7.78	6.56	6.95	7.51	8.42	10.4B	6.45	7.54	7.44	7.91	8.03	7.56	5.5
2,3,7,8-TCDF	0.712	0.742	0.844	0.828	0.54	0.598	0.729	0.814	0.665	0.692	0.954	0.894	0.724	0.703	0.716	0.609
1,2,3,7,8-PECDF	0.0944	0.101	0.152	0.0814	0.104	0.0844	ND	0.105	0.0962	0.115	0.178	0.115	0.088	0.1	0.0535	0.0717
2,3,4,7,8-PECDF	0.192	0.489B	0.249B	0.231	0.167	0.199	0.212	0.223	0.194	0.202	0.249B	0.2	0.194	0.207	0.16	0.141
1,2,3,4,7,8-HXCDF	0.0749	0.112	0.104B	0.0931	0.12	ND	0.0857	0.0841	0.115	0.0829	0.169B	0.109	0.0978	0.121	0.0881	0.0942
1,2,3,6,7,8-HXCDF	0.0694	0.0829	0.103B	ND	0.0853	ND	0.084	0.0612	0.0799	0.0992	0.108B	ND	0.0626	0.0872	ND	0.061
2,3,4,6,7,8-HXCDF	0.0918	0.0772	0.119	ND	0.0889	ND	0.121	0.0667	0.0838	0.0775	0.117	0.0629	0.0773	0.0783	ND	0.0687
1,2,3,7,8,9-HXCDF	ND	ND	ND	ND	0.0639	ND	ND	ND	ND	0.0968	0.0775	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.229	0.245	0.432	0.357	0.224	0.251	0.318	0.273	0.248	0.243	0.304	0.245	0.231	0.247	0.199	0.225
1,2,3,4,7,8,9-HPCDF	ND	ND	ND	ND	0.0452	ND	ND	0.0917	0.0472	ND	0.0817	ND	ND	ND	ND	ND
OCDF	0.216	0.251	0.333	ND	0.22	ND	ND	0.207	0.205	0.201	0.363	0.285	0.213	0.246	ND	ND
DIOXINS TEQ (ND=0)	0.153	**0.37****	**0.251***	**0.273****	0.159	0.151	0.211	0.211	0.218	**0.187***	0.205	0.121	0.22	0.103	0.1	0.147
DIOXINS TEQ (ND=1/2DL)	0.176	**0.436****	**0.256***	**0.427****	0.167	**0.33****	**0.437****	**0.358****	**0.263***	**0.302****	0.225	**0.258***	**0.301****	0.229	0.204	**0.26***
DIOXINS TEQ (ND=DL)	0.199	**0.501***	**0.261**	**0.581****	0.175	**0.51****	**0.663****	**0.506****	**0.307****	**0.417****	0.245	**0.396****	**0.381***	**0.354****	**0.308****	**0.373****

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for TEQs only.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

Note that the mean of the TEQ for individual replicates is not equivalent to TEQs calculated using the mean congener concentrations for ND=0 and ND=1/2DL.

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TABLE 9-32C *Nereis virens* (SAND WORM): MEAN DIOXIN AND FURAN CONCENTRATIONS (NG/KG) COMPARED TO OCEAN REFERENCE[(a)]

Analyte (ng/kg)	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	0.102	0.0712	0.0783	ND	0.0602	ND	ND	0.132	0.0819	ND	0.118	ND	0.0861	ND	ND	ND
1,2,3,7,8-PECDD	0.364	0.272	0.139	0.148	0.279	0.132	0.187	0.154	0.131	0.318	0.27	0.573	0.224	0.177	0.302	0.0831
1,2,3,4,7,8-HXCDD	0.111	0.0479	0.0707	0.167	0.0608	ND	ND	0.174	0.0742	0.0843	0.108	ND	0.0691	ND	ND	0.125
1,2,3,6,7,8-HXCDD	0.399	0.258	0.266	0.417	0.267	0.295	0.39	0.318	0.245	0.304	0.307	0.255	0.264	0.26	0.206	0.223
1,2,3,7,8,9-HXCDD	0.196	0.139	0.147	0.228	0.139	0.105	0.121	0.133	0.138	0.202	0.163	ND	0.114	0.101	ND	0.107
1,2,3,4,6,7,8-HPCDD	2.83	1.48	1.48	1.95	1.31	1.24	1.76	1.47	1.57	1.35	1.51	1.46	1.3	1.31	1.07	1.04
OCDD	7.44	7.05	7.31	7.78	6.56	6.95	7.51	8.42	10.4B	6.45	7.54	7.44	7.91	8.03	7.56	5.5
2,3,7,8-TCDF	0.844	0.712	0.742	0.828	0.54	0.598	0.729	0.814	0.665	0.692	0.954	0.894	0.724	0.703	0.716	0.609
1,2,3,7,8-PECDF	0.152	0.0944	0.101	0.0814	0.104	0.0844	ND	0.105	0.0962	0.115	0.178	0.115	0.088	0.1	0.0535	0.0717
2,3,4,7,8-PECDF	0.249	0.192	0.489B	0.231	0.167	0.199	0.212	0.223	0.194	0.202	0.249	0.2	0.194	0.207	0.16	0.141
1,2,3,4,7,8-HXCDF	0.104	0.0749	0.112	0.0931	0.12	ND	0.0857	0.0841	0.115	0.0829	0.169*B	0.109	0.0978	0.121	0.0881	0.0942
1,2,3,6,7,8-HXCDF	0.103	0.0694	0.0829	ND	0.0853	ND	0.084	0.0612	0.0799	0.0992	0.108	ND	0.0626	0.0872	ND	0.061
2,3,4,6,7,8-HXCDF	0.119	0.0918	0.0772	ND	0.0889	ND	0.121	0.0667	0.0838	0.0775	0.117	0.0629	0.0773	0.0783	ND	0.0687
1,2,3,7,8,9-HXCDF	ND	ND	ND	ND	0.0639	ND	ND	ND	ND	0.0968	0.0775	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.432	0.229	0.245	0.357	0.224	0.251	0.318	0.273	0.248	0.243	0.304	0.245	0.231	0.247	0.199	0.225
1,2,3,4,7,8,9-HPCDF	ND	ND	ND	ND	0.0452	ND	ND	0.0917	0.0472	ND	0.0817	ND	ND	ND	ND	ND
OCDF	0.333	0.216	0.251	ND	0.22	ND	ND	0.207	0.205	0.201	0.363	0.285	0.213	0.246	ND	ND
DIOXINS TEQ (ND=0)	0.251	0.153	0.37	0.273	0.159	0.151	0.211	0.211	0.218	0.187	0.205	0.121	0.22	0.103	0.1	0.147
DIOXINS TEQ (ND=1/2DL)	0.256	0.176	**0.436****	**0.427****	0.167	0.33	**0.437****	**0.358***	0.263	0.302	0.225	0.258	0.301	0.229	0.204	0.26
DIOXINS TEQ (ND=DL)	0.261	0.199	**0.501***	**0.581****	0.175	**0.51****	**0.663****	**0.506****	0.307	**0.417****	0.245	**0.396***	**0.381***	**0.354***	0.308	**0.373***

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for TEQs only.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site (p < 0.05*, p < 0.01).**

Note that the mean of the TEQ for individual replicates is not equivalent to TEQs calculated using the mean congener concentrations for ND=0 and ND=1/2DL.

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TABLE 9-33 *Nereis virens* (SAND WORM): UPTAKE RATIOS FOR DIOXIN AND FURAN CONGENERS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	1.43	1.03	1.14	ND	0.87	ND	ND	1.92	1.19	ND	1.72	ND	1.25	ND	ND	ND
1,2,3,7,8-PECDD	2.48	1.35	0.69	0.73	1.38	0.65	0.93	0.76	0.65	1.58	1.34	2.84	1.11	0.88	1.50	0.41
1,2,3,4,7,8-HXCDD	0.96	0.68	1.01	2.38	0.86	ND	ND	2.47	1.05	1.2	1.53	ND	0.98	ND	ND	1.77
1,2,3,6,7,8-HXCDD	1.60	2.1	2.16	3.39	2.17	2.4	3.17	2.59	1.99	2.47	2.5	2.07	2.14	2.12	1.68	1.81
1,2,3,7,8,9-HXCDD	2.00	1.53	1.61	2.51	1.52	1.15	1.32	1.46	1.51	2.22	1.78	ND	1.25	1.11	ND	1.18
1,2,3,4,6,7,8-HPCDD	0.91	1.01	1	1.33	0.89	0.84	1.2	1	1.07	0.92	1.03	0.99	0.88	0.89	0.73	0.71
OCDD	0.32	0.71	0.73	0.78	0.66	0.69	0.75	0.84	1.04	0.64	0.75	0.74	0.79	0.8	0.76	0.55
2,3,7,8-TCDF	2.11	1.5	1.56	1.74	1.14	1.26	1.54	1.71	1.4	1.46	2.01	1.88	1.53	1.48	1.51	1.28
1,2,3,7,8-PECDF	3.14	1.45	1.54	1.25	1.59	1.29	ND	1.61	1.48	1.77	2.73	1.76	1.35	1.54	0.82	1.1
2,3,4,7,8-PECDF	1.56	1.75	4.46	2.1	1.52	1.81	1.93	2.03	1.77	1.85	2.27	1.83	1.77	1.88	1.46	1.29
1,2,3,4,7,8-HXCDF	1.36	1.08	1.63	1.35	1.74	ND	1.24	1.22	1.67	1.2	2.45	1.57	1.42	1.76	1.27	1.36
1,2,3,6,7,8-HXCDF	1.44	1.38	1.65	ND	1.69	ND	1.67	1.21	1.59	1.97	2.15	ND	1.24	1.73	ND	1.21
2,3,4,6,7,8-HXCDF	1.32	1.43	1.2	ND	1.39	ND	1.88	1.04	1.31	1.21	1.83	0.98	1.2	1.22	ND	1.07
1,2,3,7,8,9-HXCDF	ND	ND	ND	ND	3.4	ND	ND	ND	ND	5.15	4.12	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.59	0.5	0.54	0.78	0.49	0.55	0.69	0.6	0.54	0.53	0.66	0.53	0.5	0.54	0.43	0.49
1,2,3,4,7,8,9-HPCDF	ND	ND	ND	ND	1.63	ND	ND	3.31	1.7	ND	2.95	ND	ND	ND	ND	ND
OCDF	0.27	0.26	0.3	ND	0.26	ND	ND	0.24	0.24	0.24	0.43	0.34	0.25	0.29	ND	ND
DIOXIN TEQ (ND=0)	**1.66**	1.1	**2.67**	**1.97**	1.15	1.09	1.52	1.52	1.58	**1.35**	1.48	0.87	1.59	0.75	0.72	1.06
DIOXIN TEQ (ND=1/2DL)	**0.78**	1.25	**3.10**	**3.03**	1.19	**2.35**	**3.11**	**2.55**	**1.87**	**2.14**	1.6	**1.84**	**2.14**	1.62	1.45	**1.85**
DIOXIN TEQ (ND=DL)	**0.52**	1.4	**3.51**	**4.06**	1.22	**3.57**	**4.64**	**3.54**	**2.15**	**2.92**	1.71	**2.77**	**2.67**	**2.48**	**2.16**	**2.61**

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

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TABLE 9-34A *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN DIOXIN AND FURAN CONCENTRATIONS (NG/KG) COMPARED TO INSIDE SITE 104[a]

Analyte (ng/kg)	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	ND	ND	0.0956	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDD	ND	ND	0.157B	0.0521	ND	ND	ND	0.0633	0.0756	ND	ND	ND	ND	ND	ND	0.0562
1,2,3,4,7,8-HXCDD	ND	ND	0.0903	0.11	ND	ND	ND	0.105	0.117	0.0768	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDD	0.226	0.234	0.185	0.258	ND	0.192	0.208	0.272	0.297	0.202	0.269	0.186	0.26	0.237	0.202	0.227
1,2,3,7,8,9-HXCDD	0.112	0.231	0.142	0.141	ND	0.0851	0.108	0.191	0.171	0.0941	0.12	ND	0.137	0.0902	0.101	0.0773
1,2,3,4,6,7,8-HPCDD	2.6	2.44	1.77	2.33	2.16	2.36	1.86	2.66	2.2	1.66	3.4	2.13	2.45	2.94	2.02	1.75
OCDD	22.8	21.9	4.58	21.4	21.9	22.4	16.5	20	18	13.2	21.2	19.6	21.1	18.3	14.8	19.4
2,3,7,8-TCDF	ND	ND	0.107	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDF	ND	ND	0.126	0.0703	ND	ND	ND	0.0582	0.0607	ND	ND	ND	ND	ND	0.0627	ND
2,3,4,7,8-PECDF	0.179	ND	0.104	0.0644	ND	ND	ND	0.065	0.0605	ND	ND	0.042	ND	0.0355	0.0481	ND
1,2,3,4,7,8-HXCDF	0.136	ND	0.11	0.106	ND	0.0693	0.057	0.152	0.127	0.0663	0.0908	0.105	0.072	ND	0.0951	0.124
1,2,3,6,7,8-HXCDF	0.108	ND	0.0933	0.0727	ND	ND	ND	0.0994	0.084	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HXCDF	0.173	ND	0.0962	0.0838	ND	ND	ND	0.122	0.0783	ND	ND	ND	ND	ND	ND	0.0608
1,2,3,7,8,9-HXCDF	ND	ND	0.0848	ND	ND	ND	ND	ND	0.0741	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.675	0.254	0.238	0.336	0.308	0.281	0.221	0.542	0.335	0.211	0.397	0.277	0.283	0.298	0.277	0.237
1,2,3,4,7,8,9-HPCDF	ND	ND	0.0651	ND	ND	ND	ND	ND	0.105	ND	ND	ND	ND	ND	ND	ND
OCDF	0.485	ND	0.239	0.34	ND	0.251	0.168	0.403	0.406	0.253	0.399	0.347	0.227	0.213	0.228	0.204
DIOXINS TEQ (ND=0)	0.114	0.0609	0.121	0.1	0.0383	0.0488	0.0219	0.0938	0.0908	0.0188	0.0786	0.0533	0.0485	0.0596	0.0461	0.0533
DIOXINS TEQ (ND=1/2DL)	0.362	0.254	0.125	0.239	0.395	0.197	0.155	0.242	0.201	0.15	0.266	0.208	0.197	0.218	0.2	0.208
DIOXINS TEQ (ND=DL)	0.609	0.447	0.13	0.377	0.752	0.344	0.288	0.391	0.311	0.281	0.453	0.362	0.345	0.376	0.354	0.363

B = detected in laboratory blank in at least one of the five test replicates

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for TEQs only.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Inside Site 104 ($p < 0.05$*, $p < 0.01$).**

Note that the mean of the TEQ for individual replicates is not equivalent to TEQs calculated using the mean congener concentrations for ND=0 and ND=1/2DL.

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TABLE 9-34B *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN DIOXIN AND FURAN CONCENTRATIONS (NG/KG) COMPARED TO OUTSIDE SITE 104[(a)]

Analyte (ng/kg)	Outside Site 104	Inside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	ND	ND	0.0956	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDD	ND	ND	0.157B	0.0521	ND	ND	ND	0.0633	0.0756	ND	ND	ND	ND	ND	ND	0.0562
1,2,3,4,7,8-HXCDD	ND	ND	0.0903	0.11	ND	ND	ND	0.105	0.117	0.0768	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDD	0.234	0.226	0.185	0.258	ND	0.192	0.208	0.272	0.297	0.202	0.269	0.186	0.26	0.237	0.202	0.227
1,2,3,7,8,9-HXCDD	0.231	0.112	0.142	0.141	ND	0.0851	0.108	0.191	0.171	0.0941	0.12	ND	0.137	0.0902	0.101	0.0773
1,2,3,4,6,7,8-HPCDD	2.44	2.6	1.77	2.33	2.16	2.36	1.86	2.66	2.2	1.66	3.4	2.13	2.45	2.94	2.02	1.75
OCDD	21.9	22.8	4.58	21.4	21.9	22.4	16.5	20	18	13.2	21.2	19.6	21.1	18.3	14.8	19.4
2,3,7,8-TCDF	ND	ND	0.107	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDF	ND	ND	0.126B	0.0703	ND	ND	ND	0.0582	0.0607	ND	ND	ND	ND	ND	0.0627	ND
2,3,4,7,8-PECDF	ND	0.179	0.104B	0.0644	ND	ND	ND	0.065	0.0605	ND	ND	0.042	ND	0.0355	0.0481	ND
1,2,3,4,7,8-HXCDF	ND	0.136	0.11B	0.106	ND	0.0693	0.057	0.152B	0.127B	0.0663	0.0908	0.105	0.072	ND	0.0951	0.124B
1,2,3,6,7,8-HXCDF	ND	0.108	0.0933B	0.0727	ND	ND	ND	0.0994	0.084	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HXCDF	ND	0.173	0.0962B	0.0838	ND	ND	ND	0.122	0.0783	ND	ND	ND	ND	ND	ND	0.0608
1,2,3,7,8,9-HXCDF	ND	ND	0.0848	ND	ND	ND	ND	ND	0.0741	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.254	0.675	0.238	0.336	0.308	0.281	0.221	0.542B	0.335	0.211	0.397	0.277	0.283	0.298	0.277	0.237
1,2,3,4,7,8,9-HPCDF	ND	ND	0.0651	ND	ND	ND	ND	ND	0.105	ND	ND	ND	ND	ND	ND	ND
OCDF	ND	0.485	0.239B	0.34	ND	0.251	0.168	0.403	0.406	0.253	0.399	0.347	0.227	0.213	0.228	0.204
DIOXINS TEQ (ND=0)	0.0609	0.114	0.121	0.1	0.0383	0.0488	0.0219	0.0938	0.0908	0.0188	0.0786	0.0533	0.0485	0.0596	0.0461	0.0533
DIOXINS TEQ (ND=1/2DL)	0.254	0.362	0.125	0.239	**0.395***	0.197	0.155	0.242	0.201	0.15	0.266	0.208	0.197	0.218	0.2	0.208
DIOXINS TEQ (ND=DL)	0.447	0.609	0.13	0.377	**0.752****	0.344	0.288	0.391	0.311	0.281	0.453	0.362	0.345	0.376	0.354	0.363

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for TEQs only.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than Outside Site 104 ($p < 0.05$*, $p < 0.01$).**

Note that the mean of the TEQ for individual replicates is not equivalent to TEQs calculated using the mean congener concentrations for ND=0 and ND=1/2DL.

TABLE 9-34C *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN DIOXIN AND FURAN CONCENTRATIONS (NG/KG) COMPARED TO OCEAN REFERENCE[a]

Analyte (ng/kg)	O Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	0.0956	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDD	0.157	ND	ND	0.0521	ND	ND	ND	0.0633	0.0756	ND	ND	ND	ND	ND	ND	0.0562
1,2,3,4,7,8-HXCDD	0.0903	ND	ND	0.11	ND	ND	ND	0.105	0.117	0.0768	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDD	0.185	0.234	0.226	0.258	ND	0.192	0.208	0.272	0.297	0.202	0.269	0.186	0.26	0.237	0.202	0.227
1,2,3,7,8,9-HXCDD	0.142	0.231	0.112	0.141	ND	0.0851	0.108	0.191	0.171	0.0941	0.12	ND	0.137	0.0902	0.101	0.0773
1,2,3,4,6,7,8-HPCDD	1.77	2.44	2.6	2.33	2.16	2.36	1.86	2.66	2.2B	1.66	3.4	2.13	2.45	2.94	2.02	1.75
OCDD	4.58	21.9	22.8	21.4	21.9	22.4	16.5B	20B	18B	13.2B	21.2	19.6	21.1	18.3	14.8	19.4
2,3,7,8-TCDF	0.107	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDF	0.126	ND	ND	0.0703	ND	ND	ND	0.0582	0.0607	ND	ND	ND	ND	ND	0.0627	ND
2,3,4,7,8-PECDF	0.104	ND	0.179	0.0644	ND	ND	ND	0.065	0.0605	ND	ND	0.042	ND	0.0355	0.0481	ND
1,2,3,4,7,8-HXCDF	0.11	ND	0.136	0.106	ND	0.0693	0.057	0.152	0.127	0.0663	0.0908	0.105	0.072	ND	0.0951	0.124
1,2,3,6,7,8-HXCDF	0.0933	ND	0.108	0.0727	ND	ND	ND	0.0994	0.084	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HXCDF	0.0962	ND	0.173	0.0838	ND	ND	ND	0.122	0.0783	ND	ND	ND	ND	ND	ND	0.0608
1,2,3,7,8,9-HXCDF	0.0848	ND	ND	ND	ND	ND	ND	ND	0.0741	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	0.238	0.254	0.675	0.336	0.308	0.281	0.221	0.542B	0.335	0.211	0.397	0.277*	0.283	0.298	0.277	0.237
1,2,3,4,7,8,9-HPCDF	0.0651	ND	ND	ND	ND	ND	ND	ND	0.105	ND	ND	ND	ND	ND	ND	ND
OCDF	0.239	ND	0.485	0.34	ND	0.251	0.168	0.403	0.406	0.253	0.399	0.347	0.227	0.213	0.228	0.204
DIOXINS TEQ (ND=0)	0.121	0.0609	0.114	0.1	0.0383	0.0488	0.0219	0.0938	0.0908	0.0188	0.0786	0.0533	0.0485	0.0596	0.0461	0.0533
DIOXINS TEQ (ND=1/2DL)	0.125	**0.254***	**0.362****	**0.239***	**0.395****	0.197	0.155	**0.242***	0.201	0.15	**0.266****	**0.208***	0.197	**0.218***	0.2	**0.208***
DIOXINS TEQ (ND=DL)	0.13	**0.447****	**0.609****	**0.377****	**0.752****	**0.344****	**0.288****	**0.391****	**0.311****	**0.281****	**0.453****	**0.362****	**0.345****	**0.376****	**0.354****	**0.363****

B = detected in laboratory blank in at least one of the five test replicates.

ND = not detected in any of the five tested replicates.

(a) Statistical comparisons not conducted for individual congeners; statistical comparisons conducted for TEQs only.

Asterisks, shaded and bolded cells indicate sites where mean tissue residues were statistically higher than the Ocean Reference site ($p < 0.05$*, $p < 0.01$).**

Note that the mean of the TEQ for individual replicates is not equivalent to TEQs calculated using the mean congener concentrations for ND=0 and ND=1/2DL.

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TABLE 9-35 *Macoma nasuta* (BLUNT-NOSE CLAM): UPTAKE RATIOS FOR DIOXIN AND FURAN CONGENERS

Analyte	Ocean Reference	Outside Site 104	Inside Site 104	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
2,3,7,8-TCDD	1.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDD	1.96	ND	ND	0.64	ND	ND	ND	0.78	0.94	ND	ND	ND	ND	ND	ND	0.7
1,2,3,4,7,8-HXCDD	0.9	ND	ND	1.78	ND	ND	ND	1.7	1.88	1.24	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDD	1.03	1.84	1.78	2.03	ND	1.51	1.63	2.14	2.34	1.59	2.12	1.46	2.04	1.86	1.59	1.78
1,2,3,7,8,9-HXCDD	1.68	3.53	1.71	2.16	ND	1.3	1.66	2.92	2.61	1.44	1.84	ND	2.09	1.38	1.54	1.18
1,2,3,4,6,7,8-HPCDD	1.25	2.61	2.78	2.49	2.32	2.52	1.99	2.85	2.36	1.78	3.63	2.28	2.62	3.14	2.16	1.87
OCDD	0.75	7.35	7.64	7.18	7.34	7.51	5.55	6.72	6.04	4.42	7.12	6.56	7.07	6.15	4.97	6.51
2,3,7,8-TCDF	1.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDF	2.52	ND	ND	1.45	ND	ND	ND	1.2	1.25	ND	ND	ND	ND	ND	1.29	ND
2,3,4,7,8-PECDF	2.98	ND	3.78	1.36	ND	ND	ND	1.37	1.27	ND	ND	0.88	ND	0.75	1.01	ND
1,2,3,4,7,8-HXCDF	1.99	ND	2.56	2	ND	1.31	1.07	2.87	2.39	1.25	1.71	1.99	1.36	ND	1.79	2.34
1,2,3,6,7,8-HXCDF	1.70	ND	2.21	1.5	ND	ND	ND	2.04	1.73	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HXCDF	1.37	ND	2.98	1.44	ND	ND	ND	2.1	1.35	ND	ND	ND	ND	ND	ND	1.05
1,2,3,7,8,9-HXCDF	1	ND	ND	ND	ND	ND	ND	ND	1.21	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	1.4	1.5	3.97	1.98	1.81	1.66	1.3	3.19	1.97	1.24	2.33	1.63	1.67	1.75	1.63	1.39
1,2,3,4,7,8,9-HPCDF	0.77	ND	ND	ND	ND	ND	ND	ND	1.63	ND	ND	ND	ND	ND	ND	ND
OCDF	1.33	ND	2.28	1.60	ND	1.18	0.79	1.90	1.91	1.19	1.88	1.63	1.07	1	1.07	0.96
DIOXIN TEQ (ND=0)	5.47	1.18	2.21	1.94	0.74	0.95	0.43	1.82	1.76	0.36	1.52	1.03	0.94	1.16	0.89	1.03
DIOXIN TEQ (ND=1/2DL)	0.53	**1.45**	**2.06**	**1.36**	**2.25**	1.12	0.88	**1.38**	1.15	0.85	**1.52**	**1.19**	1.12	**1.24**	1.14	**1.19**
DIOXIN TEQ (ND=DL)	0.29	**1.50**	**2.04**	**1.26**	**2.51**	**1.15**	**0.96**	**1.31**	**1.04**	**0.94**	**1.51**	**1.21**	**1.15**	**1.26**	**1.18**	**1.21**

ND = not detected

Shaded and bolded values = uptake ratios for tissue residues that statistically exceeded at least one of the placement site/ reference tissue-residues.

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TABLE 9-36 *Nereis virens* (SAND WORM): MEAN LIPID (%) AND MOISTURE CONCENTRATIONS

Analyte	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
LIPIDS	0.27	0.28	0.25	0.35	0.33	0.35	0.55	0.40	0.63	0.58	0.60	0.67	0.28	0.54	1.39	0.34
MOISTURE CONTENT (%)	84.5	85.0	NT	85.0	85.4	85.8	84.8	85.4	85.6	84.5	85.2	85.5	87.1	86.2	84.9	85.3

NT = not tested (not measured)

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TABLE 9-37 *Macoma nasuta* (BLUNT-NOSE CLAM): MEAN LIPID (%) AND MOISTURE CONCENTRATIONS

Analyte	Inside Site 104	Outside Site 104	Ocean Reference	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
LIPIDS	ND	ND	0.24	0.08	ND	0.07	0.06	0.07	0.17	0.10	0.07	0.10	0.05	ND	0.05	ND
MOISTURE CONTENT (%)	86.5	86.2	NT	86.3	86.7	87.0	86.0	86.6	86.5	85.8	85.7	86.6	87.0	86.6	87.5	86.7

ND = not detected in any of the five test replicates.
NT = not tested

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TABLE 9-38A: *Nereis virens* (SAND WORM): NUMBER OF CHEMICAL ANALYTES IN CHANNEL TISSUES THAT STATISTICALLY EXCEED THE PLACEMENT SITE OR REFERENCE TISSUE RESIDUES

ANALYTE	Inside Site 104		Outside Site 104		Ocean Reference	
	# Exceed/Total*	Percent	# Exceed/Total*	Percent	# Exceed/Total*	Percent
METALS	43/208	21	67/208	32	14/208	7
PESTICIDES	34/286	12	43/286	15	21/286	7
PAHs	0/208	0	0/208	0	2/208	<1
PCB AROCLORS	0/91	0	0/91	0	0/91	0
TOTAL PCB CONGENERS (ND=0)	0/13	0	0/13	0	3/13	23
SVOCs	8/611	1	7/611	1	8/611	1
DIOXIN/FURAN TEQ (ND=1/2DL)	0/13	0	9/13	69	3/13	23
TOTAL	85/1430	6	126/1430	9	51/1430	4

*Total number of analytes tested times 13 channel reaches

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TABLE 9-38B: *Macoma nasuta* (BLUNT NOSE CLAM): NUMBER OF CHEMICAL ANALYTES IN CHANNEL TISSUES THAT STATISTICALLY EXCEED THE PLACEMENT SITE OR REFERENCE TISSUE RESIDUES

	Inside Site 104		Outside Site 104		Ocean Reference	
ANALYTE	# Exceed/Total*	Percent	# Exceed/Total*	Percent	# Exceed/Total*	Percent
METALS	61/208	29	104/208	50	49/208	24
PESTICIDES	19/286	7	21/286	7	22/286	8
PAHs	14/208	7	21/208	10	87/208	42
PCB AROCLORS	0/91	0	0/91	0	0/91	0
TOTAL PCB CONGENERS (ND=0)	0/13	0	4/13	31	7/13	54
SVOCs	11/611	2	15/611	2	23/611	4
DIOXIN/FURAN TEQ (ND=1/2DL)	0/13	0	1/13	8	7/13	54
TOTAL	105/1430	7	166/1430	12	195/1430	14

*Total number of analytes tested times 13 channel reaches

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TABLE 9-39A *Nereis virens* (SAND WORM) NUMBER OF STATISTICAL EXCEEDANCES IN TARGET ANALYTE FRACTIONS VS. INSIDE SITE 104

ANALYTE	# Tested Analytes	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	16	4	3	5	1	0	4	0	4	5	3	5	5	4
PAHs	16	0	0	0	0	0	0	0	0	0	0	0	0	0
PESTICIDES	22	4	6	5	0	0	1	1	2	2	4	5	2	2
TOTAL PCBs (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
PCB AROCLORS	7	0	0	0	0	0	0	0	0	0	0	0	0	0
SVOCs	47	1	0	1	0	0	2	1	0	0	1	0	1	1
DIOXIN/FURAN CONGENERS (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	110	9	9	11	1	0	7	2	6	7	8	10	8	7

TABLE 9-39B *Macoma nasuta* (BLUNT NOSE CLAM) NUMBER OF STATISTICAL EXCEEDANCES IN TARGET ANALYTE FRACTIONS VS. INSIDE SITE 104

ANALYTE	# Tested Analytes	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	16	8	4	3	9	7	5	8	5	2	3	3	2	2
PAHs	16	0	2	0	0	0	1	0	1	1	0	2	1	6
PESTICIDES	22	2	0	4	0	0	2	0	3	4	2	0	1	1
TOTAL PCBs (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
PCB AROCLORS	7	0	0	0	0	0	0	0	0	0	0	0	0	0
SVOCs	47	0	1	1	0	0	0	3	0	0	1	2	2	1
DIOXIN/FURAN CONGENERS (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	110	10	7	8	9	7	8	11	9	7	6	7	6	10

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TABLE 9-40A *Nereis virens* (SAND WORM) NUMBER OF STATISTICAL EXCEEDANCES IN TARGET ANALYTE FRACTIONS VS. OUTSIDE SITE 104

ANALYTE	# Tested Analytes	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	16	4	5	6	4	4	5	4	5	6	6	6	7	5
PAHs	16	0	0	0	0	0	0	0	0	0	0	0	0	0
PESTICIDES	22	3	6	3	1	0	4	5	5	4	4	3	2	3
TOTAL PCBs (ND=0)	1	0	0	0	1	0	0	1	0	1	0	0	0	0
PCB AROCLORS	7	0	0	0	0	0	0	0	0	0	0	0	0	0
SVOCs	47	1	0	1	0	0	1	1	0	0	1	0	1	1
DIOXIN/FURAN CONGENERS (ND=0)	1	1	0	0	0	0	0	1	0	0	0	0	0	0
TOTAL	110	9	11	10	6	4	10	12	10	11	11	9	10	9

TABLE 9-40B *Macoma nasuta* (BLUNT NOSE CLAM) NUMBER OF STATISTICAL EXCEEDANCES IN TARGET ANALYTE FRACTIONS VS. OUTSIDE SITE 104

ANALYTE	# Tested Analytes	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	16	10	9	8	9	9	8	7	8	8	8	7	5	8
PAHs	16	1	3	1	0	0	2	0	2	4	0	2	1	5
PESTICIDES	22	2	1	4	0	0	1	0	4	4	3	0	1	1
TOTAL PCBs (ND=0)	1	1	0	1	0	0	0	1	0	0	1	0	0	0
PCB AROCLORS	7	0	0	0	0	0	0	0	0	0	0	0	0	0
SVOCs	47	0	2	1	0	0	0	3	0	0	1	2	3	3
DIOXIN/FURAN CONGENERS (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	110	14	15	15	9	9	11	11	14	16	13	11	10	17

TABLE 9-41A *Nereis virens* (SAND WORM) NUMBER OF STATISTICAL EXCEEDANCES IN TARGET ANALYTE FRACTIONS VS. OCEAN REFERENCE

ANALYTE	# Tested Analytes	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	16	2	1	1	1	0	1	0	1	1	2	2	1	1
PAHs	16	0	1	0	0	0	0	0	0	0	0	1	0	0
PESTICIDES	22	1	5	2	0	0	1	1	0	2	2	2	2	3
TOTAL PCBs (ND=0)	1	0	0	0	1	0	0	1	0	1	0	0	0	0
PCB AROCLORS	7	0	0	0	0	0	0	0	0	0	0	0	0	0
SVOCs	47	1	0	1	0	0	2	1	0	0	1	0	1	1
DIOXIN/FURAN CONGENERS (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	110	4	7	4	2	0	4	3	1	4	5	5	4	5

TABLE 9-41B *Macoma nasuta* (BLUNT NOSE CLAM) NUMBER OF STATISTICAL EXCEEDANCES IN TARGET ANALYTE FRACTIONS VS. OCEAN REFERENCE

ANALYTE	# Tested Analytes	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Core)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METALS	16	5	5	5	4	5	3	2	3	3	4	3	3	4
PAHs	16	5	7	5	5	4	9	4	9	10	5	6	7	11
PESTICIDES	22	2	1	5	2	2	2	1	2	3	2	0	0	0
TOTAL PCBs (ND=0)	1	1	1	1	1	1	0	1	0	0	1	0	0	0
PCB AROCLORS	7	0	0	0	0	0	0	0	0	0	0	0	0	0
SVOCs	47	2	1	1	1	1	1	3	1	2	1	3	3	3
DIOXIN/FURAN CONGENERS (ND=0)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	110	15	15	17	13	13	15	11	15	18	13	12	13	18

TABLE 9-42 COPCs* IDENTIFIED IN TISSUES OF WORMS AND CLAMS EXPOSED TO CHANNEL SEDIMENTS PROPOSED FOR OPEN-WATER AND OCEAN PLACEMENT

COPCs (in tissue)	Inside Site 104	Outside Site 104	Ocean Reference
DIOXIN TEQ		c,w	c,w
ALUMINUM	c,w	c,w	c
ANTIMONY	c,w	c,w	c
ARSENIC	c	c	
BERYLLIUM	c,w	c,w	c,w
CADMIUM		c	
CHROMIUM	c,w	c,w	c
COPPER	w	w	
IRON	c	c	c
MANGANESE	c,w	c,w	c,w
MERCURY	c	c	c
NICKEL	c,w	c,w	c,w
SELENIUM	c	c	c
SILVER			c,w
ZINC	c	c,w	w
ACENAPHTHYLENE	c	c	c
ANTHRACENE		c	c
BENZ[A]ANTHRACENE	c		c
BENZO[A]PYRENE			c
BENZO[B]FLUORANTHENE	c	c	c
CHRYSENE		c,w	c
FLUORANTHENE		c	c,w
FLUORENE	c		c
NAPHTHALENE	c	c	c
PHENANTHRENE	c		c
PYRENE			c
TOTAL PAHs	c,w	c	c
TOTAL PCBs		c	c,w
4,4'-DDD	c,w	c,w	c,w
4,4'-DDT	c,w	c	c
ALDRIN	w	w	c,w
ALPHA-BHC	c,w	c,w	c,w
BETA-BHC	w	w	c,w
CHLORBENSIDE	w	w	w
DACTHAL	w	w	w
DELTA-BHC	w	w	
DIELDRIN	c	c	
ENDOSULFAN I			c
ENDOSULFAN II	c,w	c	c
ENDRIN	w	w	
GAMMA-BHC	c,w	c,w	c
HEPTACHLOR	c,w	c,w	w
HEPTACHLOR EPOXIDE	w	w	
1-METHYLNAPHTHALENE		c	c
2-METHYLPHENOL	c,w	c,w	c,w
3,4-METHYLPHENOL	c	c	c
4-NITROPHENOL	c	c	c
BENZOIC ACID	c	c	
BENZYL ALCOHOL			c
DI-N-BUTYL PHTHALATE	w		w
DI-N-OCTYL PHTHALATE	w	w	w
PENTACHLOROPHENOL	w	w	w
PHENOL	w	w	c,w

c = clam tissue; w = worm tissue
* Any constituent that statistically exceeded a placement site/reference area tissue-residue was retained as a COPC.

TABLE 9-43 OCTANOL-WATER PARTITION COEFFICIENTS (K_{OW}) FOR NEUTRAL ORGANIC COMPOUNDS

Analyte	Log_{10} K_{ow}	Reference
DIOXINS TEQ (ND=0)	6.64	1
DIOXINS TEQ (ND=1/2)	6.64	1
ACENAPHTHENE	3.9	3
ACENAPHTHYLENE	4.1	3
ANTHRACENE	4.3	3
BENZ[A]ANTHRACENE	5.6	3
BENZO[A]PYRENE	6	3
BENZO[B]FLUORANTHENE	6.6	3
BENZO[G,H,I]PERYLENE	7	3
BENZO[K]FLUORANTHENE	6.8	3
CHRYSENE	5.6	3
DIBENZ[A,H]ANTHRACENE	6.69	1
FLUORANTHENE	5.5	3
FLUORENE	4.4	3
INDENO[1,2,3-CD]PYRENE	7.7	3
NAPHTHALENE	3.6	3
PHENANTHRENE	4.5	3
PYRENE	4.9	3
2,2',3,3',4,4',5,5',6,6'-DECACHLOROBIPHENYL (BZ#209)	8.18	4
2,2',3,3',4,4',5,5',6-NONACHLOROBIPHENYL (BZ# 206)	8.09	4
2,2',3,3',4,4',5,6-OCTACHLOROBIPHENYL (BZ# 195)	7.56	4
2,2',3,3',4,4',5-HEPTACHLOROBIPHENYL (BZ# 170)	7.27	4
2,2',3,3',4,4'-HEXACHLOROBIPHENYL (BZ# 128)	6.74	4
2,2',3,4',5,5',6-HEPTACHLOROBIPHENYL (BZ# 187)	7.17	4
2,2',3,4,4',5',6-HEPTACHLOROBIPHENYL (BZ# 183)	7.2	4
2,2',3,4,4',5'-HEXACHLOROBIPHENYL (BZ# 138)	6.83	4
2,2',3,4,4',5,5'-HEPTACHLOROBIPHENYL (BZ# 180)	7.36	4
2,2',3,4,4',6,6'-HEPTACHLOROBIPHENYL (BZ# 184)	6.85	4
2,2',3,4,5'-PENTACHLOROBIPHENYL (BZ# 87)	6.29	4
2,2',3,5'-TETRACHLOROBIPHENYL (BZ# 44)	5.75	4
2,2',4,4',5,5'-HEXACHLOROBIPHENYL (BZ# 153)	6.92	4
2,2',4,5'-TETRACHLOROBIPHENYL (BZ# 49)	5.85	4
2,2',4,5,5'-PENTACHLOROBIPHENYL (BZ# 101)	6.38	4
2,2',5,5'-TETRACHLOROBIPHENYL (BZ# 52)	5.84	4
2,2',5-TRICHLOROBIPHENYL (BZ# 18)	5.24	4
2,3',4,4',5-PENTACHLOROBIPHENYL (BZ# 118)	6.74	4
2,3',4,4'-TETRACHLOROBIPHENYL (BZ# 66)	6.2	4
2,3,3',4,4',5,-HEXACHLOROBIPHENYL (BZ# 156)	7.18	4
2,3,3',4,4'-PENTACHLOROBIPHENYL (BZ# 105)	6.65	4
2,4'-DICHLOROBIPHENYL (BZ# 8)	5.07	4
2,4,4'-TRICHLOROBIPHENYL (BZ# 28)	5.67	4
3,3',4,4',5,5'-HEXACHLOROBIPHENYL (BZ# 169)	7.42	4
3,3',4,4',5-PENTACHLOROBIPHENYL (BZ# 126)	6.89	4
3,3',4,4'-TETRACHLOROBIPHENYL (BZ# 77)	6.36	4
AROCLOR 1016	5.9	3
AROCLOR 1221	4	3
AROCLOR 1232	4.5	3
AROCLOR 1242	6	3
AROCLOR 1248	6.1	3
AROCLOR 1260	6.1	3

TABLE 9-43 CONTINUED

Analyte	$Log_{10} K_{ow}$	Reference
4,4'-DDD	6.1	3
4,4'-DDE	6.76	3
4,4'-DDT	6.83	3
ALDRIN	3	3
ALPHA-BHC	3.8	3
BETA-BHC	3.8	3
CHLORDANE	6.32	1
DACTHAL	4.4	1
DELTA-BHC	3.8	3
DIELDRIN	5.5	3
ENDOSULFAN I	3.6	3
ENDOSULFAN II	3.6	3
ENDOSULFAN SULFATE	3.6	3
ENDRIN	4.6	3
ENDRIN ALDEHYDE	5.6	3
GAMMA-BHC	3.8	3
HEPTACHLOR	5.4	3
HEPTACHLOR EPOXIDE	5.4	3
METHOXYCHLOR	4.3	3
MIREX	6.9	3
TOXAPHENE	3.3	3
1,2,4-TRICHLOROBENZENE	4.2	3
1,2-DICHLOROBENZENE	3.4	3
1,2-DIPHENYLHYDRAZINE	2.9	3
1,4-DICHLOROBENZENE	3.5	3
1-METHYLNAPHTHALENE	3.87	1
2,2'-OXYBIS(1-CHLOROPROPANE)	2.6	3
2,4,6-TRICHLOROPHENOL	3.7	3
2,4-DICHLOROPHENOL	3.1	3
2,4-DIMETHYLPHENOL	2.4	3
2,4-DINITROPHENOL	1.5	3
2,4-DINITROTOLUENE	2.1	3
2,6-DINITROTOLUENE	2	3
2-CHLORONAPHTHALENE	4.7	3
2-CHLOROPHENOL	2.2	3
2-METHYL-4,6-DINITROPHENOL	2.564	1
2-METHYLNAPHTHALENE	3.36	1
2-METHYLPHENOL	1.99	1
2-NITROPHENOL	1.8	3
3,3'-DICHLOROBENZIDINE	3	3
3,4-METHYLPHENOL	2.36	1
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	2.22	1
4-BROMOPHENYL PHENYL ETHER	5.1	3
4-CHLORO-3-METHYLPHENOL	3.1	1
4-CHLOROPHENYL PHENYL ETHER	4.9	3
4-NITROPHENOL	2.9	3
BENZOIC ACID	1.86	1
BENZYL ALCOHOL	1.11	1
BIS(2-CHLOROETHOXY)METHANE	1.3	3
BIS(2-CHLOROETHYL) ETHER	2.6	3
BIS(2-ETHYLHEXYL) PHTHALATE	4.2	3
DI-N-BUTYL PHTHALATE	5.1	3
DI-N-OCTYL PHTHALATE	9.2	3
DIETHYL PHTHALATE	1.4	3
DIMETHYL PHTHALATE	1.6	3
HEXACHLORO-1,3-BUTADIENE	4.3	3

TABLE 9-43 CONTINUED

Analyte	Log_{10} K_{ow}	Reference
HEXACHLOROBENZENE	5.2	3
HEXACHLOROCYCLOPENTADIENE	5.5	3
HEXACHLOROETHANE	3.8	3
M-DICHLOROBENZENE	3.42	1
METHANAMINE, N-METHYL-N-NITROSO	-0.57	1
N-NITROSODI-N-PROPYLAMINE	1.3	3
N-NITROSODIPHENYLAMINE	1.3	3
NITROBENZENE	1.9	3
PENTACHLOROPHENOL	5	3
PHENOL	1.5	3

References:

1) Syracuse Research Corporation (SRC 2000)
2) Mabey et al. (1982)
3) USEPA/USACE (1998): ITM
4) Hawker, D.W. and D.W. Connell (1988)

TABLE 9-44 USFDA ACTION LEVELS AND USEPA TOLERANCE/GUIDANCE LEVELS[a]

Chemical Constituent (s) [b]	Action/Tolerance/ Guidance Level	UNITS	Fish Commodity	Reference
Aldrin/Dieldrin [c]	300	UG/KG	All Fish	Compliance Policy Guide sec. 575.100
Chlordane	300	UG/KG	All Fish	Compliance Policy Guide sec. 575.100
DDT,DDD, DDE [c]	5000	UG/KG	All Fish	Compliance Policy Guide sec. 575.100
Arsenic	86	MG/KG	Molluscan bivalves	FDA Guidance Document
Cadmium	4	MG/KG	Molluscan bivalves	FDA Guidance Document
Chromium	13	MG/KG	Molluscan bivalves	FDA Guidance Document
Lead	1.7	MG/KG	Molluscan bivalves	FDA Guidance Document
Nickel	80	MG/KG	Molluscan bivalves	FDA Guidance Document
Methyl Mercury	1	MG/KG	Molluscan bivalves	Compliance Policy Guide sec. 540.600
Heptachlor/Heptachlor Epoxide	300	UG/KG	All Fish	Compliance Policy Guide sec. 575.100
Mirex	100	UG/KG	All Fish	Compliance Policy Guide sec. 575.100
Total PCBs [d]	2000	UG/KG	All Fish	21 CFR 109.30

(a) primary reference for all values: (USFDA 1998) *Fish and Fishery Products Hazards and Control Guide.* U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. January.

(b) Values provided only for chemcial constituents tested and relevant to this project.

(c) Action Level applies to residues for the individual pesticides or in combination.

(d) Tolerance value, rather than guidance level or action level.

TABLE 9-45A *Nereis virens* (SAND WORM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO THE USFDA ACTION LEVELS

ANALYTE	USFDA ACTION LEVEL	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METHYL MERCURY	1000	UG/KG	46	49	49	49	50	48	49	50	51	45	49	49	45
TOTAL PCB (ND=0)	2000	UG/KG	16	18	15	49	39	64	42	26	56	12	52	23	13
TOTAL PCB (ND=1/2DL)	2000	UG/KG	36	36	34	126	99	92	109	46	124	26	92	49	28
TOTAL PCB (ND=DL)	2000	UG/KG	41	42	39	130	105	98	113	50	130	32	102	53	33
ALDRIN+DIELDRIN	300	UG/KG	1	39	1	1	1	6	1	6	1	1	1	1	1
CHLORDANE	300	UG/KG	4	4	4	4	4	4	4	4	4	4	4	4	4
DDD+DDT+DDE	5000	UG/KG	5	36	5	10	8	8	10	8	11	5	47	38	29
MIREX	100	UG/KG	5	5	5	5	5	5	5	5	5	5	5	5	5
TOTAL HEPTACHLOR	300	UG/KG	10	1	14	1	1	1	1	1	1	11	5	3	3

TABLE 9-45B *Macoma nasuta* (BLUNT-NOSE CLAM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO THE USFDA ACTION LEVELS

ANALYTE	USFDA ACTION LEVEL	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
METHYL MERCURY	1000	UG/KG	121	122	128	49	45	51	49	48	52	120	49	50	50
TOTAL PCBs (ND=0)	2000	UG/KG	17	16	19	14	13	8	15	9	6	20	7	6	7
TOTAL PCBs (ND=1/2DL)	2000	UG/KG	29	19	33	22	19	11	26	11	9	33	11	9	9
TOTAL PCBs (ND=DL)	2000	UG/KG	34	26	38	28	26	18	31	18	16	38	18	17	17
ALDRIN+DIELDRIN	300	UG/KG	1	5	3	4	7	4	5	5	3	2	3	3	3
CHLORDANE	300	UG/KG	4	4	4	4	4	4	4	4	4	4	4	4	4
DDD+DDT+DDE	5000	UG/KG	18	7	13	6	13	22	11	16	18	18	5	5	5
MIREX	100	UG/KG	5	5	5	5	5	5	5	5	5	5	5	5	5
TOTAL HEPTACHLOR	300	UG/KG	3	6	6	1	1	9	1	6	6	8	1	2	2

TABLE 9-46A *Nereis virens* (SAND WORM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO USEPA TOLERANCE VALUES

ANALYTE	USEPA TOLERANCE VALUE	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ARSENIC	76000	UG/KG	1810	1790	2020	2430	1730	2310	1870	1950	1810	1790	1600	1940	1980
CADMIUM	3000	UG/KG	20	20	38.4	20	20	20	20	20	20	20	20	20	20
CHROMIUM	12000	UG/KG	630	188	543	283	238	405	149	636	662	531	549	1020	632
LEAD	2000	UG/KG	146	378	209	145	145	145	145	245	258	235	145	145	145
NICKEL	70000	UG/KG	1370	854	1480	1180	811	696	683	1200	1220	1000	1140	1070	1050

TABLE 9-46B *Macoma nasuta* (BLUNT-NOSE CLAM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO USEPA TOLERANCE VALUES

ANALYTE	USEPA TOLERANCE VALUE	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
ARSENIC	76000	UG/KG	2720	2910	2390	2940	2680	2760	3040	2700	3280	2790	2690	2640	2600
CADMIUM	3000	UG/KG	20	50.7	20	20	20	20	20	20	20	20	20	20	20
CHROMIUM	12000	UG/KG	887	678	837	3630	2660	993	2350	962	622	728	543	426	469
LEAD	2000	UG/KG	480	513	211	145	220	365	234	388	245	144	146	145	328
NICKEL	70000	UG/KG	1170	1220	1100	3420	2720	1190	2220	1290	964	1030	924	789	995

TABLE 9-47 USEPA RECOMMENDED FISH TISSUE SCREENING VALUES[a]

Chemical Constituent (s) [b]	Screening Value (SV) [c]	UNITS	Notes
Arsenic (Inorganic)	3	MG/KG	non-carcinogen
Cadmium	10	MG/KG	non-carcinogen
Mercury	0.6	MG/KG	non-carcinogen; assumes methyl mercury
Selenium	50	MG/KG	non-carcinogen; selenious acid or selenium sulfate
Total DDT	300	UG/KG	carcinogen; DDD+DDE+DDT
Dieldrin	7	UG/KG	carcinogen
Endodulfan (I and II)	60,000	UG/KG	non-carcinogen
Endrin	3,000	UG/KG	non-carcinogen
Heptachlor Epoxide	10	UG/KG	carcinogen
Gamma-BHC (Lindane)	80	UG/KG	carcinogen
Dioxins/Furans	0.7	NG/KG	carcinogen

(a) primary reference for screening values: USEPA 1995a. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume I: Fish Sampling and Analysis.* Second Edition. EPA 823-R-95-007.

(b) Values provided only for chemcial constituents tested and relevant to this project.

(c) SV are target analyte concentrations in fish tissue that are equal to the oral reference dose (RfD) (mg/kg/d or ug/kg/d) for non-carcinogens or the oral slope factor (SF) [(mg/kg/d)$^{-1}$ or (ug/kg/d)$^{-1}$] and a risk level (RL) of 10^{-5} for carcinogens. Assumes an average consumption rate (CR) of 6.5 g/day for a 70 kg adult. Values represent the recommended SVs for use in State fish/shellfish comumption advisory programs for the general adult population.

TABLE 9-48A *Nereis virens* (SAND WORM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO USEPA SCREENING VALUES

ANALYTE	USEPA SCREENING VALUE	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
DIOXINS TEQ (ND=0)	0.7	NG/KG	0.882						0.577						
DIOXINS TEQ (ND=1/2DL)	0.7	NG/KG	1.36		1.08	1.41	1.15	0.838	0.972		0.826	0.946			0.832
DIOXINS TEQ (ND=DL)	0.7	NG/KG	1.44		0.968	1.4	1.13	0.862	0.955		0.848	1.05	0.666	0.65	0.845
4,4'-DDT	300	UG/KG											9.37		
ENDOSULFAN II	60000	UG/KG	25.7		22.1							30.7	13.2		
ENDRIN	3000	UG/KG								1.84					
GAMMA-BHC	80	UG/KG		4.28				2.66	1.38	1.82	2.32				
TOTAL HEPTACHLOR	10	UG/KG	9.68		14.4							11.3	4.93		

Shaded cells indicate that 95% UCLM exceeds criterion

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TABLE 9-48B *Macoma nasuta* (BLUNT-NOSE CLAM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO

ANALYTE	USEPA SCREENING VALUE	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
DIOXINS TEQ (ND=1/2DL)	0.7	NG/KG	0.755	1.32			0.753			0.829	0.627		0.659		0.61
DIOXINS TEQ (ND=DL)	0.7	NG/KG	0.774	1.25	0.653	0.51	0.793	0.645	0.497	0.87	0.686	0.655	0.719	0.652	0.692
MERCURY	1000	UG/KG	121	122	128							120			
4,4'-DDT	300	UG/KG	12.5		6.57			16.7		10.4	10.4	11.8			
DIELDRIN	7	UG/KG												2.34	2.33
ENDOSULFAN I	60000	UG/KG			5.35										
ENDOSULFAN II	60000	UG/KG	5.1		3.17							4.52			
GAMMA-BHC	80	UG/KG								2.11	2.22				
SELENIUM	50000	UG/KG	910		765	938	885	716	863	697	697	711	777	782	917
TOTAL HEPTACHLOR	10	UG/KG		5.61						6.45	5.58	7.83			

Shaded values indicate that 95% UCLM exceeds criterion.

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TABLE 9-49 RESIDUE-EFFECT DATA* FROM PUBLISHED LITERATURE

Chemical Constituent	Test Species	Exposure Concentration	UNITS	Effect	Endpoint	Exposure Route	Body Part	Life Stage	Reference
Silver	*Mya arenaria* (soft-shell clam)	10.4	MG/KG	Physiological	LOED	Absorption	Whole Body	Adult	Thurberg et al. 1974; ERED database
Zinc	*Mytilus edulis* (blue mussel)	130	MG/KG	Mortality	ED100	-	Whole Body	-	Burbridge et al. 1994; USEPA 2000d
Benzo(a)pyrene	*Mercenaria mercenaria*	2.21	UG/KG	Physiological	LOED	Absorption	Whole Body	NA	Anderson et al. 1981; ERED database
				Mortality	NOED	Absorption	Whole Body	NA	Anderson et al. 1981; ERED database
Fluoranthene	*Mytilus edulis* (blue mussel)	112	UG/KG	Physiological	LOED	-	Whole Body	-	Malins et al. 1985; USEPA 2000d
Phenanthrene	*Mytilus edulis* (blue mussel)	30,700	UG/KG	Physiological	ED50	-	Whole Body	-	Donkin et al. 1989; USEPA 2000d
Pyrene	*Mytilus edulis* (blue mussel)	189,000	UG/KG	Physiological	ED50	-	Whole Body	-	Donkin et al. 1989; USEPA 2000d
Pentachlorophenol	*Nereis virens* (sand worm)	28,000	UG/KG	Physiological	LOED	Absorption	Whole Body	Adult	Carr and Neff 1981; ERED database

* If exposure concentrations from multiple residue-effect studies were available, the lowest exposure concentration that produced an effect was used in the project comparisons.

TABLE 9-50A *Nereis virens* (SAND WORM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO RESIDUE EFFECT DATA

ANALYTE	EFFECT CONCENTRATIONS	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
PENTACHLOROPHENOL	28000	UG/KG						188	192						

TABLE 9-50B *Macoma nasuta* (BLUNT-NOSE CLAM): COMPARISON OF THE UPPER 95% CONFIDENCE LEVEL OF THE MEAN STEADY-STATE TISSUE RESIDUE TO RESIDUE-EFFECT DATA

ANALYTE	EFFECT CONCENTRATION	UNITS	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
SILVER	10000	UG/KG		315	147	187								263	
ZINC	130000	UG/KG	18600	16500	15200	18400	15900	20600	18400	18300	23900		16300		14800
BENZO[A]PYRENE	2	UG/KG								2.49	2.47				2.96
FLUORANTHENE	112	UG/KG	13.7	14.6	14.5	16.6	13.7	14.6	19.3	30.4	21.3	16.7		31	14.5
PHENANTHRENE	30700	UG/KG						3.46							5.48
PYRENE	189000	UG/KG	5.16	6.79	5.77	4.67		6.26		7.41	7.13	8.82		6.47	6.32

TABLE 9-51A *Nereis virens* (SAND WORM): ACUTE AND CHRONIC CRITICAL BODY RESIDUE FOR PAHs AND PESTICIDES

NEUTRAL ORGANICS	EFFECT CONCENTRATION (RANGE)	UNITS (wet weight)	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
PAHs (acute)	2 - 8 (acute)	mmol/KG	0.4	0.2	0.2	0.05	0.003	0.006	0.003	0.003	0.003	0.08	0.2	0.06	0.003
PAHs (chronic)	0.2 - 0.8 (chronic)	mmol/KG	0.04	0.02	0.02	0.005	0.0003	0.0006	0.0003	0.0003	0.0003	0.008	0.02	0.006	0.0003
PAHs + pesticides (acute)	2 - 8 (acute)	mmol/KG	0.4	0.2	0.2	0.05	0.006	0.01	0.006	0.007	0.009	0.09	0.2	0.07	0.008
PAHs + pesticides (chronic)	0.2 - 0.8 (chronic)	mmol/KG	0.04	0.02	0.02	0.005	0.0006	0.001	0.0006	0.0007	0.0009	0.009	0.02	0.007	0.0008

TABLE 9-51B *Macoma nasuta* (BLUNT-NOSE CLAM): ACUTE AND CHRONIC CRITICAL BODY RESIDUE FOR PAHs AND PESTICIDES

NEUTRAL ORGANICS	EFFECT CONCENTRATION (RANGE)	UNITS (wet weight)	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
PAHs (acute)	2 - 8 (acute)	mmol/KG	0.04	0.02	0.04	0.007	0.008	0.03	0.01	0.04	0.05	0.05	0.06	0.04	0.04
PAHs (chronic)	0.2 - 0.8 (chronic)	mmol/KG	0.004	0.002	0.004	0.0007	0.0008	0.003	0.001	0.004	0.005	0.005	0.006	0.004	0.004
PAHs + pesticides (acute)	2 - 8 (acute)	mmol/KG	0.04	0.02	0.04	0.01	0.01	0.04	0.01	0.04	0.05	0.05	0.06	0.04	0.05
PAHs + pesticides (chronic)	0.2 - 0.8 (chronic)	mmol/KG	0.004	0.002	0.004	0.001	0.001	0.004	0.001	0.004	0.005	0.005	0.006	0.004	0.005

TABLE 9-52A *Nereis virens* : COPC COMPARISONS (95% UCLM Css) TO SCREENING CRITERIA [(1)]

				USEPA	Weight-of-Evidence															
COPCs	Carcinogen (C) or Non-carcinogen (N)*	UNITS	US FDA Action Level (a)	Tolerance/ Guidance Level (b)	USEPA Screening Value (c)	Residue Effect Data (d)	USEPA RBC (e)	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
DIOXIN TEQ (ND=0)	C	NG/KG			0.7		0.021	**0.882 ce**						**0.577 e**						
DIOXIN TEQ (ND=1/2DL)	C	NG/KG			0.7		0.021	**1.36 ce**		**1.08 ce**	**1.41 ce**	**1.15 ce**	**0.838 ce**	**0.972 ce**		**0.826 ce**	**0.946 ce**			**0.832 ce**
DIOXIN TEQ (ND=DL)	C	NG/KG			0.7		0.021	**1.44 ce**		**0.968 ce**	**1.4 ce**	**1.13 ce**	**0.862 ce**	**0.955 ce**		**0.848 ce**	**1.05 ce**	**0.666 e**	**0.65 e**	**0.845 ce**
ALUMINUM	N	MG/KG					1400		18.9				27.4		14.9	40.9		11.6	13.3	12.2
ANTIMONY	N	MG/KG					0.54			**0.151 e**			**0.153 e**				**0.242 e**	**0.179 e**	**0.207 e**	
BERYLLIUM	N	MG/KG					2.7	0.0718		0.07			0.03		0.032	0.0393	0.07	0.03	0.03	0.03
CHROMIUM	N	MG/KG		12			4.1***	**0.63 e**	0.188	**0.543 e**	0.283	0.238	0.405	0.149	**0.636 e**	**0.662 e**	**0.531 e**	**0.549 e**	**1.02 e**	**0.632 e**
COPPER	N	MG/KG					54	1.79	2.19	1.9	1.71	1.58	1.64	1.61	1.75	1.7	2.2	1.81	1.84	1.82
MANGANESE	N	MG/KG					190		5.05	4.22		1.99		1.9		9.51	1.72			
NICKEL	N	MG/KG		70			27	1.37	0.854	1.48	1.18	0.811	0.696	0.683	1.2	1.22	1	1.14	1.07	1.05
SILVER	N	MG/KG					6.8	0.201									0.244	0.129		
ZINC	N	MG/KG					410		35		**43.1 e**								**61.4 e**	
CHRYSENE	C	UG/KG					430		7.42											
FLUORANTHENE	N	UG/KG					54000											13.1		
TOTAL PAHs (ND=0)**		UG/KG																19.1		
TOTAL PAHs (ND=1/2DL)**		UG/KG																39.4		
TOTAL PAHs (ND=DL)**		UG/KG																59.7		
TOTAL PCB ND=0	C	UG/KG	2000				1.6				**48.6 e**			**41.6 e**		**56.2 e**				
4,4'-DDD	C	UG/KG					13		**14.3 e**					6.66		7.85		**35.6 e**	**31.8 e**	**25.1 e**
4,4'-DDT	C	UG/KG			300		9.3											**9.37 e**		
ALDRIN	C	UG/KG					0.19		**36.1 e**				**5.85 e**	**0.727 e**	**5.68 e**					
ALDRIN+DIELDRIN		UG/KG	300						38.8				6.39	1.27	6.22					
ALPHA-BHC	C	UG/KG					0.5		**4.55 e**											
BETA-BHC	C	UG/KG					1.8						**6.39 e**				**1.87 e**			
CHLORBENSIDE**		UG/KG							45		13.3		11.3	18.6	11.8	16.2				20.1
DACTHAL	N	UG/KG					14000	65.4	145	49.6					48.8	82.1	51	48.2	48.2	51
DDD+DDT+DDE		UG/KG	5000						36.2					10.2		11.4		46.9	38.3	28.6
DELTA-BHC	C	UG/KG					1.8***	**2.48 e**		**3.17 e**				**2.26 e**			**3.44 e**			
ENDOSULFAN II	N	UG/KG			60000		8100	25.7		22.1							30.7	13.2		
ENDRIN		UG/KG			3000										1.84					
GAMMA-BHC	C	UG/KG			80		2.4		**4.28 e**				**2.66 e**	1.38	1.82	2.32				
HEPTACHLOR	C	UG/KG					0.7	**6.53 e**		**9.36 e**							**7.93 e**			
HEPTACHLOR EPOXIDE	C	UG/KG					0.35	**3.15 e**		**5.02 e**							**3.4 e**	**4.53 e**		
HEPTACHLOR (TOTAL)		UG/KG	300		10			9.68		**14.4 c**							**11.3 c**	4.93		
2-METHYLPHENOL	N	UG/KG					68000	244		327							258			
DI-N-BUTYL PHTHALATE	N	UG/KG					140000						85.1							
DI-N-OCTYL PHTHALATE	N	UG/KG					27000													253
PENTACHLOROPHENOL	C	UG/KG				28000	26						**188 e**	**192 e**						
PHENOL	N	UG/KG					810000												59.7	

(1) Statistical exceedances (95% UCLM) are bolded/shaded and designated as an exceedance of (a) US FDA Action Level, (b) USEPA Tolerance/Guidance Level, (c) USEPA Screening Value, (d) residue-effect data, or (e) fish tissue RBC value.
(a) Source: US FDA 1998; see Table 9-44
(b) Source: US FDA 1998; see Table 9-44
(c) Source: USEPA 1995; see Table 9-47
(d) see Table 9-49 for relevant literature references
(e) Source: USEPA 2000a. October 2000. www.epa.gov/reg3hwmd/risk/riskmenu.htm
* Applies to constituents with RBCs. Non-carcinogenic constituents screened against one-tenth of the RBC value.
** No screening criteria for Total PAHs and chlorbenside
*** No RBC values for chromium or delta-BHC. RBC for hexavalent chromium used as surrogate for chromium; RBC for beta-BHC used as surrogate for delta-BHC.

TABLE 9-52B *Macoma nasuta* : COPC COMPARISONS (95% UCLM Css) TO SCREENING CRITERIA [1]

COPCs	Carcinogen (C) or Non-carcinogen (N)*	UNITS	US FDA Action Level (a)	USEPA Tolerance/ Guidance Level (b)	Weight-of-Evidence: USEPA Screening Value (c)	Weight-of-Evidence: Residue Effect Data (d)	USEPA RBC (e)*	Brewerton Channel Eastern Extension	C&D Approach (Surficial)	C&D Approach (Cores)	Craighill Channel	Craighill Angle East	Craighill Angle West	Craighill Entrance	Craighill Upper Range	Cutoff Angle	Swan Point Channel	Tolchester Channel North	Tolchester Channel South	Tolchester Straightening
DIOXIN TEQ (ND=1/2DL)	C	NG/KG			0.7		0.021	**0.755 ce**	**1.32 ce**			**0.753 ce**			**0.829 ce**	**0.627 e**		**0.659 e**		**0.61 e**
DIOXIN TEQ (ND=DL)	C	NG/KG			0.7		0.021	**0.774 ce**	**1.25 ce**	**0.653 e**	**0.51 e**	**0.793 ce**	**0.645 e**	**0.497 e**	**0.87 ce**	**0.686 e**	**0.655 e**	**0.719 ce**	**0.652 e**	**0.692 e**
ALUMINUM	N	MG/KG					1400	87.4			53.1	51.6		40.4						58.3
ANTIMONY	N	MG/KG					0.54	**0.133 e**		**0.167 e**	**0.206 e**	**0.216 e**		**0.188 e**			**0.121 e**	**0.153 e**	**0.187 e**	**0.156 e**
ARSENIC	C	MG/KG		76	3		0.0021	**2.72 e**	**2.91 e**		**2.94 e**	**2.68 e**	**2.76 e**	**3.04 ce**	**2.7 e**	**3.28 ce**	**2.79 e**			**2.6 e**
BERYLLIUM	N	MG/KG					2.7	0.0378	0.08	0.0349			0.0378		0.0378	0.0378	0.03	0.04	0.0438	0.04
CADMIUM	N	MG/KG		3			1.4		0.0507											
CHROMIUM	N	MG/KG		12			4.1	**0.887 e**	**0.678 e**	**0.837 e**	**3.63 e**	**2.66 e**	**0.993 e**	**2.35 e**	**0.962 e**	**0.622 e**	**0.728 e**	**0.543 e**	**0.426 e**	**0.469 e**
IRON	N	MG/KG					410	**177 e**	**227 e**	**222 e**	**245 e**	**241 e**	**275 e**	**201 e**	**198 e**	**218 e**	**178 e**	**176 e**		**176 e**
MANGANESE	N	MG/KG					190	**24.8 e**	14.8	12.9	15.5	**23.9 e**	**26.9 e**	17.1	13.5	18.2	12.9	10.9	10.6	5.02
MERCURY	N	MG/KG	1		0.6		0.14***	**0.121 e**	**0.122 e**	**0.128 e**							**0.12 e**			
NICKEL	N	MG/KG		70			27	1.17	1.22	1.1	**3.42 e**	**2.72 e**	1.19	2.22	1.29	0.964	1.03	0.924	0.789	0.995
SELENIUM	N	MG/KG			50		6.8	**0.91 e**		**0.765 e**	**0.938 e**	**0.885 e**	**0.716 e**	**0.863 e**	**0.697 e**	**0.697 e**	**0.711 e**	**0.777 e**	**0.782 e**	**0.917 e**
SILVER	N	MG/KG				10.4	6.8		0.315	0.147	0.187								0.263	
ZINC	N	MG/KG				130	410	18.6	16.5	15.2	18.4	15.9	20.6	18.4	18.3	23.9		16.3		14.8
ACENAPHTHYLENE	N	UG/KG					80000		263	909			544		643	1210		968		645
ANTHRACENE	N	UG/KG					410000						4.64			3.97	4.49			4.32
BENZ[A]ANTHRACENE	C	UG/KG					4.3		**6.84 e**				**8.39 e**		**4.98 e**	**5.24 e**		**4.82 e**	**4.7 e**	**5.67 e**
BENZO[A]PYRENE	C	UG/KG				2.21	0.43								**2.49 de**	**2.47 de**				**2.96 de**
BENZO[B]FLUORANTHENE	C	UG/KG					4.3	**25.3 e**	**49.5 e**	**27.2 e**	**22.3 e**	**23.7 e**	**20.3 e**	**19.9 e**	**23.7 e**	**23 e**	**37.1 e**	**37.1 e**	**30.2 e**	**50.3 e**
CHRYSENE	C	UG/KG					430	7.05	7.75				8.49		5.8	5.84		5.5	5.5	7.13
FLUORANTHENE	N	UG/KG				112	54000	13.7	14.6	14.5	16.6	13.7	14.6	19.3	30.4	21.3	16.7		31	14.5
FLUORENE	N	UG/KG					54000	11.4	11.6	10.3	10.7	10.4	11.5	10.9	9.8	9.97	12	11.5	10.5	20.1
NAPHTHALENE	N	UG/KG					27000				38.4	43.1		52.6	35.4	37.3		47	47.8	57.5
PHENANTHRENE	N	UG/KG				30700	27000***						3.46							5.48
PYRENE	N	UG/KG				189000	41000	5.16	6.79	5.77	4.67		6.26		7.41	7.13	8.82		6.47	6.32
TOTAL PAHs (ND=0)**		UG/KG							102		95.5	115	118	118	136	115	138	125	138	162
TOTAL PAHs (ND=1/2DL)**		UG/KG						103	117	102	107	125	126	130	146	126	149	138	151	173
TOTAL PAHs (ND=DL)**		UG/KG						116	131	116	120	134	135	142	155	137	160	151	165	183
TOTAL PCB ND=0	C	UG/KG	2000				1.6	**17.2 e**	**15.8 e**	**19.4 e**	**14.4 e**	**13.3 e**		**14.8 e**			**19.9 e**			
4,4'-DDD	C	UG/KG					13			4.75					3.84	5.34				
4,4'-DDT	C	UG/KG			300		9.3	**12.5 e**		6.57			**16.7 e**		**10.4 e**	**10.4 e**	**11.8 e**			
ALDRIN	C	UG/KG					0.19		**4.69 e**		**3.08 e**	**4.49 e**		**2.68 e**						
ALDRIN+DIELDRIN		UG/KG	300						5.23		4.42	6.83		5.03					3.46	3.37
ALPHA-BHC	C	UG/KG					0.5			**12.2 e**			**2.87 e**							
BETA-BHC	C	UG/KG					1.8				**4.56 e**	**11.3 e**	**7.02 e**							
DACTHAL	N	UG/KG					14000													
DDD+DDT+DDE		UG/KG	5000					18.4		13.2			21.5		16.1	17.6	17.7			
DELTA-BHC	C	UG/KG					1.8													
DIELDRIN	C	UG/KG			7		0.2												**2.34 e**	**2.33 e**
ENDOSULFAN I	N	UG/KG			60000		8100			5.35										
ENDOSULFAN II	N	UG/KG			60000		8100	5.1		3.17							4.52			
GAMMA-BHC	C	UG/KG			80	63	2.4								2.11	2.22				
HEPTACHLOR	C	UG/KG					0.7		**5.18 e**						**4.79 e**	**5.15 e**	**7.4 e**			
HEPTACHLOR (TOTAL)		UG/KG	300		10				5.61						6.45	5.58	7.83			
1-METHYLNAPHTHALENE	N	UG/KG					27000***												23	22.4
2-METHYLPHENOL	N	UG/KG					68000							104	60.8	58.2		95.8	95.3	91.4
3,4-METHYLPHENOL	N	UG/KG					68000	142	494	253	89.8	42.3	111	124		57.2	1130	39	56.3	66.3
4-NITROPHENOL	N	UG/KG					11000							175						
BENZOIC ACID	N	UG/KG					5400000		5310					4860				6910	8100	5990
BENZYL ALCOHOL	N	UG/KG					410000											163		
BIS(2-ETHYLHEXYL) PHTHALATE	C	UG/KG					230													
PHENOL	N	UG/KG					810000	130												

(1) Statistical exceedances (95% UCLM) are bolded/shaded and designated as an exceedance of (a) US FDA Action Level, (b) USEPA Tolerance/Guidance Level, (c) USEPA Screening Value, (d) residue-effect data, or (e) fish tissue RBC value.
(a) Source: US FDA 1998; see Table 9-44
(b) Source: US FDA 1998; see Table 9-44
(c) Source: USEPA 1995; see Table 9-47
(d) see Table 9-49 for relevant literature references
(e) Source: USEPA 2000a. October 2000. www.epa.gov/reg3hwmd/risk/riskmenu.htm
* Applies to constituents with RBCs. Non-carcinogenic constituents screened against one-tenth of the RBC value.
** No screening criteria for Total PAHs.
*** No RBC value for mercury, phenanthrene, or 1-methylnaphthalene. RBC for methyl mercury used as surrogate for mercury; RBC for naphthalene used as surrogate for both phenanthrene and 1-methylnaphthalene.

TABLE 9-53 SUMMARY OF RESULTS FOR BIOACCUMULATION SURVIVAL BALTIMORE HARBOR APPROACH CHANNELS, INSIDE SITE 104, OUTSIDE SITE 104 REFERENCE, AND NORFOLK OCEAN REFERENCE SITE

	Bioaccumulation Tests					
	Sand worm *Nereis virens*			**Blunt-nose clam** *Macoma nasuta*		
	Mean 28-day Survival (%)			Mean 28-day Survival (%)		
Sample Identification	Round#1	Round#2	Round#3	Round#1	Round#2	Round#3
Laboratory Control Sediment	95	97	-	93	92	-
Inside Site 104	89	89	-	96	93	-
Outside Site 104	NT	83	-	NT	92	-
Brewerton Channel Eastern Extension	82	91	-	96	91	-
C&D Approaches (Cores)	95	93	-	97	87	-
C&D Approaches (Surficial)	79	96	-	97	92	-
Craighill Channel	95	95	-	97	95	-
Craighill Entrance	95	89	-	96	81[a][b]	-
Craighill Angle - East	94	88	-	97	79[a][b]	-
Craighill Angle - West	98	89	-	96	88	-
Craighill Upper Range	91	96	-	98	97	-
Cutoff Angle	93	98	-	94	95	-
Swan Point Channel	85	94	-	95	87	-
Tolchester Channel - North	98	94	-	94	86	-
Tolchester Channel - South	95	94	-	93	87	-
Tolchester Straightening	88	95	-	94	91	-
Laboratory Control Sediment	-	-	96	-	-	99
Norfolk Ocean Reference[c]	-	-	96	-	-	99

NT= not tested; Outside Placement Site 104 not tested in first round of bioaccumulation studies

(a) Survival statistically lower (P=0.05) than Inside Placement Site 104

(b) Survival statistically lower (P=0.05) than Outside Placement Site 104

(c) Norfolk Ocean Reference bioaccumulation studies conducted independently of channel sediment studies

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TABLE 9-54 COPCs IDENTIFIED IN TISSUE-RESIDUES FOR EACH CHANNEL/PLACEMENT OPTION

CHANNEL	Brewerton Channel Eastern Extension			C&D Approach (Surficial)			C&D Approach (Cores)			Craighill Channel			Craighill Angle East			Craighill Angle West			Craighill Entrance			Craighill Upper Range			Cutoff Angle			Swan Point Channel			Tolchester Channel North			Tolchester Channel South			Tolchester Straigthening		
COPCs	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean
DIOXIN TEQ		w	w,c		c	c		w			w	w,c		w	w,c		w			w				c		w	c		w				c					w	c
ALUMINUM	c	c	c	w						c	c		c	c		w			c			w	w		w	w					w	w		w	w		w	w,c	
ANTIMONY	c						w,c	w		c	c	c	c	c		w	w		c									w,c	w		w,c	w		w,c	w		c		
ARSENIC		c			c					c	c			c			c		c	c			c			c			c									c	
BERYLLIUM	w	w,c	w,c	c	c	c	w	w,c	w,c							w	w,c	w,c				w	w,c	w,c	w	w,c	w,c	w	w,c	w,c	w	w,c	w,c	w	w,c	w,c	w	w,c	w,c
CADMIUM					c																																		
CHROMIUM	w,c	w,c			w,c		w	w,c		c	w,c		c	w,c	c	w,c	w,c		c	w,c		w,c	w,c		w	w,c		w	w,c		w	w,c		w	w,c		w	w,c	
COPPER	w	w		w	w			w			w			w			w			w			w			w			w			w			w			w	
IRON		c	c		c	c		c	c	c	c	c	c	c	c		c	c		c	c		c	c		c	c		c	c		c	c					c	c
MANGANESE	c	c	c	w,c	w,c	w,c	w,c	w,c	c	c	c	c	c	w,c	c	c	c	c	c	w,c	c	c	c	c	w,c	w,c	c	c	w,c	c	c	c	c		c	c			c
MERCURY	c	c	c	c	c	c		c	c																				c	c									
NICKEL	w,c	w,c		c	w,c		w	w,c		w,c	w,c		c	w,c	c	c	w,c		c	w,c		w,c	w,c		w	w,c			w,c		w	w,c		w	w,c		w	w,c	
SELENIUM	c	c					c	c		c	c		c	c	c	c	c		c	c		c	c		c	c		c	c		c	c		c	c		c	c	c
SILVER			w			c			c			c																		w			w			c			
ZINC	c	c			w,c			c		c	w,c	w		c		c	c		c	c		c	c			c						c			w			c	
ACENAPHTHYLENE					c	c		c	c								c	c					c	c		c	c				c	c	c				c	c	c
ANTHRACENE																		c								c	c			c								c	c
BENZ[A]ANTHRACENE				c		c										c		c				c		c	c		c				c		c	c		c	c		c
BENZO[A]PYRENE																								c			c												c
BENZO[B]FLUORANTHENE			c	c	c	c			c			c			c			c			c			c			c			c			c			c	c	c	c
CHRYSENE		c	c		c	w,c											c	c					c	c		c	c					c	c		c	c		c	c
FLUORANTHENE			c			c			c			c			c			c			c			c		c	c			c			w			c			c
FLUORENE			c			c			c			c			c			c			c			c			c			c			c			c	c		c
NAPHTHALENE												c			c						c			c			c						c			c	c	c	c
PHENANTHRENE																		c																			c		c
PYRENE			c			c			c			c						c						c			c			c						c			c
TOTAL PAHs			c			c			c			c			c			c			c		c	c		c	c			c	w,c	c	c			c		c	c
TOTAL PCBs		c	c			c		c	c			w,c			c					c	w,c						w		c	c									
4,4'-DDD				w	w	w	c	c	c											w		c	c	c	c	w,c	c				w	w	w	w	w	w	w	w	w
4,4'-DDT	c	c	c				c	c	c							c	c	c				c	c	c	c	c	c	c	c	c	w								
ALDRIN				w	w	w,c						c			c		w			w	c		w																
ALPHA-BHC				w	w	w	c	c	c							c																							
BETA-BHC												c			c	w	w	w,c												w									
CHLORBENSIDE				w	w	w					w						w			w	w		w			w	w											w	w
DACTHAL		w		w	w	w	w	w	w													w	w		w	w	w		w		w	w	w	w	w	w	w	w	w
DELTA-BHC	w	w					w	w											w	w								w	w										
DIELDRIN																																		c	c		c	c	
ENDOSULFAN I									c																														
ENDOSULFAN II	w,c	c	c				w,c	c	c																			w,c	c	c	w								
ENDRIN																						w	w																
GAMMA-BHC				w	w												w			w		c	w,c		w,c	w,c	c												
HEPTACHLOR	w		w		c		w		w														c		c	c		w	w,c	w									
HEPTACHLOR EPOXIDE	w	w					w	w																				w	w		w	w							
1-METHYLNAPHTHALENE																																			c	c		c	c
2-METHYLPHENOL	w	w	w				w	w	w										c	c	c			c			c	w	w	w	c	c	c	c	c	c	c	c	c
3,4-METHYLPHENOL			c	c	c	c	c	c	c			c			c			c	c		c						c	c	c	c			c			c			c
4-NITROPHENOL																			c	c	c																		
BENZOIC ACID					c															c											c	c		c	c			c	
BENZYL ALCOHOL																																	c						
DI-N-BUTYL PHTHALATE																w		w																					
DI-N-OCTYL PHTHALATE																																					w	w	w
PENTACHLOROPHENOL																w	w	w	w	w	w																		
PHENOL			c																															w	w	w			

c = clam tissue; w = worm tissue

* Any constituent that exceeded a placement site/reference area tissue-residue was retained as a COPC.

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TABLE 9-55A BREWERTON CHANNEL EASTERN EXTENSION: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=0)	NG/KG	Yes	Yes	0.273	N/A	N/A	5/5	1.97	–	79.2	–	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	Yes	0.427	N/A	N/A	5/5	3.03	--	143	66.9	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	Yes	0.581	N/A	N/A	5/5	4.06	--	191	123	Yes	*	*		Yes	*	Yes		✔	
BERYLLIUM	MG/KG	Yes	No	0.07	0.1	Yes	4/4	6.75	575	575	575	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.53	0.1	No	4/4	1.84	249	428	--	No	*	No	✔	*	*	(A)			
COPPER	MG/KG	Yes	Yes	1.68	0.1	No	4/4	1.28	23.4	90.8	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	1.00	0.1	No	4/4	8.85	104	255	--	No	*	No	✔	*	*	(A)			
SILVER	MG/KG	Yes	NO	0.13	0.1	No	3/4	1.00	--	--	225	No	*	*		*	*	No	✔		
DACTHAL	UG/KG	No	No	50.60	2	No	5/5	1.64	--	406	--	Yes	*	*		*	*	No	✔		
DELTA-BHC	UG/KG	No	No	2.02	NONE	N/A	5/5	0.36	486	486	--	Yes	*	*		*	*	Yes	✔		UR<1
ENDOSULFAN II	UG/KG	No	No	17.68	10	No	5/5	3.17	124	--	--	Yes	*	*		No	*	No	✔		
HEPTACHLOR	UG/KG	No	Yes	3.37	10	Yes	4/5	9.91	188	--	891	Yes	No	*	✔	*	*	(A)			<TDL
HEPTACHLOR EPOXIDE	UG/KG	No	Yes	2.04	10	Yes	5/5	5.59	181	326	--	Yes	No	*	✔	*	*	(A)			<TDL
2-METHYLPHENOL	UG/KG	No	No	196	20	No	5/5	2.17	160	131	111	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-55B: BREWERTON CHANNEL EASTERN EXTENSION: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	Yes	0.239	N/A	N/A	5/5	1.36	--	--	90.5	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	Yes	0.377	N/A	N/A	5/5	1.26	--	--	190	Yes	*	*		Yes	*	Yes		✔	
ALUMINUM	MG/KG	Yes	Yes	67.44	1.0	No	5/5	7.59	108.0	122.0	105	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.11	0.1	No	5/5	3.03	155.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological importance
ARSENIC	MG/KG	Yes	Yes	2.60	0.1	No	5/5	1.07	--	22.4	--	No	*	No	✔	(A)	*	(C)			
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	0.47	--	70.0	70	No	*	*		*	*	Yes	✔		
CHROMIUM	MG/KG	Yes	Yes	0.76	0.1	No	5/5	1.92	69.1	656.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	172.6	10	No	5/5	2.63	--	44.7	42.9	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	22.46	0.5	No	5/5	8.20	204.0	261.0	806.0	No	*	*		*	*	Yes	✔		Low toxicological importance
MERCURY	MG/KG	Yes	No	0.12	0.01	No	5/5	0.97	43.9	88.8	151.0	Yes	No	*	✔	(A)	*	(C)			
NICKEL	MG/KG	Yes	Yes	1.08	0.1	No	5/5	1.69	48.1	259.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	Yes	0.80	0.2	No	5/5	1.93	91.4	122.0	--	Yes	*	*		No	*	Yes	✔		
ZINC	MG/KG	Yes	No	17.14	2.0	No	5/5	1.05	19.6	37.9	--	No	*	*		*	No	No	✔		
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	7.44	20	Yes	5/5	3.61	--	--	170.0	No	*	*		*	*	Yes	✔		Detected in laboratory method blank
CHRYSENE	UG/KG	Yes	No	4.52	20	Yes	5/5	2.47	--	138.0	40.4	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	9.32	20	Yes	5/5	1.06	--	--	24.6	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	7.88	20	Yes	4/5	0.87	--	--	294.0	No	*	*		*	*	No	✔		
PYRENE	UG/KG	Yes	No	4.38	20	Yes	5/5	1.58	--	--	36.9	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=1/2DL, ND=DL)	UG/KG	Yes	No	51.6-70.1	NONE	N/A	5/5	1.85	--	--	36.4, 48.6	No	*	*		*	*	*	✔		CBR<acute or chronic threshold
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	9.76	NONE	N/A	5/5	0.70	--	181.0	917.0	Yes	No	*	✔	*	*	(C)			UR<1
4,4'-DDT	UG/KG	No	No	3.64	10	Yes	2/5	0.34	148.0	507.0	507.0	Yes	No	*	✔	(A)	*	(C)			UR<1
ENDOSULFAN II	UG/KG	No	No	4.44	10	Yes	5/5	4.28	450.0	933.0	933.0	Yes	*	*		No	*	No	✔		
3,4-METHYLPHENOL	UG/KG	Yes	No	109	NONE	N/A	4/5	0.58	--	--	227.0	No	*	*		*	*	No	✔		
PHENOL	UG/KG	No	No	100	20	No	5/5	1.37	--	--	77.3	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-56A C&D APPROACHES (SURFICIAL): INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

									Magnitude of Exceedance (%)				ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	
Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Inside 104	Outside 104	Ocean	Propensity to Biomagnify?	Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		Comments
ALUMINUM	MG/KG	Yes	Yes	14.6	1.0	No	4/5	0.30	69.5	--	--	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.15	0.1	No	1/5	0.53	--	52	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.86	0.1	No	5/5	1.42	37	112	--	Yes	*	No	✔	*	*	(C)			
MANGANESE	MG/KG	Yes	Yes	3.78	0.5	No	5/5	1.43	278	473	215	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.65	0.1	No	5/5	5.70	--	129	--	No	*	*		*	*	No	✔		
ZINC	MG/KG	Yes	Yes	26.76	2.0	No	5/5	2.11	--	104	--	No	*	*			*	No	✔		
CHRYSENE	UG/KG	Yes	No	2.64	20	Yes	3/4	0.12	--	--	998	No	*	*		*	*	No	✔		
4,4'-DDD	UG/KG	No	No	5.88	10	Yes	5/5	7.84	135	684	187	Yes	No	*	✔	*	*	(C)			<TDL; not detected in sediment
ALDRIN	UG/KG	No	No	28.60	10	No	5/5	2.25	107	10700	484	Yes	No	*	✔	*	*	(C)			<TDL; not detected in sediment
ALPHA-BHC	UG/KG	No	No	3.54	NONE	N/A	5/5	9.83	75.8	641	287	Yes	*	*		*	*	Yes		✔	not detected in sediment
CHLORBENSIDE	UG/KG	No	No	35.20	2	No	5/5	3.60	136	2030	628	Yes	*	*		*	*	*		✔	not detected in sediment; no criterion
DACTHAL	UG/KG	No	No	116.80	2	No	5/5	3.80	363	1070	363	Yes	*	*		*	*	No	✔		
GAMMA-BHC	UG/KG	No	Yes	3.16	10	Yes	5/5	1.20	130	671	--	Yes	*	*		No	*	Yes	✔		<TDL

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-56B C&D APPROACH (SURFICIAL): INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.395	N/A	N/A	5/5	2.25	--	55.4	215	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.752	N/A	N/A	5/5	2.51	--	68.0	479	Yes	*	*		Yes	*	Yes		✔	
ARSENIC	MG/KG	Yes	Yes	2.58	0.1	No	5/5	1.07	--	21.4	--	No	*	No	✔	(A)	*	(C)			
BERYLLIUM	MG/KG	Yes	No	0.08	0.1	Yes	5/5	1.06	68.9	280.0	280	No	*	*		*	*	No	✔		
CADMIUM	MG/KG	Yes	No	0.04	0.1	Yes	2/5	0.76	--	204.0	--	No	*	No	✔	*	*	(C)			
CHROMIUM	MG/KG	Yes	Yes	0.58	0.1	No	5/5	1.48	--	482.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	No	200.20	10	No	5/5	3.05	--	67.9	65.7	No	*	*		*	*	No	✔		
MANGANESE	MG/KG	Yes	Yes	12.30	0.5	No	5/5	8.20	66.4	97.6	396	No	*	*		*	*	No	✔		
MERCURY	MG/KG	Yes	Yes	0.12	0.01	No	5/5	0.95	41.5	85.6	147.0	Yes	No	*	✔	(A)	*	(C)			
NICKEL	MG/KG	Yes	Yes	1.14	0.1	No	5/5	1.79	56.6	280.0	--	No	*	No	✔	*	*	(C)			
SILVER	MG/KG	Yes	No	0.23	0.1	No	4/5	4.88	--	--	333.0	No	*	*		*	No	No	✔		
ZINC	MG/KG	Yes	Yes	15.42	2	No	5/5	0.94	--	24.1	--	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	Yes	No	208	20	No	5/5	0.75	--	890.0	890.0	No	*	*		*	*	No	✔		
BENZO[A]ANTHRACENE	UG/KG	Yes	No	3.29	20	Yes	4/5	4.39	186.0	--	339.0	No	*	*		*	*	Yes		✔	
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	16.20	20	Yes	5/5	7.86	43.6	69.2	487.0	No	*	*		*	*	Yes		✔	
CHRYSENE	UG/KG	Yes	No	4.90	20	Yes	5/5	2.68	--	158.0	52.2	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	9.60	20	Yes	5/5	1.10	--	--	28.3	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	10.64	20	Yes	5/5	1.17	--	--	432.0	No	*	*		*	*	No	✔		
PYRENE	UG/KG	Yes	No	5.70	20	Yes	5/5	2.06	--	--	78.1	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	56.1-76.1	NONE	N/A	5/5	0.82	--	--	48.1-83.8	No	*	*		*	*	*	✔		CBR<acute or chronic threshold
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	7.49	NONE	N/A	5/5	0.54	--	--	680.0	Yes	No	*	✔	*	*	(C)			UR<1
ALDRIN	UG/KG	No	No	3.13	10	Yes	4/5	5.90	--	--	339.0	No	No	*	✔	*	*	(C)			
HEPTACHLOR	UG/KG	No	Yes	3.86	10	Yes	5/5	0.45	--	1040.0	--	Yes	No	*	✔	*	*	(C)	✔		detected in laboratory method blank
3,4-METHYLPHENOL	UG/KG	Yes	Noo	351	NONE	N/A	4/5	1.85	430.0	623.0	947.0	No	*	*		*	*	No	✔		
BENZOIC ACID	UG/KG	No	No	4500	100	No	5/5	0.93	--	47.5	--	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-57A C&D APPROACHES (CORES): INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

									Magnitude of Exceedance (%)				ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	
Chemical Constituent	Units[1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Inside 104	Outside 104	Ocean	Propensity to Biomagnify?	Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		Comments
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.33	N/A	N/A	5/5	2.35	--	87.8	--	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.51	N/A	N/A	5/5	3.57	--	156	95.5	Yes	*	*		Yes	*	Yes		✔	
ANTIMONY	MG/KG	Yes	Yes	0.13	0.1	No	5/5	2.22	170	163	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.07	0.1	Yes	5/5	7.00	600	600	600	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.45	0.1	No	5/5	1.56	195	346	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.58	0.1	No	5/5	1.21	--	80	--	Yes	*	*		*	*	No	✔		
MANGANESE	MG/KG	Yes	Yes	2.90	0.5	No	4/5	1.09	190	339	--	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	1.11	0.1	No	5/5	9.79	126	294	--	No	*	No	✔	*	*	(C)			
DACTHAL	UG/KG	No	No	41.00	2	No	5/5	1.33	62.6	310	62.4	Yes	*	*		*	*	No	✔		
DELTA-BHC	UG/KG	No	No	2.70	NONE	N/A	5/5	0.49	683	683	--	Yes	*	*		*	*	Yes	✔		UR<1
ENDOSULFAN II	UG/KG	No	No	16.78	10	No	5/5	3.01	112	--	--	Yes	*	*		No	*	No	✔		
HEPTACHLOR	UG/KG	No	Yes	4.59	10	Yes	4/5	13.49	292	--	1250	Yes	No	*	✔	*	*	(C)			<TDL and FDA Action Level
HEPTACHLOR EPOXIDE	UG/KG	No	No	3.52	10	Yes	5/5	9.64	384	635	--	Yes	No	*	✔	*	*	(C)			
2-METHYLPHENOL	UG/KG	No	No	254	20	No	5/5	2.81	237	200	173	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

(1) all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-57B C&D APPROACHES (CORES): INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [a]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.344	N/A	N/A	5/5	1.15	--	--	165.0	Yes	*	*		Yes	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.14	0.1	No	5/5	4.00	237.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	0.44	--	60.0	60.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.66	0.1	No	5/5	1.69	--	564.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	No	196.00	10	No	5/5	2.98	--	64.4	62.3	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	10.86	0.5	No	5/5	7.24	47.0	74.5	338.0	No	*	*		*	*	No	✔		
MERCURY	MG/KG	Yes	Yes	0.12	0.01	No	5/5	0.95	--	85.6	147.0	Yes	No	*	✔	(A)	*	(C)			
NICKEL	MG/KG	Yes	Yes	0.97	0.1	No	5/5	1.52	--	223.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.65	0.2	No	5/5	1.56	54.3	78.8	--	Yes	*	*		No	*	Yes	✔		
SILVER	MG/KG	Yes	No	11	0.1	No	4/5	2.25	--	--	100.0	No	*	*		*	No	No	✔		
ZINC	MG/KG	Yes	No	14.30	2.0	No	5/5	0.87	--	15.1	--	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	No	No	526.20	20	No	4/5	1.89	--	2410.0	2410.0	No	*	*		*	*	No	✔		
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	9.44	20	Yes	5/5	4.58	--	--	242.0	No	*	*		*	*	Yes	✔		detected in the laboratory method blank
FLUORANTHENE	UG/KG	Yes	No	9.34	20	Yes	5/5	1.07	--	--	24.9	No	*	*		*	No	No	✔		detected in the laboratory method blank
FLUORENE	UG/KG	Yes	No	9.80	20	Yes	5/5	1.08	--	--	390.0	No	*	*		*	*	No	✔		detected in the laboratory method blank
PYRENE	UG/KG	Yes	No	4.94	20	Yes	5/5	1.78	--	--	54.4	No	*	*		*	No	No	✔		detected in the laboratory method blank
TOTAL PAHs (ND=1/2DL, ND=DL)	UG/KG	Yes	No	49.4-68.2	NONE	N/A	5/5	1.77	--	--	32.8-43.7	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
TOTAL PCBs (ND=0)	UG/KG	Yes	No	12.3	NONE	N/A	5/5	0.88	--	253.0	1180.0	Yes	No	*	✔	*	*	(C)			UR<1
4,4'-DDD	UG/KG	Yes	No	2.02	10	Yes	5/5	0.46	110.0	94.2	169.0	Yes	No	*	✔	*	*	(C)			
4,4'-DDT	UG/KG	No	No	1.96	10	Yes	5/5	0.80	33.3	227.0	227.0	Yes	No	*	✔	(A)	*	(C)			
ALPHA-BHC	UG/KG	No	No	10.32	NONE	N/A	5/5	28.67	2770.0	2770.0	2770.0	Yes	*	*		*	*	Yes		✔	
ENDOSULFAN I	UG/KG	No	No	3.59	10	Yes	4/5	11.75	--	--	1080.0	Yes	*	*		No	*	No	✔		
ENDOSULFAN II	UG/KG	No	No	2.13	10	Yes	4/5	2.05	163.0	394.0	394.0	Yes	*	*		No	*	No	✔		
3,4-METHYLPHENOL	UG/KG	Yes	No	189	NONE	N/A	5/5	1.00	185.0	289.0	463.0	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-58A CRAIGHILL CHANNEL: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Eluiriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.437	N/A	N/A	5/5	3.11	--	148	70.8	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.663	N/A	N/A	5/5	4.64	--	233	154	Yes	*	*		Yes	*	Yes		✔	
CHROMIUM	MG/KG	Yes	No	0.22	0.1	No	2/5	0.75	--	116	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	No	1.54	0.1	No	5/5	1.18	--	75.4	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.92	0.1	No	5/5	8.1	86.9	226	--	No	*	No	✔	*	*	(C)			
ZINC	MG/KG	Yes	No	33.00	2.0	No	5/5	2.61	--	152	80.1	No	*	*		*	*	Yes	✔		UCLM exceeds 1/10 RBC, but does not exceed RBC
TOTAL PCBs (ND=0)	UG/KG	Yes	No	31.2	NONE	N/A	5/5	1.37	--	--	457	Yes	No	*	✔	*	*	(C)			
CHLORBENSIDE	UG/KG	No	No	9.07	2	No	4/5	0.93	--	450	--	Yes	*	*		*	*	*	✔		UR<1

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-58B CRAIGHILL CHANNEL: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.288	N/A	N/A	5/5	0.96	--	--	122.0	Yes	*	*		No	*	Yes	✔		UR<1
ALUMINUM	MG/KG	Yes	Yes	48.42	1.0	No	5/5	5.45	49.6	59.3	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.19	0.1	No	5/5	5.49	363.0	96.9	15.7	No	*	*		*	*	Yes	✔		Low toxicological importance
ARSENIC	MG/KG	Yes	Yes	2.78	0.1	No	5/5	1.15	16.3	30.8	--	No	*	*		No	No	Yes	✔		
CHROMIUM	MG/KG	Yes	No	2.51	0.1	No	5/5	6.38	462.0	2410.0	--	No	*	*		No	*	Yes	✔		
IRON	MG/KG	Yes	Yes	232.00	10	No	5/5	3.53	33.0	94.5	92.1	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	14.90	0.5	No	5/5	9.93	102.0	139.0	501.0	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	2.54	0.1	No	5/5	3.99	249.0	747.0	--	No	*	*		No	*	Yes	✔		
SELENIUM	MG/KG	Yes	No	0.83	0.2	No	5/5	1.99	96.7	128.0	--	Yes	*	*		No	*	Yes	✔		
SILVER	MG/KG	No	No	0.13	0.1	No	4/5	2.75	18.2	--	144.0	No	*	*		*	No	No	✔		
ZINC	MG/KG	Yes	No	16.94	2.0	No	5/5	1.03	--	36.3	--	No	*	*		*	No	No	✔		
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	7.66	20	Yes	5/5	3.72	--	--	178.0	No	*	*		*	*	Yes		✔	<TDL
FLUORANTHENE	UG/KG	Yes	No	10.18	20	Yes	5/5	1.16	--	--	36.1	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	10.02	20	Yes	5/5	1.10	--	--	401.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	36.00	20	No	5/5	1.71	--	--	174.0	No	*	*		*	*	No	✔		
PYRENE	UG/KG	Yes	No	4.22	20	Yes	5/5	1.52	--	--	31.9	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	74-87.3	NONE	N/A	5/5	0.23	--	--	70-143	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
TOTAL PCBs (ND=0)	UG/KG	Yes	No	7.28	NONE	N/A	5/5	0.52	--	--	658.0	Yes	No	*	✔	*	*	(C)			UR<1
ALDRIN	UG/KG	No	No	2.15	10	Yes	4/5	4.05	--	--	201.0	Yes	No	*	✔	*	*	(C)			
BETA-BHC	UG/KG	No	Yes	3.25	NONE	N/A	4/5	0.43	--	--	230.0	Yes	*	*		*	*	Yes	✔		UR<1; <TDL
3,4-METHYLPHENOL	UG/KG	Yes	No	69	NONE	N/A	4/5	0.36	--	--	105.0	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-59A CRAIGHILL ANGLE EAST: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

									Magnitude of Exceedance (%)				ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	
Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Inside 104	Outside 104	Ocean	Propensity to Biomagnify?	Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		Comments
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.358	N/A	N/A	5/5	2.55	--	104	40	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.506	N/A	N/A	5/5	3.54	--	154	94.1	Yes	*	*		Yes	*	Yes		✔	
CHROMIUM	MG/KG	Yes	Yes	0.18	0.1	No	2/5	0.64	--	84	--	No	*	No	✔	*	*	(C)	✔		
COPPER	MG/KG	Yes	Yes	1.48	0.1	No	5/5	1.13	--	68.6	--	Yes	*	*		*	*	No	✔		
MANGANESE	MG/KG	No	Yes	1.46	0.5	No	2/5	0.55	--	121	--	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.62	0.1	No	5/5	5.51	--	121	--	No	*	No	✔	*	*	(C)	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-59B CRAIGHILL ANGLE EAST: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

									Magnitude of Exceedance (%)				ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	
Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Inside 104	Outside 104	Ocean	Propensity to Biomagnify?	Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		Comments
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.242	N/A	N/A	5/5	1.38	--	--	93.4	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.391	N/A	N/A	5/5	1.31	--	--	201.0	Yes	*	*		Yes	*	Yes		✔	
ALUMINUM	MG/KG	Yes	Yes	45.82	1.0	No	5/5	5.16	41.6	50.7	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.18	0.1	No	5/5	5.09	329.0	82.6	--	No	*	*		*	*	Yes	✔		Low toxicological importance
ARSENIC	MG/KG	Yes	Yes	2.54	0.1	No	5/5	1.05	--	19.5	--	No	*	No	✔	(A)	*	(C)			
CHROMIUM	MG/KG	Yes	Yes	2.24	0.1	No	5/5	5.69	401.0	2140.0	31.8	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	22.40	10	No	5/5	3.39	27.5	86.5	84.1	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	No	Yes	21.28	0.5	No	5/5	14.19	188.0	242.0	758.0	No	*	*		*	*	Yes	✔		Low toxicological importance
NICKEL	MG/KG	Yes	Yes	2.36	0.1	No	5/5	3.71	224.0	687.0	63.9	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.82	0.2	No	5/5	1.97	94.8	126.0	15.9	Yes	*	*		No	*	No	✔		
ZINC	MG/KG	Yes	No	15.04	2.0	No	5/5	0.92	--	21.0	--	No	*	*		*	No	No	✔		
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	7.74	20	Yes	5/5	3.76	--	--	180.0	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	9.20	20	Yes	5/5	1.05	--	--	23.0	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	Yes	9.94	20	Yes	5/5	1.09	--	--	397.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	37.80	20	No	5/5	1.79	--	--	187.0	No	*	*		*	*	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	Yes	81.8-93	NONE	N/A	5/5	0.25	--	--	81.1-168	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	5.74	NONE	N/A	5/5	0.41	--	--	498.0	Yes	No	*	✔	*	*	(C)			UR<1
ALDRIN	UG/KG	No	No	3.16	10	Yes	5/5	5.96	--	--	344.0	Yes	No	*	✔	*	*	(C)			
BETA-BHC	UG/KG	No	Yes	8.40	NONE	N/A	5/5	1.11	--	--	752.0	Yes	*	*		*	*	Yes		✔	not detected in sediment
3,4-METHYLPHENOL	UG/KG	Yes	No	39	NONE	N/A	2/5	0.20	--	--	15.2	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-60A CRAIGHILL ANGLE WEST: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.263	N/A	N/A	5/5	1.87	--	49.4	--	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.307	N/A	N/A	5/5	2.15	--	54.2	--	Yes	*	*		Yes	*	Yes		✔	
ALUMINUM	MG/KG	Yes	Yes	20.88	1.0	No	5/5	0.43	142	--	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.11	0.1	No	4/5	1.89	129	123	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	3.00	200	200	200	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.32	0.1	No	5/5	1.12	113	222	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.52	0.1	No	5/5	1.16	--	73.1	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.61	0.1	No	5/5	5.36	--	116	--	No	*	No	✔	*	*	(C)			
ALDRIN	UG/KG	No	No	3.35	10	Yes	4/5	0.26	--	1170	--	Yes	No	*	✔	*	*	(C)			UR<1
BETA-BHC	UG/KG	No	Yes	4.86	NONE	N/A	5/5	12.62	461	558	1160	Yes	*	*		*	*	Yes		✔	
CHLORBENSIDE	UG/KG	No	No	8.60	2	No	5/5	0.88	--	421	--	Yes	*	*		*	*	*	✔		UR<1
GAMMA-BHC	UG/KG	No	Yes	1.80	10	Yes	4/5	0.68	--	340	--	Yes	*	*		No	*	Yes	✔		
DI-N-BUTYL PHTHALATE	UG/KG	Yes	No	68	20	No	3/5	1.24	24.4	--	26.7	No	*	*		*	*	No	✔		
PENTACHLOROPHENOL	UG/KG	No	No	142	100	No	1/5	1.31	35.2	35.2	35.2	No	*	*		*	No	Yes	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

TABLE 9-60B CRAIGHILL ANGLE WEST: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Magnitude of Exceedance (%) Inside 104	Magnitude of Exceedance (%) Outside 104	Magnitude of Exceedance (%) Ocean	Propensity to Biomagnify?	ITM Evaluation: Exceeds USFDA Action Level?	ITM Evaluation: Exceeds USEPA Tolerance?	ITM Evaluation: COPCs Eliminated after ITM Evaluation	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Exceeds USEPA Screening Value?	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Exceeds Residue-Effect Data?	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Exceeds RBC?	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Eliminate as COPC	Remaining COPCs	Comments
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.311	N/A	N/A	5/5	1.04	--	--	140.0	Yes	*	*		No	*	Yes	✔		
ARSENIC	MG/KG	Yes	Yes	2.58	0.1	No	5/5	1.07	--	21.4	--	No	*	No	✔	(A)	*	(C)			
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	0.47	--	70.0	70.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.84	0.1	No	5/5	2.13	87.5	738.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	219.80	10	No	5/5	3.35	--	84.3	82.0	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	21.10	0.5	No	5/5	14.07	186.0	239.0	751.0	No	*	*		*	*	Yes	✔		Low toxicological importance
NICKEL	MG/KG	Yes	Yes	1.06	0.1	No	5/5	1.67	45.9	254.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.62	0.2	No	5/5	1.50	48.6	72.1	--	Yes	*	*		No	*	Yes	✔		
ZINC	MG/KG	Yes	No	18.54	2.0	No	5/5	1.13	29.4	49.2	--	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	No	No	400	20	No	5/5	1.43	--	1800.0	1800.0	No	*	*		*	*	No	✔		
ANTHRACENE	UG/KG	Yes	No	3.21	20	Yes	4/5	2.59	--	--	484.0	No	*	*		*	*	No	✔		
BENZO[A]ANTHRACENE	UG/KG	Yes	No	3.91	20	Yes	4/5	5.21	240.0	--	421.0	No	*	*		*	*	Yes		✔	<TDL
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	6.84	20	Yes	5/5	3.32	--	--	148.0	No	*	*		*	*	Yes		✔	<TDL
CHRYSENE	UG/KG	Yes	No	5.06	20	Yes	5/5	2.77	--	166.0	57.1	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	9.78	20	Yes	5/5	1.12	--	--	30.7	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	11.00	20	Yes	5/5	1.21	--	--	450.0	No	*	*		*	*	No	✔		
PHENANTHRENE	UG/KG	Yes	No	3.08	20	Yes	5/5	1.22	--	--	35.1	No	*	*		*	No	No	✔		
PYRENE	UG/KG	Yes	No	5.14	20	Yes	5/5	1.86	--	--	60.6	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	83.5-93.9	NONE	N/A	5/5	1.50	--	--	82.8-174	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
4,4'-DDT	UG/KG	No	No	4.12	10	Yes	5/5	1.67	180.0	587.0	587.0	Yes	No	*	✔	(A)	*	(C)			
ALPHA-BHC	UG/KG	No	No	1.94	NONE	N/A	3/5	5.40	440.0	--	--	Yes	*	*		*	*	Yes		✔	not detected in sediment
BETA-BHC	UG/KG	No	Yes	5.98	NONE	N/A	5/5	0.79	--	--	506.0	Yes	*	*		*	*	Yes	✔		UR<1
3,4-METHYLPHENOL	UG/KG	Yes	No	80	NONE	N/A	2/5	0.42	--	--	140.0	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-61A CRAIGHILL ENTRANCE: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units[1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=0)	NG/KG	Yes	No	0.187	N/A	N/A	5/5	1.35	--	22.5	--	Yes	*	*		No	*	Yes	✔		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.302	N/A	N/A	5/5	2.14	--	71.5	--	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.417	N/A	N/A	5/5	2.92	--	109	59.8	Yes	*	*		Yes	*	Yes		✔	
CHROMIUM	MG/KG	Yes	Yes	0.13	0.1	No	1/5	0.46	--	32	--	No	*	No	✔	*	*	(C)	✔		
COPPER	MG/KG	Yes	No	1.44	0.1	No	5/5	1.10	--	64	--	Yes	*	*		*	*	No	✔		
MANGANESE	MG/KG	Yes	Yes	1.40	0.5	No	2/5	0.53	--	112	--	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.52	0.1	No	5/5	4.62	--	85.8	--	No	*	No	✔	*	*	(C)	✔		
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	28.10	NONE	N/A	5/5	1.23	--	--	402	Yes	No	*	✔	*	*	(C)	✔		
4,4'-DDD	UG/KG	No	No	2.39	10	Yes	4/5	3.19	--	219	--	Yes	No	*	✔	*	*	(C)	✔		
ALDRIN	UG/KG	No	No	0.57	10	Yes	4/5	0.04	--	115	--	Yes	No	*	✔	*	*	(C)	✔		
CHLORBENSIDE	UG/KG	No	No	15.40	2	No	5/5	1.57	--	833	218	Yes	*	*		*	*	*		✔	no criterion; not detected in sediment
DELTA-BHC	UG/KG	No	No	1.80	NONE	N/A	5/5	0.32	422	422	--	Yes	*	*		*	*	Yes	✔		UR<1; detected in the the laboratory method blank
GAMMA-BHC	UG/KG	No	Yes	1.04	10	Yes	4/5	0.40	--	154	--	Yes	*	*		No	*	No	✔		
PENTACHLOROPHENOL	UG/KG	No	No	144	100	No	1/5	1.33	37.1	37.1	37.1	No	*	*		*	No	Yes	✔		

N/A=not applicable

*no criterion

(1) all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-61B CRAIGHILL ENTRANCE: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.281	N/A	N/A	5/5	0.94	--	--	117.0	Yes	*	*		No	*	Yes	✔		UR<1
ALUMINUM	MG/KG	Yes	Yes	38.34	1.0	No	5/5	4.32	18.5	--	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.13	0.1	No	4/5	3.74	216.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological importance
ARSENIC	MG/KG	Yes	Yes	2.8	0.1	No	5/5	1.16	17.2	31.8	--	No	*	No	✔	(A)	*	(C)			
CHROMIUM	MG/KG	Yes	Yes	1.61	0.1	No	5/5	4.08	260.0	1510.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	188.2	10	No	5/5	2.87	--	57.8	55.8	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	16.66	0.5	No	5/5	11.11	125.0	168.0	572.0	No	*	*		*	*	No	✔		Low toxicological importance
NICKEL	MG/KG	Yes	Yes	1.72	0.1	No	5/5	2.70	136.0	473.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.74	0.2	No	5/5	1.77	75.2	103.0	--	Yes	*	*		No	*	Yes	✔		
ZINC	MG/KG	Yes	No	17.06	2.0	No	5/5	1.04	19.1	37.3	--	No	*	*		*	No	No	✔		
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	6.4	20	Yes	5/5	3.11	--	--	132.0	No	*	*		*	*	Yes		✔	<TDL
FLUORANTHENE	UG/KG	Yes	No	11.12	20	Yes	5/5	1.27	--	--	48.7	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	10.18	20	Yes	5/5	1.12	--	--	409.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	44	20	No	5/5	2.09	--	--	234.0	No	*	*		*	*	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	87.1-97.7	NONE	N/A	5/5	0.38	--	--	90.3-186	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	8.67	NONE	N/A	5/5	0.62	--	150.0	803.0	Yes	No	*	✔	*	*	(C)			UR<1
ALDRIN	UG/KG	No	No	1.89	10	Yes	4/5	3.56	--	--	165.0	No	No	*	✔	*	*	(C)			not detected in sediment
2-METHYLPHENOL	UG/KG	No	No	79	20	No	2/5	1.79	47.0	78.9	86.9	No	*	*		*	*	No	✔		
3,4-METHYLPHENOL	UG/KG	Yes	No	91	NONE	N/A	5/5	0.48	37.4	--	172.0	No	*	*		*	*	No	✔		
4-NITROPHENOL	UG/KG	No	No	134	NONE	N/A	3/5	1.91	91.4	91.4	91.4	No	*	*		*	*	No	✔		
BENZOIC ACID	UG/KG	No	No	4580	100	No	5/5	0.95	--	50.2	--	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

(1) all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-62A CRAIGHILL UPPER RANGE: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
ALUMINUM	MG/KG	Yes	Yes	12.2	1.0	No	4/4	0.25	41.7	42.9	--	No	*	*		*	*	No	✔		
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	4/4	2.75	175	175	175	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.49	0.1	No	4/4	1.70	223	387	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	No	1.58	0.1	No	4/4	1.21	--	79.4	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.87	0.1	No	4/4	7.70	77.7	209	--	No	*	No	✔	*	*	(C)			
ALDRIN	UG/KG	No	No	2.87	10	Yes	3/4	0.23	--	982	--	Yes	No	*	✔	*	*	(C)			
CHLORBENSIDE	UG/KG	No	No	8.35	2	No	4/4	0.85	--	406	--	Yes	*	*		*	*	*	✔		UR<1
DACTHAL	UG/KG	No	No	40.00	2	No	4/4	1.30	58.7	300	--	Yes	*	*		*	*	No	✔		
ENDRIN	UG/KG	No	No	1.27	10	Yes	3/4	0.17	160	160	--	Yes	*	*		No	*	*	✔		
GAMMA-BHC	UG/KG	No	Yes	1.58	10	Yes	4/4	0.60	--	284	--	Yes	*	*		No	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-62B CRAIGHILL UPPER RANGE: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Magnitude of Exceedance (%) Inside 104	Magnitude of Exceedance (%) Outside 104	Magnitude of Exceedance (%) Ocean	Propensity to Biomagnify?	ITM Evaluation: Exceeds USFDA Action Level?	ITM Evaluation: Exceeds USEPA Tolerance?	ITM Evaluation: COPCs Eliminated after ITM Evaluation	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Exceeds USEPA Screening Value?	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Exceeds Residue-Effect Data?	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Exceeds RBC?	USEPA Region III Supplemental Weight-of-Evidence Evaluation: Eliminate as COPC	Remaining COPCs	Comments
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.266	N/A	N/A	5/5	1.52	--	--	112.0	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.453	N/A	N/A	5/5	1.51	--	--	249.0	Yes	*	*		Yes	*	Yes		✔	
ARSENIC	MG/KG	Yes	Yes	2.48	0.1	No	5/5	1.02	--	16.7	--	No	*	No	✔	(A)	*	(C)			
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	0.47	--	70.0	70.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.82	0.1	No	5/5	2.08	83.0	718.0	--	No	*	No	✔	(A)	*	(C)			
IRON	MG/KG	Yes	No	173.00	10	No	5/5	2.63	--	45.1	43.2	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	11.36	0.5	No	5/5	7.57	53.7	82.5	358.0	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	1.14	0.1	No	5/5	1.79	56.0	279.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.62	0.2	No	5/5	1.50	48.6	72.1	--	Yes	*	*		No	*	Yes	✔		
ZINC	MG/KG	Yes	No	16.98	2.0	No	5/5	1.04	18.5	36.7	--	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	No	No	494.00	20	No	5/5	1.77	--	2250.0	2250.0	No	*	*		*	*	Yes	✔		not detected in sediment; results may be biased high
BENZ[A]ANTHRACENE	UG/KG	Yes	No	3.44	20	Yes	5/5	4.59	199.0	--	359.0	No	*	*		*	*	No	✔		
BENZO[A]PYRENE	UG/KG	Yes	No	0.96	20	Yes	4/5	2.34	--	--	134.0	No	*	*		*	Yes	Yes		✔	<TDL
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	7.92	20	Yes	5/5	3.84	--	--	187.0	No	*	*		*	*	Yes		✔	<TDL
CHRYSENE	UG/KG	Yes	No	3.80	20	Yes	5/5	2.08	--	100.0	18.0	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	16.52	20	Yes	5/5	1.89	--	--	121.0	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	9.40	20	Yes	5/5	1.04	--	--	370.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	32.80	20	No	5/5	1.56	--	--	149.0	No	*	*		*	*	No	✔		
PYRENE	UG/KG	Yes	No	6.06	20	Yes	5/5	2.19	--	--	89.4	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	89.5-99.4	NONE	N/A	5/5	1.81	--	--	93.5-193	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
4,4'-DDD	UG/KG	No	No	1.76	10	Yes	5/5	0.40	83.3	69.2	135.0	Yes	No	*	✔	(A)	*	(C)			
4,4'-DDT	UG/KG	No	No	3.32	10	Yes	5/5	1.35	126.0	453.0	453.0	Yes	No	*	✔	(A)	*	(C)			
GAMMA-BHC	UG/KG	No	Yes	1.48	10	Yes	4/5	0.40	261.0	261.0	--	Yes	*	*		No	No	No	✔		
HEPTACHLOR	UG/KG	No	No	3.88	10	Yes	5/5	0.45	--	1040.0	--	Yes	No	*	✔	(A)	*	(C)			detected in laboratory method blank
2-METHYLPHENOL	UG/KG	No	No	52	20	No	2/5	1.19	--	--	24.0	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-63A CUTOFF ANGLE: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

									Magnitude of Exceedance (%)				ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	
Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue<TDL?	Frequency of Detection in Tissue	Uptake Ratio	Inside 104	Outside 104	Ocean	Propensity to Biomagnify?	Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		Comments
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	Yes	0.258	N/A	N/A	5/5	1.84	--	46.7	--	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	Yes	0.396	N/A	N/A	5/5	2.77	--	98.4	51.8	Yes	*	*		Yes	*	Yes		✔	
ALUMINUM	MG/KG	Yes	Yes	32.92	1.0	No	5/5	0.68	282	285	--	No	*	*		*	*	No	✔		
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	3.40	240	240	240	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	No	0.50	0.1	No	5/5	1.74	230	398	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.50	0.1	No	5/5	1.15	--	70.8	--	Yes	*	*		*	*	No	✔		
MANGANESE	MG/KG	Yes	Yes	8.92	0.5	No	2/5	3.37	792	1250	--	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.94	0.1	No	5/5	8.28	91	233	--	No	*	No	✔	*	*	(C)			
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	38.4	NONE	N/A	5/5	1.68	--	--	586	Yes	No	*	✔	*	*	(C)			
4,4'-DDD	UG/KG	No	No	2.75	10	Yes	4/5	3.67	--	267	--	Yes	No	*	✔	*	*	(C)			
CHLORBENSIDE	UG/KG	No	No	14.80	2	No	5/5	1.51	--	797	206	Yes	*	*		*	*	*		✔	no criterion; not detected in sediment
DACTHAL	UG/KG	No	No	76.00	2	No	5/5	2.47	201	660	201	Yes	*	*		*	*	No	✔		
GAMMA-BHC	UG/KG	No	Yes	2.00	10	Yes	5/5	0.76	45.7	388	--	Yes	*	*		No	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-63B CUTOFF ANGLE: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	Yes	0.208	N/A	N/A	5/5	1.19	--	--	66.0	Yes	*	*		No	*	Yes	✔		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	Yes	0.632	N/A	N/A	5/5	1.21	--	--	179.0	Yes	*	*		No	*	Yes	✔		
ARSENIC	MG/KG	Yes	Yes	2.78	0.1	No	5/5	1.15	--	30.8	--	No	*	No	✔	(A)	*	(C)			
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	0.47	--	70.0	70.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	No	0.57	0.1	No	5/5	1.44	--	466.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	187.40	10	No	5/5	2.85	--	57.1	55.1	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	16.32	0.5	No	5/5	10.88	121.0	162.0	558.0	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.87	0.1	No	5/5	1.36	--	189.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	Yes	0.57	0.2	No	5/5	1.38	36.2	57.8	--	Yes	*	No	✔	*	*	(C)			
ZINC	MG/KG	Yes	No	19.62	2.0	No	5/5	1.20	--	57.9	--	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	No	No	630.20	20	No	4/5	2.26	--	2900.0	2900.0	No	*	*		*	*	No	✔		
ANTHRACENE	UG/KG	Yes	No	3.86	20	Yes	5/5	3.11	--	40.4	602.0	No	*	*		*	*	No	✔		
BENZ[A]ANTHRACENE	UG/KG	Yes	No	3.52	20	Yes	5/5	4.69	206.0	--	369.0	No	*	*		*	*	Yes		✔	
BENZO[A]PYRENE	UG/KG	Yes	No	0.95	20	Yes	4/5	2.32	--	--	132.0	No	*	*		*	Yes	Yes		✔	
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	7.44	20	Yes	5/5	3.61	--	--	170.0	No	*	*		*	*	Yes		✔	
CHRYSENE	UG/KG	Yes	No	3.94	20	Yes	5/5	2.16	--	107.0	22.4	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	12.80	20	Yes	5/5	1.46	--	69.0	71.1	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	9.80	20	Yes	5/5	1.08	--	--	390.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	35.40	20	No	5/5	1.68	--	--	169.0	No	*	*		*	*	No	✔		
PYRENE	UG/KG	Yes	No	6.14	20	Yes	5/5	2.22	--	--	91.9	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	86.8-98.5	NONE	N/A	5/5	2.21	--	--	91.8-184	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
4,4'-DDD	UG/KG	No	No	1.99	10	Yes	4/5	0.45	107.0	91.3	165.0	Yes	No	*	✔	*	*	(C)			
4,4'-DDT	UG/KG	No	No	3.02	10	Yes	5/5	1.23	105.0	403.0	403.0	Yes	No	*	✔	No	*	(C)			
GAMMA-BHC	UG/KG	No	Yes	2.00	10	Yes	5/5	0.54	388.0	388.0	176.0	Yes	*	*		No	No	No	✔		
HEPTACHLOR	UG/KG	No	Yes	4.20	10	Yes	5/5	0.48	63.0	1140.0	--	Yes	No	*	✔	*	*	(C)			UR<1
2-METHYLPHENOL	UG/KG	No	No	51	20	No	2/5	1.15	--	--	20.2	No	*	*		*	*	No	✔		
3,4-METHYLPHENOL	UG/KG	Yes	No	45	NONE	N/A	1/5	0.24	--	--	35.5	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

DRAFT

TABLE 9-64A SWAN POINT CHANNEL: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.301	N/A	N/A	5/5	2.14	--	70.8	--	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.381	N/A	N/A	5/5	2.67	--	91.2	46.2	Yes	*	*		Yes	*	Yes		✔	
ANTIMONY	MG/KG	Yes	Yes	0.16	0.1	No	4/4	2.78	238	228	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.07	0.1	Yes	4/4	7.00	600	600	600	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.47	0.1	No	4/4	1.62	208	365	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	No	1.55	0.1	No	4/4	1.19	--	76.8	--	Yes	*	*		*	*	No	✔		
MANGANESE	MG/KG	Yes	Yes	1.25	0.5	No	2/4	1.17	--	89.4	--	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.73	0.1	No	4/4	6.44	--	159	--	No	*	No	✔	*	*	(C)			
SILVER	MG/KG	Yes	No	0.15	0.1	No	3/4	0.47	--	--	281	No	*	*		*	*	No	✔		
BETA-BHC	UG/KG	No	Yes	1.22	NONE	N/A	3/4	3.17	--	--	217	Yes	*	*		*	*	Yes		✔	Detected in 2 of 4 replicates; not detected in sediment
DACTHAL	UG/KG	No	No	37.50	2	No	4/4	1.22	--	275	--	Yes	*	*		*	*	No	✔		
DELTA-BHC	UG/KG	No	No	2.63	NONE	N/A	4/4	0.47	661	661	--	Yes	*	*		*	*	Yes	✔		UR<1
ENDOSULFAN II	UG/KG	No	No	24.25	10	No	4/4	4.35	207	--	--	Yes	*	*		No	*	No	✔		
HEPTACHLOR	UG/KG	No	Yes	5.27	10	Yes	4/4	15.51	350	205	1450	Yes	No	*	✔	*	*	(C)			
HEPTACHLOR EPOXIDE	UG/KG	No	Yes	2.45	10	Yes	4/4	6.71	237	412	--	Yes	No	*	✔	*	*	(C)			
2-METHYLPHENOL	UG/KG	No	No	214	20	No	5/5	2.37	184	153	130	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

[1] all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-64B SWAN POINT CHANNEL: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.345	N/A	N/A	5/5	1.15	--	--	165.0	Yes	*	*		No	*	Yes	✔		
ANTIMONY	MG/KG	Yes	Yes	0.10	0.1	EQUAL	5/5	2.91	146.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological importance
ARSENIC	MG/KG	Yes	Yes	2.54	0.1	No	5/5	1.05	--	19.5	--	No	*	No	✔	(A)	*	(C)			
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	0.42	--	50.0	50.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.60	0.1	No	5/5	1.52	--	498.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	161.60	10	No	5/5	2.46	--	35.5	33.8	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	11.34	0.5	No	5/5	7.56	53.5	82.2	357.0	No	*	*		*	*	No	✔		
MERCURY	MG/KG	Yes	Yes	0.11	0.01	No	5/5	0.93	--	82.4	143.0	Yes	No	*	✔	(A)	*	(C)			
NICKEL	MG/KG	Yes	Yes	0.87	0.1	No	5/5	1.36	--	189.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.67	0.2	No	5/5	1.61	59.0	84.3	--	Yes	*	*		No	*	Yes	✔		
ANTHRACENE	UG/KG	Yes	No	3.11	20	Yes	4/5	2.51	--	--	465.0	No	*	*		*	*	No	✔		Detected in laboratory method blank
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	10.86	20	Yes	5/5	5.27	--	--	293.0	No	*	*		*	*	Yes	✔		Detected in laboratory method blank
FLUORANTHENE	UG/KG	Yes	No	10.10	20	Yes	5/5	1.15	--	--	35.0	No	*	*		*	No	No	✔		Detected in laboratory method blank
FLUORENE	UG/KG	Yes	No	8.22	20	Yes	4/5	0.91	--	--	311.0	No	*	*		*	*	No	✔		Detected in laboratory method blank
PYRENE	UG/KG	Yes	No	6.62	20	Yes	5/5	2.39	--	--	107.0	No	*	*		*	No	No	✔		Detected in laboratory method blank
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	72.5-88	NONE	N/A	5/5	2.06	--	--	71.3-138	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
TOTAL PCBs (ND=0)	UG/KG	Yes	Yes	11.9	NONE	N/A	5/5	0.85	--	244.0	1140.0	Yes	No	*	✔	*	*	(C)			UR<1
4,4'-DDT	UG/KG	No	No	3.08	10	Yes	5/5	1.25	110.0	413.0	413.0	Yes	No	*	✔	(A)	*	(C)			
ENDOSULFAN II	UG/KG	No	No	3.25	10	Yes	4/5	3.13	302.0	655.0	655.0	Yes	*	*		No	*	No	✔		
HEPTACHLOR	UG/KG	No	Yes	3.73	10	Yes	4/5	0.43	--	996.0	--	Yes	No	*	✔	*	*	(C)			detected in laboratory method blank
3,4-METHYLPHENOL	UG/KG	Yes	No	734	NONE	N/A	5/5	3.88	1010.0	1410.0	2090.0	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-65A TOLCHESTER CHANNEL NORTH: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units (1)	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.354	N/A	N/A	5/5	2.48	--	77.4	35.7	Yes	*	*							
ALUMINUM	MG/KG	Yes	Yes	10.96	1.0	No	5/5	0.23	27.3	28.3	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.15	0.1	No	5/5	2.65	221	213	--	No	*	*		*	*	Yes	✔		UCLM exceeds 1/10 RBC, but does not exceed RBC
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	3.00	200	200	200	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	No	0.44	0.1	No	5/5	1.53	190	338	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.64	0.1	No	5/5	1.26	--	86.8	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.85	0.1	No	5/5	7.54	73.9	203	--	No	*	No	✔	*	*	(C)			
SILVER	MG/KG	Yes	No	0.10	0.1	EQUAL	4/5	0.75	--	--	145	No	*	*		*	*	Yes	✔		UR<1
FLUORANTHENE	UG/KG	Yes	No	5.80	20	Yes	4/5	0.75	--	--	194	No	*	*		*	*	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	8.95-37	NONE	N/A	5/5	0.65	3.6-198	--	--	No	*	*		*	*	*	✔		CBR<acute and chronic effect threshold
4,4'-DDD	UG/KG	No	No	13.74	10	No	5/5	2.05	450	1730	570	Yes	No	*	✔	*	*	(C)			
4,4'-DDT	UG/KG	No	No	2.20	10	Yes	3/5	18.32	267	--	--	Yes	No	*	✔	*	*	(C)			
DACTHAL	UG/KG	No	No	44.00	2	No	5/5	1.06	74.5	340	74.3	Yes	*	*		*	*	No	✔		
ENDOSULFAN II	UG/KG	No	No	9.88	20	Yes	5/5	1.77	25	--	--	Yes	*	*		No	*	No	✔		
HEPTACHLOR EPOXIDE	UG/KG	No	Yes	2.45	20	Yes	4/5	6.72	238	412	--	Yes	No	*	✔	*	*	(C)			

N/A=not applicable

*no criterion

(1) all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-65B TOLCHESTER CHANNEL NORTH: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.218	N/A	N/A	5/5	1.24	--	--	74.1	Yes	*	*		No	*	Yes	✔		<EPA screening value
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.376	N/A	N/A	5/5	1.26	--	--	190.0	Yes	*	*		Yes	*	Yes		✔	
ANTIMONY	MG/KG	Yes	Yes	0.13	0.1	No	5/5	3.66	208.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.04	0.1	Yes	5/5	0.50	--	80.0	80.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	No	0.46	0.1	No	5/5	1.16	--	356.0	--	No	*	No	✔	*	*	(C)			
IRON	MG/KG	Yes	Yes	161.20	10	No	5/5	2.45	--	35.2	33.4	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	10.04	0.5	No	5/5	6.69	35.9	61.3	305.0	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.86	0.1	No	5/5	1.35	--	187.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.73	0.2	No	5/5	1.76	74.8	102.0	--	Yes	*	*		No	*	Yes	✔		
ZINC	MG/KG	Yes	No	15.22	2.0	No	5/5	0.93	--	22.5	--'	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	Yes	No	784.00	20	No	5/5	2.81	58.3	3630.0	3630.0	No	*	*		*	*	No	✔		
BENZO[A]ANTHRACENE	UG/KG	Yes	No	3.24	20	Yes	5/5	4.32	182.0	--	332.0	No	*	*		*	*	Yes		✔	<TDL
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	11.40	20	Yes	5/5	5.53	--	--	313.0	No	*	*		*	*	Yes		✔	<TDL
CHRYSENE	UG/KG	Yes	No	3.70	20	Yes	5/5	2.02	--	94.7	14.9	No	*	*		*	*	No	✔		
FLUORENE	UG/KG	Yes	No	10.50	20	Yes	5/5	1.16	--	--	425.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	39.60	20	No	5/5	1.88	--	--	201.0	No	*	*		*	*	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	83-97.2	NONE	N/A	5/5	2.69	--	--	89.2-172	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
2-METHYLPHENOL	UG/KG	No	No	81	20	No	5/5	1.83	50.5	83.2	91.4	No	*	*		*	*	No	✔		
3,4-METHYLPHENOL	UG/KG	Yes	No	36	NONE	N/A	1/5	0.19	--	--	7.5	No	*	*		*	*	No	✔		
BENZOIC ACID	UG/KG	No	No	5980	100	No	5/5	1.24	35.6	96.1	--	No	*	*		*	*	No	✔		
BENZYL ALCOHOL	UG/KG	No	No	128	100	No	5/5	0.96	--	--	103.0	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-66A TOLCHESTER CHANNEL SOUTH: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units (a)	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.308	N/A	N/A	5/5	2.16	--	54.5	--	Yes	*	*		Yes	*	Yes	✔		
ALUMINUM	MG/KG	Yes	Yes	12.34	1.0	No	5/5	0.25	43.3	44.5	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.16	0.1	No	5/5	2.75	234	225	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.03	0.1	Yes	5/5	3.00	200	200	200	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.79	0.1	No	5/5	2.76	424	692	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.54	0.1	No	5/5	1.18	--	75.4	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.82	0.1	No	5/5	7.25	67.4	191	--	No	*	No	✔	*	*	(C)			
ZINC	MG/KG	Yes	No	41.66	2.0	No	4/5	3.29	--	218	--	No	*	*		*	*	Yes	✔		Low toxicological importance
4,4'-DDD	UG/KG	Yes	No	10.32	10	No	5/5	13.76	313	1280	403	Yes	No	*	✔	*	*	(C)			
DACTHAL	UG/KG	No	No	41.20	2	No	5/5	1.34	63.4	312	63.2	Yes	*	*		*	*	No	✔		
PHENOL	UG/KG	Yes	No	54	20	No	1/5	1.09	9.72	9.09	10.2	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

(1) all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-66B TOLCHESTER CHANNEL SOUTH: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

Chemical Constituent	Units (1)	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.354	N/A	N/A	5/5	1.18	--	--	173	Yes	*	*		No	*	Yes	✔		
ANTIMONY	MG/KG	Yes	Yes	0.16	0.1	No	5/5	4.57	286.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological importance
BERYLLIUM	MG/KG	Yes	No	0.04	0.1	Yes	5/5	0.53	--	90.0	90	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.40	0.1	No	5/5	1.02	--	300.0	--	No	*	No	✔	*	*	(C)			
MANGANESE	MG/KG	Yes	Yes	8.98	0.5	No	5/5	5.99	--	44.3	262	No	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.72	0.1	No	5/5	1.13	--	140.0	--	No	*	No	✔	*	*	(C)			
SELENIUM	MG/KG	Yes	No	0.69	0.2	No	5/5	1.65	63.3	89.2	--	Yes	*	*		No	*	Yes	✔		
SILVER	MG/KG	Yes	No	0.18	0.1	No	4/5	3.71	--	--	230	No	*	*		*	No	No	✔		
BENZO[A]ANTHRACENE	UG/KG	Yes	No	3.14	20	Yes	5/5	4.19	173.0	--	319	No	*	*		*	*	Yes		✔	<TDL
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	10.22	20	Yes	5/5	4.96	--	--	270	No	*	*		*	*	Yes		✔	<TDL
CHRYSENE	UG/KG	Yes	No	3.74	20	Yes	5/5	2.05	--	96.8	16.1	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	16.86	20	Yes	5/5	1.92	--	--	125	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	10.10	20	Yes	5/5	1.11	--	--	405	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	41.40	20	No	5/5	1.96	--	--	215	No	*	*		*	*	No	✔		
PYRENE	UG/KG	Yes	No	5.12	20	Yes	5/5	1.85	--	--	60	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	93.5-108	NONE	N/A	5/5	1.85	--	--	110-207	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
DIELDRIN	UG/KG	No	No	1.20	10	Yes	4/5	3.11	107.0	149.0	--	No	No	*	✔	(A)	*	(C)			
1-METHYLNAPHTHALENE	UG/KG	Yes	No	16	NONE	N/A	4/5	3.41	--	241.0	241.0	No	*	*		*	*	No	✔		
2-METHYLPHENOL	UG/KG	No	No	77	20	No	4/5	1.74	43.0	74.1	81.9	No	*	*		*	*	No	✔		
3,4-METHYLPHENOL	UG/KG	No	No	45	NONE	N/A	2/5	0.24	--	--	34.9	No	*	*		*	*	No	✔		
BENZOIC ACID	UG/KG	No	No	6940	100	No	5/5	1.43	57.3	128.0	--	No	*	*		*	*	No	✔		

N/A=not applicable

*no criterion

(1) all values reported to specified units (i.e., mean tissue concentration, TDL)

(A) criteria exists, but constituent was screened out after ITM evaluation

(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-67A TOLCHESTER STRAIGHTENING: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Nereis virens* (SAND WORM)

Chemical Constituent	Units (a)	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Mean Tissue Residue < TDL?	Frequency of Detection in Tissue	Uptake Ratio	Magnitude of Exceedance (%)			Propensity to Biomagnify?	ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	Comments
									Inside 104	Outside 104	Ocean		Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.26	N/A	N/A	5/5	1.85	--	47.7	--	Yes	*	*		Yes	*	Yes		✔	
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.373	N/A	N/A	5/5	2.61	--	87	43.1	Yes	*	*		Yes	*	Yes		✔	
ALUMINUM	MG/KG	Yes	Yes	11.28	1.0	No	5/5	0.23	31	32.1	--	No	*	*		*	*	No	✔		
BERYLLIUM	MG/KG	Yes	Yes	0.03	0.1	Yes	5/5	3.00	200	200	200	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.44	0.1	No	4/5	1.54	192	342	--	No	*	No	✔	*	*	(C)			
COPPER	MG/KG	Yes	Yes	1.38	0.1	No	5/5	1.06	--	57.2	--	Yes	*	*		*	*	No	✔		
NICKEL	MG/KG	Yes	Yes	0.90	0.1	No	5/5	7.92	82.9	218	--	No	*	No	✔	*	*	(C)			
4,4'-DDD	UG/KG	Yes	No	10.73	10	No	4/4	14.30	329	1330	423	Yes	No	*	✔	*	*	(C)			
CHLORBENSIDE	UG/KG	No	No	13.40	2	No	4/4	1.37	--	712	177	Yes	*	*		*	*	*		✔	
DACTHAL	UG/KG	No	No	50.50	2	No	4/4	1.64	100	405	100	Yes	*	*		*	*	No	✔		
DI-N-OCTYL PHTHALATE	UG/KG	No	No	196	20	No	1/5	1.02	5.95	5.95	5.95	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
(1) all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

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TABLE 9-67B TOLCHESTER STRAIGHTENING: INTEGRATED EVALUATION OF BIOACCUMULATION IN *Macoma nasuta* (BLUNT-NOSE CLAM)

									Magnitude of Exceedance (%)				ITM Evaluation			USEPA Region III Supplemental Weight-of-Evidence Evaluation				Remaining COPCs	
Chemical Constituent	Units [1]	Detected in Bulk Sediment?	Detected in Elutriate?	Mean Tissue Concentration	TDL	Tissue-Residue < TDL?	Frequency of Dectection in Tissue	Uptake Ratio	Inside 104	Outside 104	Ocean	Propensity to Biomagnify?	Exceeds USFDA Action Level?	Exceeds USEPA Tolerance?	COPCs Eliminated after ITM Evaluation	Exceeds USEPA Screening Value?	Exceeds Residue-Effect Data?	Exceeds RBC?	Eliminate as COPC		Comments
DIOXIN TEQ (ND=1/2DL)	NG/KG	Yes	No	0.208	N/A	N/A	5/5	1.19	--	--	66.4	Yes	*	*		No	*	Yes	✔		<EPA screening value
DIOXIN TEQ (ND=DL)	NG/KG	Yes	No	0.363	N/A	N/A	5/5	1.21	--	--	180.0	Yes	*	*		No	*	Yes	✔		
ALUMINUM	MG/KG	Yes	Yes	47.2	1.0	No	5/5	5.32	--	55.3	--	No	*	*		*	*	No	✔		
ANTIMONY	MG/KG	Yes	Yes	0.13	0.1	No	5/5	3.66	208.0	--	--	No	*	*		*	*	Yes	✔		Low toxicological improtance
ARSENIC	MG/KG	Yes	Yes	2.44	0.1	No	5/5	1.01	--	14.8	--	No	*	No		No	*	Yes	✔		
BERYLLIUM	MG/KG	Yes	Yes	0.04	0.1	Yes	5/5	0.50	--	80.0	80.0	No	*	*		*	*	No	✔		
CHROMIUM	MG/KG	Yes	Yes	0.43	0.1	No	5/5	1.09	--	330.0	--	No	*	No		*	*	Yes	✔		
IRON	MG/KG	Yes	Yes	167.4	10	No	5/5	2.55	--	40.4	38.6	No	*	*		*	*	Yes	✔		Low toxicological importance
MANGANESE	MG/KG	Yes	Yes	4.52	0.5	No	5/5	3.01	--	--	82.3	No	*	*		*	*	Yes	✔		Low toxicological importance
NICKEL	MG/KG	Yes	Yes	0.93	0.1	No	5/5	1.47	--	211.0	--	No	*	No		*	*	No	✔		
SELENIUM	MG/KG	Yes	Yes	0.83	0.2	No	5/5	1.99	97.1	128.0	17.3	Yes	*	*		No	*	Yes	✔		
ZINC	MG/KG	Yes	No	14.8	2.0	No	5/5	0.86	--	13.3	--	No	*	*		*	No	No	✔		
ACENAPHTHYLENE	UG/KG	Yes	No	541.00	20	No	5/5	1.96	10.3	2500.0	2500.0	No	*	*		*	*	No	✔		
ANTHRACENE	UG/KG	Yes	No	4.10	20	Yes	5/5	3.31	--	49.1	645.0	No	*	*		*	*	No	✔		
BENZ[A]ANTHRACENE	UG/KG	Yes	No	3.74	20	Yes	5/5	4.99	225.0	--	399.0	No	*	*		*	*	Yes		✔	<TDL
BENZO[A]PYRENE	UG/KG	Yes	No	1.10	20	Yes	4/5	2.69	--	--	169.0	No	*	*		*	Yes	Yes		✔	<TDL
BENZO[B]FLUORANTHENE	UG/KG	Yes	No	16.40	20	Yes	5/5	7.96	45.4	71.3	494.0	No	*	*		*	*	Yes		✔	<TDL
CHRYSENE	UG/KG	Yes	No	4.64	20	Yes	5/5	2.54	--	144.0	44.1	No	*	*		*	*	No	✔		
FLUORANTHENE	UG/KG	Yes	No	9.74	20	Yes	5/5	1.11	--	--	30.2	No	*	*		*	No	No	✔		
FLUORENE	UG/KG	Yes	No	18.00	20	Yes	5/5	1.98	69.7	--	800.0	No	*	*		*	*	No	✔		
NAPHTHALENE	UG/KG	Yes	No	48.60	20	No	5/5	2.31	44.6	35.9	269.0	No	*	*		*	*	No	✔		
PHENANTHRENE	UG/KG	Yes	No	4.64	20	Yes	5/5	1.84	29.6	--	104.0	No	*	*		*	No	No	✔		
PYRENE	UG/KG	Yes	No	5.42	20	Yes	5/5	1.96	--	--	69.4	No	*	*		*	No	No	✔		
TOTAL PAHs (ND=0, ND=1/2DL, ND=DL)	UG/KG	Yes	No	117-128	NONE	N/A	5/5	2.05	--	--	150-282	No	*	*		*	*	*	✔		CBR<acute and chronic threshold values
DIELDRIN	UG/KG	No	No	1.20	10	Yes	4/5	3.11	107.0	149.0	--	Yes	*	*		No	*	Yes	✔		
1-METHYLNAPHTHALENE	UG/KG	Yes	No	16	NONE	N/A	4/5	3.33	--	233.0	233.0	No	*	*		*	*	No	✔		
2-METHYLPHENOL	UG/KG	No	No	77	20	No	5/5	1.75	43.8	75.0	82.9	No	*	*		*	*	No	✔		
3,4-METHYLPHENOL	UG/KG	Yes	No	52	NONE	N/A	2/5	0.27	--	--	54.0	No	*	*		*	*	No	✔		
BENZOIC ACID	UG/KG	No	No	5040	100	No	5/5	1.04	--	65.2	--	No	*	*		*	*	No	✔		

N/A=not applicable
*no criterion
[1] all values reported to specified units (i.e., mean tissue concentration, TDL)
(A) criteria exists, but constituent was screened out after ITM evaluation
(C) criteria exists, but constituent was screened out after ITM evaluation

TABLE 9-68 CONSTITUENTS RETAINED AS COPCs AFTER INTEGRATED EVALUATION

CHANNEL	Brewerton Channel Eastern Extension			C&D Approach (Surficial)			C&D Approach (Cores)			Craighill Channel			Craighill Angle East			Craighill Angle West			Craighill Entrance			Craighill Upper Range			Cutoff Angle			Swan Point Channel			Tolchester Channel North			Tolchester Channel South			Tolchester Straigthening		
COPCs	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean	Inside Site 104	Outside Site 104	Ocean
DIOXIN TEQ		w	w,c		c	c		w	w		w	w,c		w	w,c		w			w	w			c		w	w		w	w			c					w	w
BENZ[A]ANTHRACENE				c		c										c		c							c		c				c		c	c		c	c		c
BENZO[A]PYRENE																								c			c												c
BENZO[B]FLUORANTHENE				c	c	c						c						c			c			c			c						c			c	c	c	c
ALPHA-BHC				w	w	w	c	c	c							c																							
BETA-BHC															c	w	w	w												w									
CHLORBENSIDE				w	w	w														w	w					w	w											w	w

c = clam tissue; w = worm tissue

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CHAPTER 10 -
REFERENCES

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CHAPTER 11 -
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