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1. DATASET IDENTIFICATION

1.1 Title of Catalog document
   MAIA-Estuaries Summary Database
   1997 and 1998 Stations
   Sediment Toxicity Data

1.2 Authors of the Catalog entry
   John Kiddon, U.S. EPA NHEERL-AED
   Harry Buffum, OAO Corp.

1.3 Catalog revision date
   April 30, 2000

1.4 Dataset name
   TOXICITY

1.5 Task Group
   MAIA Estuaries

1.6 Dataset identification code
   006

1.7 Version
   001

1.8 Request for Acknowledgment
   EMAP requests that all individuals who download EMAP data acknowledge the source of these data
   in any reports, papers, or presentations. If you publish these data, please include a statement similar
   to: “Some or all of the data described in this article were produced by the U. S. Environmental
   Protection Agency through its Environmental Monitoring and Assessment Program (EMAP).”
2. INVESTIGATOR INFORMATION (for full addresses see Section 13)

2.1 Principal Investigators
John Paul, U.S. Environmental Protection Agency, NHEERL-Atlantic Ecology Division (AED)
Charles Strobel, U.S. Environmental Protection Agency, NHEERL-Atlantic Ecology Division (AED)

2.2 Sample Collection Investigators
Charles Strobel, U.S. Environmental Protection Agency, NHEERL-Atlantic Ecology Division (AED)
John Macauley, U.S. Environmental Protection Agency, Gulf Ecology Division (GED)
Jeffrey L. Hyland, National Oceanographic and Atmospheric Admin.-Carolinian Province (NOAA-DB)
Michelle Harmon, National Oceanographic and Atmospheric Admin.-Delaware Bay (NOAA-DB)
Carl Zimmerman, National Park Service (NPS)
Dan Dauer, Chesapeake Bay Program, Old Dominion University (CBP-ODU)
J. Ananda Ranasinghe, Chesapeake Bay Program, Versar, Inc. (CBP-VER)

2.3 Sample Processing Investigators

3. DATASET ABSTRACT

3.1 Abstract of the Dataset
The TOXICITY data file reports three measures of sediment toxicity: a static ten-day test conducted using the amphipod *Ampelisca abdita*, a Microtox® assay performed on whole sediments, and a Microtox® assay performed on an organic extract of the sediment. One record is presented per sampling event. A record includes the results of the tests, and parameters indicating the statistical and biological significance of the results.

3.2 Keywords for the Dataset
Sediment toxicity, *Ampelisca abdita*, EC50 values, amphipod, Microtox®, whole sediments, interstitial pore water, biological significance

4. OBJECTIVES AND INTRODUCTION

4.1 Program Objective
The main objectives of the MAIA-Estuaries program are: (1) to evaluate the ecological condition of the Mid-Atlantic estuaries by measuring key properties of the water, sediment, and the community of organisms; (2) to focus attention on small estuaries in order to develop better monitoring approaches for these critical systems; and (3) to develop partnerships among federal and state environmental organizations.

The Environmental Monitoring and Assessment Program (EMAP) is an EPA research and monitoring program designed to provide unbiased assessments of the condition of selected resources over a wide region. A key feature of the program is a probabilistic sampling strategy that randomly selects sampling sites and assigns weighting factors based on area to all measured results. EMAP’s strategy was adopted by the Mid-Atlantic Integrated Assessment (MAIA) program, which was designed to assess the conditions of the estuaries, forests, streams and lakes, and agricultural lands in the eight-state Mid-Atlantic region. This file contains data measured in MAIA estuaries during the Summers of 1997 and 1998. Samples were collected for water and sediment analyses primarily in 1997, with a few additional sites sampled in 1998. Fish samples were collected only in 1998. Several estuaries were designated as intensive sites and were sampled in greater detail (see STATIONS file).
The partners in MAIA-Estuaries program are: (1) The U.S. Environmental Protection Agency (USEPA), including both the Atlantic Ecology Division (AED) and the Gulf Ecology Division (GED); (2) National Park Service (NPS) under their project “Maryland Coastal Bays Monitoring”; (3) National Oceanographic and Atmospheric Administration (NOAA) which conducted sampling both in the Delaware Bay (DB) under their “National Status and Trends Program” and in the Carolinian Province (CP); and (4) The Chesapeake Bay Program (CBP), which is a consortium of federal, state, and local governments and nongovernmental organizations. Each partner was responsible for collecting, processing, and reviewing data. The USEPA Atlantic Ecology Division was responsible for final assembly and review of all data. Laboratories contracted to process samples are specified by the parameter LABCODE included in all data files (Section 4.4). Details regarding use of partner and LABCODE information are presented in the EVENTS metadata file.

4.2 Dataset Objective
The purpose of the TOXICITY data file is to report the results and biological significance of three sediment toxicity tests performed on sediment samples: the *Ampelisca* mortality assay, the Microtox® assay performed on whole sediments, and the Microtox® assay performed on organic extracts of sediments.

4.3 Background Discussion
The amphipod survival test is commonly used in North America to assess sediment quality. The test is simple in concept – amphipods are added to relatively unaltered sediment, and their survival rate is used as an indicator of sediment toxicity. *Ampelisca abdita* is used as the test organism because it is an ecologically important species in coastal waters and it is native to a wide range of waters along the U.S. eastern seaboard, along the eastern Gulf of Mexico, and along portions of the Californian coast. The amphipod survival test assesses the integrated effect of complex mixtures of compounds, but does not identify which compound or class of compounds may be the toxic agent. Ammonia in the porewater of the sediments can interfere with the assay; therefore the procedure calls for monitoring the ammonia concentration in the test sample and removal by flushing if above a threshold value.

The Microtox® test uses the bioluminescent bacterium *Vibrio fischeri* to assess the toxicity of sediments. Toxic exposure impairs respiration in the bacterium and results in inhibition of the bioluminescence. The results of two Microtox® tests are reported here, one performed on whole sediments and the other on organic extracts of the sediments. The tests are simple, fast, reproducible and inexpensive, and there is a wide range of published data regarding Microtox® response to specific compounds (Johnson and Long, 1998). The organic extraction procedure favors the extraction of neutral, non-ionic organic compounds such as aromatic and chlorinated hydrocarbons, but is less suited for other classes of toxicants such as metals and polar organic compounds.

The intention of sediment assays is to measure the toxicity of the sediments. However, the tests are still considered exploratory in nature and their ecological significance is still being evaluated. The different tests are not necessarily expected to yield similar measures of toxicity on a sediment sample, as each test may respond to a different class of toxic compounds.

4.4 Summary of Dataset Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATION</td>
<td>Station name</td>
</tr>
<tr>
<td>EVNTDATE</td>
<td>Event date</td>
</tr>
<tr>
<td>SRVPCCON</td>
<td>Results of the <em>Ampelisca</em> test; survival rate of amphipod, expressed as percent of control survival. Smaller values indicate higher toxicity.</td>
</tr>
<tr>
<td>SRVPC_SG</td>
<td>Statistical significance of the amphipod test: Y if the p-value #0.05, N if other.</td>
</tr>
</tbody>
</table>
4.4 Summary of Dataset Parameters, continued

**ATOX_SIG**  Biological significance of the amphipod test: Y if toxic, N if non-toxic. A sediment is classified toxic if amphipod survival in the test-sediment is less than 80% of the survival in the control-sediment, and the test values are statistically valid (p-value #0.05).

**EC50_MC**  Results of the whole-sediment Microtox® test, reported as the concentration of sediment in solution (mass of dry sediments divided by mass of solution, expressed as a percent) which results in 50% mortality of the test organisms. Smaller values indicate higher toxicity.

**MTOX_SIG**  Biological significance of the Microtox® test (whole sediment test): Y if toxic, N if non-toxic. Sediments with a silt fraction ≥ 20% are classified as toxic if EC50_MC is ≤ 0.2%, while sediments with a silt fraction < 20% are toxic if EC50_MC is ≤ 0.5% (see Section 5.2.2).

**OE_EC50**  Results of the Microtox® test performed on organic extracts of sediments, reported in units of (mg equivalent sediment wet weight/mL organic extract). Smaller values indicate higher toxicity.

**OE_SRI**  Sediment Reference Index (organic extract Microtox® test); the ratio of OE_EC50 in the field sample to that in the reference sediment.

**OE_SIG**  Biological significance of the Microtox® test (organic extract test): Y if toxic, N if non-toxic. A sample is toxic when OE_SRI is > 1.

**LABCODE**  A code identifying data blocks grouped according to processing contract

- **TOX-1**  AED contract
- **TOX-2**  NOAA (Carolinian Province) contract
- **TOX-4**  NOAA (Delaware Bay) contract
- **TOX-5**  GED contract

**QACODE**  Quality assurance/quality control codes

- **TOX-A**  EC50_MC is reported as maximum value possible; sample is non-toxic

**YEAR**  Year of sample collection: 1997 or 1998

* denotes parameters that should be used as key fields when merging data files

5. DATA ACQUISITION AND PROCESSING METHODS

5.1 Data Acquisition / Field Sampling

The sample collection methods used by USEPA field crews are described here. Significant variations by other MAIA partners are noted in Section 5.1.12. Details regarding MAIA partners are reported in the EVENTS data file.

5.1.1 Sampling Objective

Sediment sub-samples were collected for the measurement of toxicity in the sediments. The sub-samples were prepared from a homogenate of the upper two-centimeters of sediment grabs. The remaining portions of the grabs were used for grain size and chemical analyses.

5.1.2 Sample Collection: Methods Summary

Multiple sediment grabs were collected from each site using a Young-modified Van Veen grab sampler. The primary purpose of these grabs was to characterize the chemical and toxicological properties of the sediment. Each grab was nominally 440 cm$^2$ in area and up to 10 cm in depth, but only the top two centimeters of a grab were retained for the analyses described here. A sufficient number of grabs were processed to provide three liters of sediment. The sediment composite was homogenized and separated into two fractions for storage until analysis. One
fraction was frozen and used in the measurement of total organic carbon (TOC) and chemical contaminants. The second fraction was chilled but never frozen during storage, and was used for grain-size and toxicity analyses.

5.1.3 Beginning Sampling Dates
8 July 1997
13 July 1998

5.1.4 Ending Sampling Dates
8 October 1997
8 October 1998

5.1.5 Sampling Platform
Samples were collected from gasoline or diesel powered boats, 18 to 133 feet in length.

5.1.6 Sampling Equipment
A 1/25 m², stainless steel (coated with Kynar), Young-modified Van Veen grab sampler was used to collect sediments.

5.1.7 Manufacturer of Sampling Equipment
Young’s Welding, Sandwich, MA

5.1.8 Key Variables
Not applicable

5.1.9 Sample Collection: Methods Calibration
The sampling gear does not require calibration, although it was inspected regularly for damage by mishandling or impact on rocky substrates.

5.1.10 Sample Collection: Quality Control
Care was taken to minimize disturbance to the sediment grabs. Grabs that were incomplete, slumped, less than 7 cm in depth, or comprised chiefly of shelly substrates were discarded. The chance of sampling the same location was minimized by repositioning the boat five meters downstream after three sampling attempts.

5.1.11 Sample Collection: References


5.1.12 Sample Collection: Alternate Methods
Not applicable

5.2 Data Preparation and Sample Processing
The processing methods used by USEPA contracts will be described here (LABCODE = TOX-1). Any significant variations by other MAIA partners are noted in Section 5.2.6.
5.2.1 Sample Processing Objective
Determine the toxicity of sediment samples using a 10-day *Ampelisca abdita* mortality assay and Microtox® assays performed on whole sediments or organic extracts of the sediments.

5.2.2 Sample Processing: Methods Summary
In the 10-day *Ampelisca abdita* assay, amphipods were exposed to sediments for 10 days under static conditions following EMAP procedures (EPA 1994, 1995). Sediment samples were stored in the dark at 4 °C prior to analysis. Control sediments were obtained from a clean site in Long Island Sound. Each sediment sample was passed through a 1 mm mesh to remove resident organisms, pebbles, etc., and was stirred to homogenize. Five replicate tests were performed with each field sample along with a test using the control sediment. For each test, 200 mL of sediment sample were placed in a glass container and covered with 600 mL of clean, filtered water (maintained at 20 °C, a salinity of 30ppt, and a dissolved oxygen concentration >60% of saturation). Total ammonia concentration was measured colorimetrically on filtered pore water taken from a sixth replicate. For concentrations greater than 20 mg/L, the sediment was flushed until ammonia levels fell below 20 mg/L. Twenty juvenile amphipods (between 0.7 and 1.5 mm in length) were added to each test chamber for a ten-day exposure. The surviving amphipods were counted, and the results reported as the average number of amphipods surviving in the sample tests divided by the number of amphipods surviving in the control sediment, expressed as a percent. Lower values of this result indicate higher toxicity. The result was considered to be statistically significant if sample and control values were distinct with a p-value ≤0.05 in a one-tailed t-test. The assay was taken to indicate toxicity if the survival rate was less than 80% of the control and the test was statistically significant.

The whole-sediment Microtox® assays were conducted in duplicate following the "large sample size" protocol of Microbics Corporation (1992). For each test and control, 7 g of sediment sample were diluted with autoclaved seawater to prepare a series of 13 solutions ranging in concentration from 19.7% to 0.005%. The concentrations were ‘moisture-corrected’ to reflect the weight of dry sediment, and are reported with units: mass of dry sediment per mass of solution, expressed as a percent. Luminescent bacteria (*Vibrio fischeri*) were incubated in each suspension for 20 minutes, the suspension was filtered, and the post-exposure luminescence in each of the filtrates was measured on a Microtox® Model 500 Analyzer. A log-linear regression model was used to determine an EC50_MC — the sediment concentration that reduced light production by 50% relative to a control (a nontoxic reagent blank). Lower values of EC50_MC indicate higher toxicity. Sediment grain-size can affect EC50_MC values, e.g., fine-grained sediments absorb bacteria, thereby diminishing light production independently of any true change of toxicity (Ringwood, *et al.*, 1997). Therefore, the MAIA program uses two toxicity thresholds depending on sediment grain-size and EC50_MC levels. Sediments with a silt fraction ≥20% are classified as toxic if EC50_MC is ≤0.2%, while sediments with a silt fraction <20% are toxic if EC50_MC is ≥0.5%. The grain-size data are reported in the SEDGRAIN file.

The organic-extract Microtox® assay is an exploratory test (Johnson and Long, 1998) in the MAIA program. Sediment samples were screened to remove debris, and excess water was decanted and discarded. Each sample was homogenized and 10 g of the sediment (wet weight) were dried with anhydrous sodium sulfate and extracted by sonication with dichloromethane (DCM). The extract was carefully evaporated and concentrated under a flow of nitrogen, exchanged into a mixture of dimethylsulfoxide (DMSO), toluene and isopropyl alcohol (2:1:1), and brought to a final volume of 1 mL (the equivalent of 10 g of sediment, wet-weight). The extract was diluted 1:10 with DMSO to prepare the dilution series which was analyzed as described above to determine an OE_EC50 value. DMSO is non-toxic toward *Vibrio fischeri*. The OE_EC50 value is expressed in units: mg equivalent sediment wet weight / mL DMSO, or mg eq / mL. Lower values indicate greater toxicity. Each batch of samples was accompanied by the analysis of a known clean sediment from Redfish Bay, Texas. A Sediment Reference
Index (SRI) was calculated as the ratio of the OE_EC50 values measured for the field and reference sediments. Sediments were classified as toxic if the SRI was greater than one.

5.2.3 Sample Processing: Methods Calibration
Not applicable

5.2.4 Sample Processing: Quality Control
Positive controls for the amphipod assays were performed as follows. Representative amphipods were routinely tested for response by determining the EC50 concentration of the reference toxicant sodium dodecyl sulfate. The amphipods were considered viable if the measured EC50 fell within the 95% confidence interval of previous QC checks. Each batch of assays was also accompanied by a negative control assay, which was identical to the routine procedures but the amphipods were exposed to sediments that were certified as clean. Five replicates were included in the control run. Batch results were accepted if the mean survival was equal to or greater than 85% and survival in the individual replicate chambers was not less than 80% (ASTM 1993). The Microtox® assays were run with the reference toxicant with each new batch of bacteria. These tests provided measures of the general quality of the bacterial populations and certifies the ability of the laboratory to produce results consistent with the expected toxicity range (i.e., Microtox® EC50 values typically range between 13-26 mg/L).

5.2.5 Sample Processing: References


5.2.6 Sample Processing: Alternate Methods
Total ammonia and un-ionized ammonia values were not reported for records indicated with LABCODE = TOX-2. However, the values were measured and used as process criteria in the amphipod survival test (Section 5.2.2).
6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Values
Not applicable

6.2 Data Manipulation: Description
SRVPCCON (survival as percent of control; result for amphipod survival assay) was calculated as the average number of amphipods surviving in the five replicate sample tests divided by the number of amphipods surviving in the control sediment, expressed as a percent.

SRVPC_P (statistical significance of amphipod survival result) is reported as ‘Y’ if SRVPCCON is statistically significant as indicated by a p-value less than 0.05 in a one-tailed t test, and ‘N’ if otherwise.

ATOX_SIG (biological significance of amphipod survival result) is reported as ‘Y’ if SRVPCCON is less than 80% and SRVPC_P is ‘Y’; otherwise ATOX_SIG is reported as ‘N’.

EC50_MC (result for whole-sediment Microtox® assay); sediment concentration that reduces light production by 50% relative to a control. The values have been moisture-corrected and are reported with units: percent dry-weight sediment in solution.

MTOX_SIG (biological significance of whole-sediment Microtox® result) is reported as ‘Y’ if silt fraction $20\%$ and EC50_MC $\#0.2\%$, or silt fraction $<$20\% and EC50_MC $\#0.5\%$. Otherwise, MTOX_SIG is reported as ‘N’. The silt-fraction values are contained in the SEDGRAIN file.

OE_EC50 (result for organic-extract Microtox® assay); the equivalent wet-weight sediment concentration represented by the extract that reduces light production by 50% relative to a control. The units are: mg equivalent sediment wet weight / mL solvent, or mg eq / mL.

OE_SRI (Sediment Reference Index – organic-extract Microtox® assay); the value of OE_EC50 measured for sediments divided by the value measured for reference material. Values greater than one were labeled toxic by the partner agency performing the test.

OE_SIG Biological significance of the Microtox® assay (organic-extract): Y if toxic, N if non-toxic. A sample is toxic when OE_SRI is $>1$.

7. DATA DESCRIPTION

7.1 Description of Parameters

7.1.1 Components of the Dataset

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<thead>
<tr>
<th>VARIABLE</th>
<th>TYPE</th>
<th>LEN</th>
<th>LABEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATION</td>
<td>Char</td>
<td>10</td>
<td>Station Name</td>
</tr>
<tr>
<td>EVNTDATE</td>
<td>Num</td>
<td>8</td>
<td>Event Date</td>
</tr>
<tr>
<td>SRVPCCON</td>
<td>Num</td>
<td>8</td>
<td>Ampelisca Survival as % of Control</td>
</tr>
<tr>
<td>SRVPC_SG</td>
<td>Num</td>
<td>8</td>
<td>Statistical significance of SRVPCCON</td>
</tr>
<tr>
<td>ATOX_SIG</td>
<td>Char</td>
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<td>Biological significance of SRVPCCON</td>
</tr>
<tr>
<td>EC50_MC</td>
<td>Num</td>
<td>8</td>
<td>Moisture-corrected mean EC50 (%) ; whole sediment Microtox®</td>
</tr>
<tr>
<td>MTOX_SIG</td>
<td>Char</td>
<td>1</td>
<td>Biological significance of EC50_MC</td>
</tr>
<tr>
<td>OE_EC50</td>
<td>Num</td>
<td>8</td>
<td>EC50 (mg eq / mL) ; organic extract Microtox®</td>
</tr>
</tbody>
</table>
7.1.1 Components of the Dataset, continued

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>TYPE</th>
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</tr>
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<td>Sediment Reference Index</td>
</tr>
<tr>
<td>OE_SIG</td>
<td>Char</td>
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<td>Char</td>
<td>5</td>
<td>Contract/Lab Identifier</td>
</tr>
<tr>
<td>QACODE</td>
<td>Char</td>
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<td>QA Code</td>
</tr>
<tr>
<td>YEAR</td>
<td>Num</td>
<td>4</td>
<td>Year of sampling</td>
</tr>
</tbody>
</table>

7.1.2 Precision of Reported Values

The values are reliable to no more than three significant digits; however more significant digits may be reported in the dataset because of formatting restrictions.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>PRECISION</th>
<th>MIN</th>
<th>MAX</th>
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<tbody>
<tr>
<td>SRVPCCON</td>
<td>0.1</td>
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<td>%</td>
</tr>
<tr>
<td>EC50_MC</td>
<td>0.01</td>
<td>0.01</td>
<td>23.1</td>
<td>%</td>
</tr>
<tr>
<td>OE_EC50</td>
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<td>0.28</td>
<td>273</td>
<td>mg eq/mL</td>
</tr>
<tr>
<td>OE_SRI</td>
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<td>0.4</td>
<td>368</td>
<td>-</td>
</tr>
</tbody>
</table>

7.1.3 Minimum Value in Dataset

See Section 7.1.2

7.1.4 Maximum Value in Dataset

See Section 7.1.2

7.2 Data Record Example

7.2.1 Column Names for Example Records

<table>
<thead>
<tr>
<th>STATION</th>
<th>EVNTDATE</th>
<th>SRVPCCON</th>
<th>SRVPC_SG</th>
<th>ATOX_SIG</th>
<th>EC50_MC</th>
<th>MTOX_SIG</th>
<th>OE_EC50</th>
<th>OE_SRI</th>
<th>OE_SIG</th>
<th>LABCODE</th>
<th>QACODE</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA97-0001</td>
<td>8/25/97</td>
<td>91.1</td>
<td>N</td>
<td>N</td>
<td>0.92</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA97-0091</td>
<td>8/30/97</td>
<td>90.7</td>
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<td>MA97-0493</td>
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<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

7.2.2 Examples of Data Records

<table>
<thead>
<tr>
<th>STATION</th>
<th>EVNTDATE</th>
<th>SRVPCCON</th>
<th>SRVPC_SG</th>
<th>ATOX_SIG</th>
<th>EC50_MC</th>
<th>MTOX_SIG</th>
<th>OE_EC50</th>
<th>OE_SRI</th>
<th>OE_SIG</th>
<th>LABCODE</th>
<th>QACODE</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOX-1</td>
<td>TOX-A</td>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2.43</td>
<td>43.0</td>
<td>Y</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude (Westernmost)

-77.4339 decimal degrees
8.2 Maximum Longitude (Easternmost)  
-74.7230 decimal degrees

8.3 Minimum Latitude (Southernmost)  
34.9670 decimal degrees

8.4 Maximum Latitude (Northernmost)  
40.1470 decimal degrees

8.5 Name of Region  
MAIA estuary region, consisting of Delaware Bay, Chesapeake Bay, the Delmarva coastal bays,  
Albemarle-Pamlico Sound, and contiguous estuaries.

9. QUALITY CONTROL AND QUALITY ASSURANCE

9.1 Measurement Quality Objectives  
The measurement quality objectives of the EMAP-Estuaries program do not specify accuracy or  
precision requirements for toxicity measurements (see Valente and Strobel, 1993).

9.2 Data Quality Assurance Procedures  
QA procedures include running blanks, spiked samples, and standard reference materials with each  
batch of samples. See Section 5.2.4 for discussion of these tests.

9.3 Actual Measurement Quality  
All of the data reported in this data file met the QA specifications listed in Section 5.2.4.

10. DATA ACCESS

10.1 Data Access Procedures  
Data can be downloaded from the web.

10.2 Data Access Restrictions  
None.

10.3 Data Access Contact Persons  
John Paul, Principal Investigator  
U.S. EPA NHEERL-AED  
401-782-3037, 401-782-3099 (FAX), paul.john@epa.gov

Harry Buffum, Data Manager/ MAIA-Estuaries  
U.S. EPA NHEERL-AED  
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

10.4 Dataset Format  
ASCII (CSV) and SAS Export files.

10.5 Information Concerning Anonymous FTP  
Not available.

10.6 Information Concerning WWW  
No gopher access, see Section 10.1 for WWW access.
11. REFERENCES


12. TABLE OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AED</td>
<td>Atlantic Ecology Division</td>
</tr>
<tr>
<td>C</td>
<td>Degrees Celsius</td>
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<td>Carolinian Province</td>
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<td>CBP</td>
<td>Chesapeake Bay Program</td>
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<td>DB</td>
<td>Delaware Bay</td>
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<tr>
<td>DCM</td>
<td>Dichloromethane</td>
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<tr>
<td>DMSO</td>
<td>Dimethylsulfoxide</td>
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<td>EMAP</td>
<td>Environmental Monitoring and Assessment Program</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>GED</td>
<td>Gulf Ecology Division</td>
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<tr>
<td>GERG</td>
<td>Geochemical and Environmental Research Group</td>
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<tr>
<td>MAIA</td>
<td>Mid-Atlantic Integrated Assessment</td>
</tr>
<tr>
<td>mg</td>
<td>Milligram</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligrams per liter</td>
</tr>
<tr>
<td>mL</td>
<td>Milliliter</td>
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<tr>
<td>NHEERL</td>
<td>National Health and Environmental Effects Research Laboratory</td>
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12. TABLE OF ACRONYMS, continued

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<tr>
<th>Acronym</th>
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<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
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<td>NPS</td>
<td>National Park Service</td>
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<tr>
<td>ODU</td>
<td>Old Dominion University</td>
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<tr>
<td>QA/QC</td>
<td>Quality Assurance/Quality Control</td>
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<td>TOC</td>
<td>Total Organic Carbon</td>
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<td>TAMU</td>
<td>Texas A&amp;M University</td>
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<td>USEPA</td>
<td>United States Environmental Protection Agency</td>
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<td>VER</td>
<td>Versar, Inc.</td>
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<td>WWW</td>
<td>World Wide Web</td>
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</table>

13. PERSONNEL INFORMATION

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