VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY'S

BIOACCUMULATION INITIATIVE

IN VIRGINIA'S COASTAL ZONE MANAGEMENT AREA.

SUBMITTED BY

OFFICE OF ENVIRONMENTAL RESEARCH AND STANDARDS

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RICHMOND, VA 23230

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Table of Contents

List of Tables

List of Figures

List of Figures - continued

List of Figures - continued

List of Appendices

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Introduction

In 1983 the U.S. Environmental Protection Agency (EPA) articulated the concept of using risk assessment in its decision making process regarding criteria guidance (Yosie 1993). EPA's adoption of the risk assessment concept brought about a need for regulatory agencies to move beyond the relating of water quality criteria to acute and chronic toxicity to integrating water quality criteria with long term human health and ecological risk effects. In 1987, after the directions of EPA's initiative were clarified and sufficient guidance became available for risk investigations, the Virginia Department of Environmental Quality's (DEQ) Bioaccumulation Initiative (BI) was initiated. Initiative goals centered on: 1) assessing the prevalence of bioconcentratable compounds in Virginia's surface water environment; 2) determining exposure routes for the uptake of bioconcentratable compounds by human and wildlife populations; 3) assessing human health and ecological risks associated with specific exposure scenarios, and 4) assessing and inventorying monitoring protocols for use in Virginia's Pollution Discharge Elimination System (VPDES) program.

Studies performed under the DEQ BI have been conducted using a three phase approach. The three phases consist of: 1) an effluent/water "log P" screen; 2) a detailed gas chromatograph - mass spectrometer (GC-MS) investigation of effluents/waters showing high numbers of log P peaks greater than 3.5; and 3) a detailed GC-MS investigation of the sediments and biota at sites with the greatest number of bioconcentratable compounds. Using this approach the DEQ BI has screened over 200 sites in Virginia for the presence of bioconcentratable compounds in discharges and ambient waters. Of these, approximately 50 sites have been investigated through phase III. Results from past BI studies have led to modifications of the BI's three phase study design. As an alternative to phase 1 log P screens, other existing site information can be used to rank sites for study under the BI. These information sources include: 1) DEQ permit file descriptions of facility processes; 2) Federal, State, and local file descriptions of previous site studies; 3) DEQ regional office files and personnel; and 4) DEQ enforcement files.

In October 1992, DEQ's Office of Environmental Research and Standards (OERS) initiated BI studies of 12 sites in the Coastal Zone Management (CZM) Area of Virginia. The objective of the 1992 CZM BI studies was to assess the human health and ecological risks associated with the consumption of water, fish and shellfish from selected CZM Area receiving streams. Secondary objectives included: 1) the assessment and refinement of BI sampling methodologies, target species selection, and other BI monitoring protocols for CZM Area sites; and 2) the assessment of contract laboratory abilities to detect and quantify bioconcentratable compounds.

Methods

Site selection:

Due to the one year time constraint on the Virginia Department of Environmental Quality's (DEQ) Coastal Zone Management (CZM) Area Bioaccumulation Initiative (BI) studies, a canvassing of existing site data was performed for the study's Phase I in place of the alternative log P field screens. Data examined during the site selection phase included:

- -Department of Defense Installation Restoration Program (IRP) reports on Federal Facilities
- -DEQ-Waste Division's Federal Facility files
- -EPA Superfund Program CERCLIS dictionary (3.0)
- -DEQ-Water Division's Northern, Piedmont, and Tidewater Regional Office files
- -DEQ BI phase I and II files
- -DEQ-Office of Environmental Compliance and Auditing files
- -DEQ Virginia Toxics Database

Criteria for designating a site or facility as a potential study site included:

- -Documentation of the release, or potential release, of bioconcentratable compounds
- -Documentation of site activities involving bioconcentratable compounds
- -Re-occurring effluent toxicity for unknown reasons and/or unresolved toxics issues
- -log P peaks above 3.5.
- -Unresolved compliance issues
- -Continuing occurrence of pollution incidents involving bioconcentratable compounds
- -DEQ-Water Division Regional Office, Waste Division, or Office of Enforcement recommendation

A list of proposed study sites was circulated throughout DEQ for comments and prioritization. A final list of study sites was created in response to the solicited comments and the study's funding limitations.

Sampling:

Effluent and Ambient Water:

All sites on the final study list were included for sampling in phase II of the CZM study. Phase II consisted of collecting effluent/water samples for GC-MS analysis. The objective of phase II sampling was to determine if any of the study sites were actively discharging or releasing bioconcentratable compounds of

concern (COC, Appendix B). Sites documented as discharging or releasing COC were given the highest priority for follow up study in phase III of the CZM study.

Samples collected from continuous discharges were 1 liter, 24-hour composite samples split from the facility's VPDES permit sample. Samples collected from intermittent discharges or stormwater runoff were 1-liter grab samples. All samples were collected using 10% HCl - acetone stripped, stainless steel, glass, or Teflon sampling equipment. Effluent/water samples were collected into stripped glass jars with Teflon lined lids. Collected samples were stored at 4°C. Effluent samples were extracted within seven days of collection. Effluent sample extracts were analyzed within 40 days of extraction.

Sediment and Tissue:

Phase I and II data resulted in eight sites being selected for phase III sampling. The phase III sampling objective was to collect a minimum of two tissue samples from indigenous organisms and 1 sediment sample from each of the eight sites.

Sediment collections focused on areas of silt and clay deposits. Sediment samples were collected using Ekman dredges or stainless steel scoops which had been stripped with 10% HCl and acetone. Sediment samples were collected from surficial layers only. Samples were collected into stripped stainless steel buckets and then transferred to stripped glass jars with Teflon lined lids.

Whenever possible, tissue collecting targeted a bottom oriented fish or shellfish, a pelagic fish, and a game fish. Indigenous organisms were collected using electro-fishing, gill netting, seining, dredging, and manual capture techniques. Collected organisms were wrapped in aluminum foil, dull side toward sample, by species and station.

Sediment and tissue samples were stored on ice during transport to the DEQ-OERS laboratory. Samples were stored at the DEQ-OERS laboratory at -20°C until processing and delivery to the analytical laboratory. Processed samples were transported to the analytical laboratory in pre-chilled coolers and were stored at the analytical laboratory at -20°C until analyzed.

Tissue samples were processed as either whole organisms, or as edible tissues separated from remaining tissues (Appendix A). Tissue samples were processed by homogenizing partially-thawed tissues in stainless steel blenders or food processors. All equipment used in sample processing was stripped with 10% HCl and acetone between samples. Processed tissue samples were transferred to 10% HCl - acetone stripped glass jars with teflon lids. No post collection processing of sediment samples was done. All tissue and sediment samples were extracted within 60

days of collection and analyzed within 30 days of extraction.

Sample Analysis and Reporting:

General:

All samples were analyzed by Spectralytix of Gaithersburg, Maryland. Organic compounds in the CZM BI samples were extracted and analyzed using gas chromatography with mass spectrometry or electron capture detection (GC-MS, GC-ECD). All chromatographic peaks were reverse-searched against the National Bureau of Standards mass spectral library. Spectra with fits of 70% or greater were considered tentatively- identified. The five tentatively identified spectra with the best fit for a given identification were further analyzed for spectral purity. The single spectra with the highest fit and purity (with fit dominating over purity) was reported as the compound identification. Computer-generated identifications were then confirmed by the project analyst. Spectra with fits of less than 70% were reported as unknown.

Effluent/Water:

Sample extraction, fractionation, and spiking followed the VIMS Analytical Protocol for Hazardous Organic Chemicals in Environmental Samples (Virginia Institute of Marine Science 1991). The entire one-liter of sample was extracted. Identification and quantification of sample compounds were accomplished with: 1) EPA method 8100 (via 8270) for analysis of polyaromatic hydrocarbons and tentatively-identified compounds (EPA 1986a) (TICs, quantified assuming a response factor of 1); and 2) EPA method 8080 for analysis of halogenated organics (EPA 1986a) (GC-ECD used for pesticides and PCBs).

Sediment:

Moisture content, total organic carbon (TOC), total acid volatile sulfide (AVS), and grain size were determined for all sediment samples using the EPA Contract Laboratory Procedures Statement Of Work (EPA CLP SOW, EPA 1991a), EPA 415.1 (EPA 1974), EPA Draft Method for determination of Acid Volatile Sulfides (EPA 1991), and ASTM D422-63 (ASTM 1990) methods respectively. All sediment data were reported on a dry weight basis.

Sediment samples were lyophilized and extracted following the VIMS' Analytical Protocol for Hazardous Organic Chemicals in Environmental Samples (Virginia Institute of Marine Science 1991). Sample extracts were cleaned using gel permeation chromatography followed by silica gel column chromatography. The extract fraction containing the halogenated organics was subjected to fluorosil cleanup following EPA method 3620 (EPA 1986a). Identification and quantification of sample compounds were accomplished using methods described for the effluent/water samples.

Tissue:

Moisture and total lipid content were determined for all tissue samples using the EPA CLP SOW (1991a) and gravimetric analysis methods respectively. All tissue data were reported on a wet weight basis.

Tissue sample extraction and clean-up were accomplished using methods described for sediment samples. Identification and quantification of extracted sample compounds were accomplished using methods described for effluent/water samples.

Analytical Quality Control:

General:

All organic analysis samples were spiked with surrogate standards to assess extraction recoveries. Matrix spikes were used to assess detection responses.

The GC-MS and GC-ECD were calibrated using a three point initial calibration curve which was confirmed daily with a single point calibration, as recommended by the EPA 600/8000 series methods and CLP SOW (EPA 1990, 1991a). Every 12 hours or 10 samples, whichever came first, decafluorotriphenyl phosphine (DFTPP) was run for a spectrum validation test. If the criteria specified (40 CFR 136, Appendix A, method 625) were met, then analyses continued. If these criteria were not satisfied, sample analyses were stopped until the problem was corrected and the system shown to be working properly.

Effluent/water:

In addition to the general quality control steps, distilled water method blanks were extracted and analyzed with each batch of samples.

Sediment:

Sample duplicates were run for moisture content determinations. Analytical performance for Acid Volatile Sulfides (AVS) analyses was checked through the daily analysis of method blanks and spiked method blanks. Sample duplicates were also included with each batch of AVS analyses. Total Organic Carbon (TOC) quality control included method blanks and matrix spikes. Grain size analyses were run on single samples without quality controls.

In addition to the general quality control steps for organic analyses, sodium sulfate method blanks were extracted and analyzed for each batch of sediment samples.

Tissue:

Sample duplicates were run for percent moisture determinations.

Sample blanks were run for percent lipid determinations. In addition to the general quality control steps for organic analyses, sodium sulfate method blanks were extracted and analyzed for each batch of tissue samples.

Analytical Quality Assurance

The DEQ BI has found laboratory capabilities for achieving the detection and quantitation limits required in the analysis of bioconcentratable compounds ($\leq$ 1 ppb) to be highly variable. The demonstrated ability to achieve the required detection levels was a critical factor in the laboratory selection process of the CZM BI study. The DEQ Invitation for Bid for analytical services required bidders to submit documentation demonstrating the bidder's ability to achieve the required detection limits and to meet specified quality assurance/quality control (QA/QC) requirements. The QA/QC requirements for the DEQ BI study were those set forth in the EPA 600 and 8000 series methods (EPA 1986a), and the EPA CLP SOW (EPA 1991a).

To ensure acceptable levels of detection and quantitation were being met, seven CZM BI study phase II effluent samples, six DEQ BI sediment, and 17 DEQ BI tissue samples were split between Spectralytix and the Virginia Institute of Marine Science (VIMS). In previous DEQ BI studies, VIMS has demonstrated the ability to achieve the required detection and quantitation levels on a consistent basis. Assessment of Spectralytix's performance was made by comparing Spectralytix's number of identified halogenated compounds, and quantitation of these compounds, to the VIMS data for the split samples.

In addition to the above quality assurance steps, Spectralytix was required to provide a confidence ranking for each identification reported. The confidence ranking system was based on a scale of 0 - 3, using the following definitions:

0 The compound is unknown. Neither the retention time or mass spectra match with any compounds in the NBS library.

1 The compound is tentatively identified. One component (retention time or mass spectra) matches with a compound in the NBS library.

2 The compound is confirmed. Both the retention time and the mass spectra correlate to a single compound in the NBS library.

3 The compound is confirmed. The retention time and the mass spectra are matched against the compound's standard.

Data Analyses:

The overall prevalence of bioconcentratable compounds in Virginia's CZM area was assessed using a frequency of occurrence analysis. Analyses determined the number of occurrences of a particular compound in effluent/water, sediment, soil, and tissue matrices.

Regional and site specific exposure routes were determined using station specific frequency of occurrence analyses. Analyses determined if compounds were partitioning through all sampled matrices, or concentrating in specific matrices.

Risk was assessed by comparing sample contaminant concentrations to risk-based State and Federal standards and criteria. The order of magnitude by which a standard or criteria was exceeded was used to estimate the risk associated with the exceedance. Non-risk-based assessment criteria were also included in comparative analyses when risk-based criteria were unavailable or non-risk-based criteria represented legally enforceable contamination limits. Standards, criteria, and other risk assessment values are detailed in Appendix B.

Effluent/water data were screened against: 1) Virginia Water Quality Standards (VWQS) (Commonwealth of Virginia 1992); 2) EPA 304(a) criteria (EPA 1991c); 3) EPA Compounds of Concern (EPA 1991d); 4) EPA Region III Risk Based Concentrations (RBC, EPA-III 1993); 5) Compound information from the EPA Integrated Risk Information System database (IRIS, EPA 1986b), the National Library of Medicine's MEDLARS databases (National Institute of Health 1993), and the NUMERICA databases (Technical Database Services 1993); and 6) Existing receiving stream characterization reports (IRP reports, DEQ-Bioaccumulation Initiative site files, and DEQ-Toxicity Reduction Evaluation files).

Soil data were screened against: 1) EPA Compounds of Concern; 2) EPA 304(a) criteria; 3) EPA RBC; and 4) Compound information from the IRIS, MEDLARS, and Numerica databases.

Sediment data were screened against: 1) EPA Compounds of Concern; 2) EPA 304(a) criteria; 3) EPA RBC; 4) Compound information from the IRIS, MEDLARS, and Numerica databases; 5) Draft EPA sediment criteria (EPA 1991c); and 2) National Oceanic and Atmospheric Administration (NOAA) National Status and Trends Data (NOAA 1991).

Tissue data were screened against: 1) EPA Compounds of Concern; 2) EPA 304(a) criteria; 3) EPA RBC; 4) Compound information from the IRIS, MEDLARS, and Numerica databases; 5) U.S. Food and Drug Administration's (FDA) Action Levels, Tolerances and Other Values for Poisonous or Deleterious Substances in Seafood (FDA 1988); and 6) Virginia Draft Screening Values for Fish Tissue Contaminants (Virginia Department of Environmental Quality 1992).

Results of Sample Analyses

Site selection

The initial list of candidate sites for the CZM BI study contained 61 sites. Review and prioritization of these sites resulted in the final selection of 12 sites (table 1). The site selection process distributed the final sites among Virginia's CZM Area (Figure 1) as follows: 1) The three sites in the DEQ-Northern Region (NR) consisted of three Federal Facilities; 2) The two sites in the DEQ-Piedmont Region (PR) consisted of one Federal Facility and one private industry; and 3) The seven sites in the DEQ-Tidewater Region (TR) consisted of three Federal Facilities, three private industries, and one Sewage Treatment Plant (STP).

The number of sampling locations within the CZM BI study sites ranged widely (table 1). The number of sampling locations established within each site was governed by three factors: 1) the number of known or suspected areas of contamination at the site; 2) the known or suspected extent of off site migration of contaminants from a particular site; and 3) the budgetary limitations of the CZM BI study. Sampling locations at each site were grouped for matrix correlation analyses (Table 1). Groups consisted of locations which were spatially associated with a known or suspected contamination source. Site maps showing sample locations and sample location groupings are presented in Appendix A.

Analytical results

All CZM BI study analytical results are reported in Appendix A. Data for the CZM BI study Quality Control and Quality Assurance Analyses are reported in Appendix C.

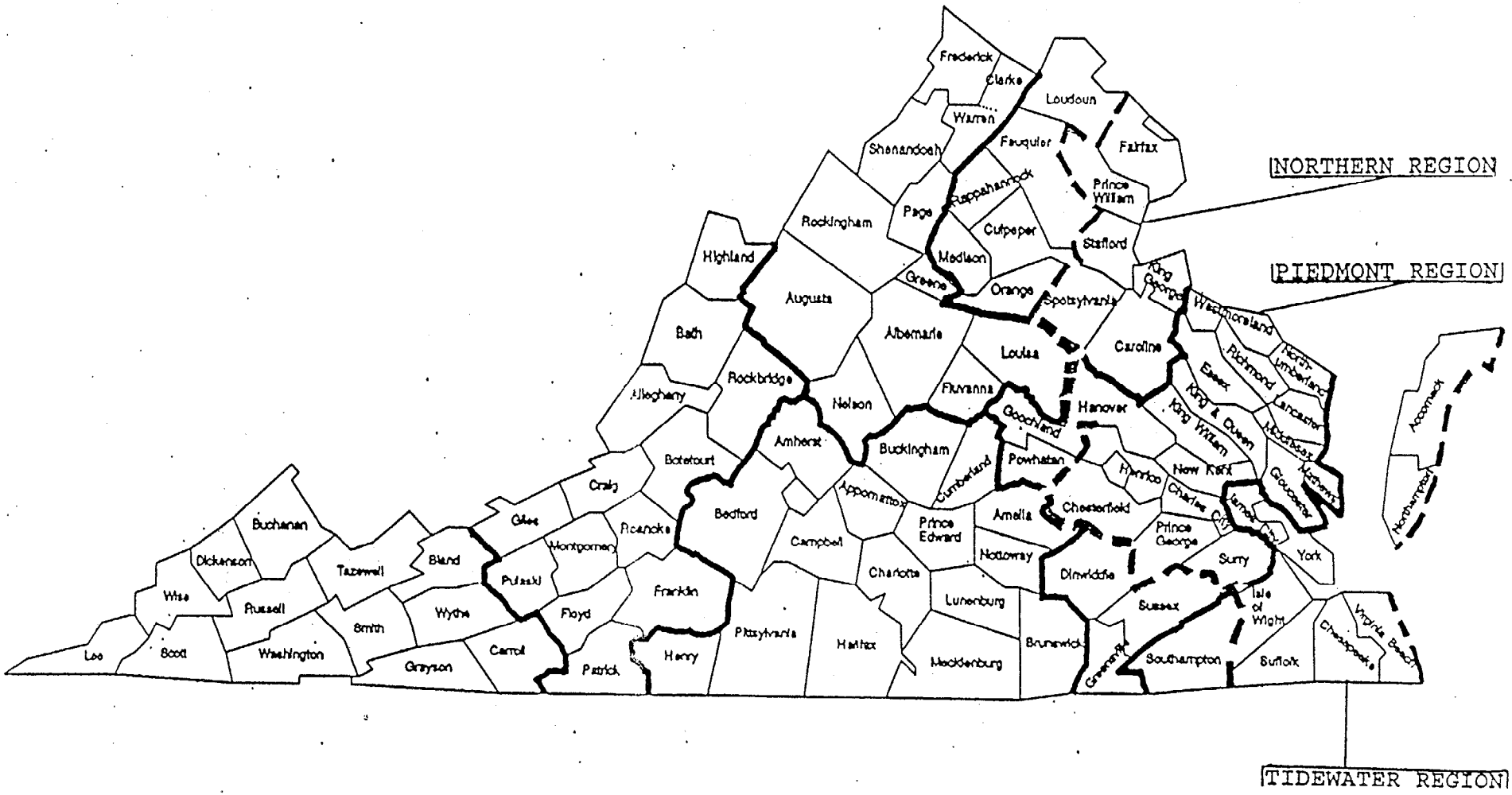
Effluent and Ambient Water:

1) Under phase II of the CZM BI study a total of 49 effluent/water samples were collected. The samples consisted of 26 effluent samples and 23 ambient water samples.

2) Phase II data from four of the 12 study sites removed the sites from the CZM BI study's phase III candidate list. Analyses of phase II samples from **Fort A.P. Hill - APH-G1-G6**, and **NASA Goddard - NSG-G1** indicated no COC were being discharged or released into Virginia's CZM Area waters in concentrations greater than 1 ppb (1 ppb = detection level) from these sites.

Analyses of phase II samples from **Chesapeake Corporation - CC-G1** indicated 4-ethyl-1,3-benzenediol (45 ppb), decamethyl-cyclopentasiloxane (38 ppb), and phthalic acid esters (up to 120 ppb) were being discharged. The two phthalic acid esters

Figure 1. 1992 Virginia Department of Environmental Quality Regions (bold boundaries) and Virginia's Coastal Zone Management Area (dashed boundary).



identified in the Chesapeake Corporation discharge are listed on the Federal Priority Pollutant list (EPA 1986c) and one is listed as a known carcinogen in the Numerica database QSAR (Technical Database Systems 1993). However, the bioconcentration factors (BCF) for these two compounds are relatively low. Therefore, the compounds would not be expected to readily partition into sediments and tissues.

Analyses of phase II samples from the **Quantico Marine Base - QM-G1** indicated alcohols (17 ppb) and esters (3 ppb) were being discharged. Analyses of internal samples (QM360) indicated a potential for the discharge of benzene based compounds, and trimethyl hexane. None of the compounds in the Quantico Marine Base 060 discharge are COC.

No existing receiving stream characterization reports were found for the Fort A.P. Hill sites. Existing receiving stream characterization reports for the Chesapeake, NASA, and Quantico sites indicated that sediment and tissue characterizations had either been done previously or were being addressed.

The phase II sample results, available compound information, and existing receiving stream characterization reports, did not justify including these four sites on the CZM BI phase III candidate list.

3) Phase II data from five of the 12 study sites resulted in the sites being selected for further study under phase III of the CZM BI study. Analyses indicated COC were being discharged or released from these sites. The five sites, number of samples per site, COC, and maximum compound concentrations (ppb) were:

Dahlgren Naval Surface Warfare Center - DA-G2 (DASTP001), 1, Lindane, 0.12, Endrin, 0.21, Methoxychlor, 2.3, Heptachlor, 0.38, and Heptachlor epoxide, 0.20;

Driver Naval Radio Station - DRI-G1 (DRI001), 5, PCBs, 10;

Hampton Roads Sanitation District (HRSD) - Nansemond Point STP - HN-G1 (HN001), 1, alpha-BHC 0.02 (estimated), gamma-BHC (Lindane), 0.02 (estimated);

New Church Energy - NCE-G1 (NCE001), 1, PCBs, 0.14 (estimated);

Woodbridge Research Facility - WRF-G1 (WRF03), 1, PCBs, 15, diethyl ester phthalic acid, 9; **WRF-G2 (WRF08)**, 3, PCBs, 1.5.

Existing receiving stream characterization reports for the Dahlgren and Driver sites indicated that sediment and tissue characterizations had either been done previously or were being addressed. However, the sites were selected for further study under phase III of the CZM BI study. The characterization work at Driver had been done prior to the removal of a PCB contaminated site, and the characterization work at Dahlgren had

not been initiated. The goal of the phase III work at Driver was to assess the effectiveness of the removal action. The goal of the phase III work at Dahlgren was to screen for risks as a time appropriate response to the phase II data.

Available reports for the HRSD site indicated that some sediment characterization work had been done. However, the reports did not indicate that tissue characterizations had been done or were planned. Therefore, this site was selected for further study under phase III of the CZM BI.

Available reports for the New Church and Woodbridge sites did not indicate that sediment and tissue characterizations had been done. The reports also did not indicate that these characterizations were planned.

4) Phase II data from three of the 12 study sites did not indicate the discharge or release of COC. However, the sites were selected for further study under phase III of the CZM BI for other reasons.

The **Allied Colloids** site was selected for further study due to the record of calls to the DEQ Tidewater Regional Office about suspected toxics problems with the facility's stormwater runoff. No reports were found indicating that sediment and tissues had been characterized in the receiving stream or that such characterizations were planned.

The **Boykins Narrow Fabrics** site was selected for further study due to DEQ-Regional and DEQ-Office of Enforcement and Compliance Auditing concerns about potential long term impacts from compounds seeping into CZM area waters from the site's unlined treatment ponds. No reports were found indicating that sediment and tissues had been characterized in the receiving stream or that such characterizations were planned. Phase III studies also sampled one background location at this site (BNF-G2).

The **Yorktown Naval Weapons Station NWS-G1** site was selected for further study due to reported and observed contamination of the site. The site had been used as a landfill for a variety of materials, much of which was unknown. Phase II observations noted the presence of old practice bombs at NWS06 and what were reported to be old torpedo batteries in the NWS06 receiving stream. Phase II observations noted the presence of old fire fighting equipment at NWS07. No reports were found indicating that sediment and tissues had been characterized in the receiving stream or that such characterizations were planned.

Sediment/soil:

1) Under phase III of the CZM BI study 69 sediment/soil samples were collected. The samples consisted of 61 sediment samples and 8 soil samples. Soil samples were collected at the Woodbridge Research Facility WRF-G1 (WRF04) site only. Surface soil samples were collected at this site as Phase II data indicated an active

source of PCBs to be present, and the general lack of information as to its potential location.

2) All Phase III sediment/soil samples contained COC. The eight sites, number of samples per site, COC, and maximum compound concentrations (ppb) were:

Dahlgren Naval Surface Warfare Center - DA-G2 (DA4-5), 8, Anthracene, 76; PCBs, 157; Benz[a]anthracene, 48; Benzo[b]fluoranthene, 59; Benzo[k]fluoranthene, 73; Benzo[ghi]perylene, 130; Benzo[a]pyrene, 38; Chlordane, 7; Chrysene, 320; DDD, 320; DDE, 120; DDT, 31; Dibenz(a,h)anthracene, 39; Dieldrin, 60; Fluoranthene, 68; Fluorene, 28; Indeno(1,2,3-cd)pyrene, 16; Napthalene, 14; Phenanthrene, 280; Pyrene, 59.

The DA-G2 site includes a drainage swale which originates in the vicinity of the Dahlgren IRP Pesticide Rinse Area site. Due to the presence of pesticides in the DASTP001 phase II sample, two of the DA-G2 sediment samples were collected in the pesticide rinse area drainage swale;

Driver Naval Radio Station - DRI-G1 (DRI1-8), 9, PCBs, 4330; Benz[a]anthracene, 54; Benzo[b]fluoranthene, 160; Benzo[k]fluoranthene, 53; Benzo[ghi]perylene, 49; Benzo[a]pyrene, 63; Chrysene, 100; Fluoranthene, 180; Indeno(1,2,3-cd)pyrene, 42; Phenanthrene, 35; and Pyrene, 140;

HRSD - Nansemond Point STP - HN-G1 (HN1-7), 6, Anthracene, 28; PCBs, 71; Benz[a]anthracene, 130; Benzo[b]fluoranthene, 280; Benzo[k]fluoranthene, 87; Benzo[ghi]perylene, 60; Benzo[a]pyrene, 150; Chrysene, 140; Fluoranthene, 190; Indeno(1,2,3-cd)pyrene, Maneb, 48; Phenanthrene, 78; and Pyrene, 240;

New Church Energy - NCE-G1 (NCE2-5, 301), 5, Anthracene, 17; Chrysene, 30; DDE, 12; DDT, 1; Fluoranthene, 24; Napthalene, 12; Phenanthrene, 41; Pyrene, 16.

Woodbridge Research Facility - WRF-G1 (WRF04, soil), 8, Acenaphthene, 140; Acenaphthylene, 18; Anthracene, 180; PCBs, 1100; Benz[a]anthracene, 660; delta-BHC, 2; Benzo[b]fluoranthene, 1100; Benzo[k]fluoranthene, 300; Benzo[ghi]perylene, 160; Benzo[a]pyrene, 530; Chlordane, 3; Chrysene, 600; DDD, 0.5; DDE, 6; DDT, 4; Dibenz(a,h)anthracene, 160; Endosulfan sulfate, 0.3; Fluoranthene, 1200; Fluorene, 93; Indeno(1,2,3-cd)pyrene, 530; Napthalene, 32; Phenanthrene, 950; Pyrene, 1000; **WRF-G1 (WRF03)**, 8, PCBs, 39; Benz[a]anthracene, 170; beta-BHC, 0.6; Benzo[b]fluoranthene, 400; Benzo[k]fluoranthene, 120; Benzo[ghi]perylene, 190; Benzo[a]pyrene, 250; Chlordane, 2; Chrysene, 180; DDD, 2; DDE, 1; DDT, 1; Dibenz(a,h)anthracene, 41; Dieldrin, 0.4; Endosulfan (I, II, sulfate), 1; Endrin (aldehyde), 1; Fluoranthene, 110; Heptachlor epoxide, 0.1; Indeno(1,2,3-cd) pyrene, 190; Phenanthrene, 35; Pyrene, 140; **WRF-G2 (WRF08)**, 4, PCBs, 96000; Benz[a]anthracene, 120; Benzo[b]fluoranthene, 380;

Benzo[k]fluoranthene, 55; Benzo[a]pyrene, 190; Chrysene, 140; Fluoranthene, 46; Phenanthrene, 94; Pyrene, 230.

Boykins Narrow Fabrics - BNF-G1 (BNF1-2, 4-5, x-trib and below Tarrara Creek Confluence), 4, PCBs, 219; Benzo[b]fluoranthene, 65; Chrysene, 37; DDE, 8.1; Dieldrin, 4.7; Fluoranthene, 27; Pyrene, 33; **BNF-G2 (BNF3,** above Tarrara Creek Confluence), 1, DDD, 0.6.

Allied Colloids - ACL-G1 (ACL1-3), 4, Aldrin, 3; PCBs, 40; Benzo[b]fluoranthene, 105; Chlordane 39; DDD, 5; DDE, 3; DDT, 9.5; Dieldrin, 1.4; Endosulfan I, 2.6; Fluoranthene, 125; Heptachlor epoxide, 3; Pyrene, 47.

Yorktown Naval Weapons Station - NWS-G1 (NWS06-07), 12, Anthracene, 22; PCBs, 270; Benz[a]anthracene, 180; Benzo[b]fluoranthene, 360; Benzo[k]fluoranthene, 140; Benzo[ghi]perylene, 270; Benzo[a]pyrene, 280; Chlordane, 10; Chrysene, 260; DDD, 19; DDE, 11; DDT, 13; Dibenz(a,h)anthracene, 38; Fluoranthene, 330; Indeno(1,2,3-cd)pyrene, 200; Phenanthrene, 130; Pyrene, 300.

Tissue:

1) Under phase III of the CZM BI study a total of 47 tissue samples were collected.

2) All Phase III tissue samples contained COC. The eight sites, number of samples per site, COC, and maximum compound concentrations (ppb) were:

Dahlgren Naval Surface Warfare Center - DA-G2 (DA5), 6, PCBs, 440; Chlordane, 4; DDD, 7; DDE, 20; Dieldrin, 1; Endrin, 5.3;

Driver Naval Radio Station - DRI-G1 (DRI5, 8), 4, PCBs, 28024; DDE, 3.4;

HRSD - Nansemond Point STP - HN-G1 (HN1, 7), 5, PCBs, 39; Chlordane, 3.2; DDD, 0.6; DDE, 12.9;

New Church Energy - NCE-G1 (NCE2-5, 301), 2, PCBs, 16; gamma-BHC (Lindane), 0.8; Chlordane, 2.7; DDD, 4; DDE, 12; Heptachlor, 0.5;

Woodbridge Research Facility - WRF-G1 (WRF03), 14, PCBs, 1500; Benzo[a]pyrene, 140; Chlordane, 24; DDD, 27; DDE, 97; DDT, 2; Dieldrin, 3; Endrin (aldehyde), 29;

Boykins Narrow Fabrics - BNF-G1 (BNF4-5, x-trib and below Tarrara Creek Confluence), 10, PCBs, 7; DDD, 7; DDE, 26; DDT, 1;

Allied Colloids - ACL-G1 (ACL3), 3, PCBs, 13; DDD, 1; DDE, 4; DDT, 1;

Yorktown Naval Weapons Station - NWS-G1 (NWS06-07), 3, PCBs, 18; Chlordane, 7; DDD, 37; DDE, 3; DDT, 5; Phthalic acid, diethyl ester, 14000.

Table 1. Sites sampled under the 1993 Virginia Department of Environmental Quality's study of bioconcentratable compounds in the Coastal Zone Management Area of Virginia. Select sampling locations at each site were grouped. Groups consisted of sampling locations spatially associated with a known or suspected contamination source.

Virginia Dept. of Environmental Quality's Northern Region

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
DAHLGREN NAVAL WEAPONS LAB				
DA-G1	Gambo Creek bel IRP Sites 2,9,12,19 and Hideaway Pond			S
DA1	Gambo Cr bel IRP site 19 and Hideaway Pond, Dahlgren NWL	POTOM	Gambo Cr to Potomac R	
DA2	Gambo Cr bel IRP sites 2,9,12, ab Hideaway Pond, Dahlgren NW	POTOM	Gambo Cr to Potomac R	
DA3	Hideaway Pond outfall, Dahlgren NWL	POTOM	Hideaway Pond to Gambo Cr to Potomac R	
DA-G2	STP outfall 001 to Potomac R			S
DA4	X-trib to Potomac R, 30 m ab Dahlgren DASTP001, 200 m ab confl	POTOM	X-trib to Potomac R .2 mi ab Machodoc Cr	
DA5	Potomac R, 100 m radius of DASTP001, 0.2 mi ab Machodoc Cr	POTOM	Potomac R	
DASTP001	Dahlgren Naval Weapons Lab STP 001	POTOM	Potomac R	
QUANTICO MARINE BASE				
QM-G1	Outfall 060 and internal sampling point 360			F
QM060	Quantico Marine Base 060	POTOM	Potomac R	
QM360	Quantico Marine Base 360	POTOM	Potomac R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
WOODBRIDGE RESEARCH FACILITY (HARRY DIAMOND LABS)				
WRF-G1	**Old landfill, IRP Site 1 to Occoquan Bay**			F
WRF03	Occoquan Bay off Woodbridge Res. Fac. old landfill, IRP Site 1	POTOM	Occoquan R to Potomac R	
WRF04	Woodbridge Research Fac. old landfill, IRP Site 1	POTOM	Occoquan R to Potomac R	
WRF10	Woodbridge Research Facility 30 m W old landfill/IRP Site 1	POTOM	Occoquan R to Potomac R	
WRF-G2	**Main compound to storm drainages to Potomac River**			F
WRF05	Potomac R at S confl of Woodbridge Research Fac. main X-trib	POTOM	Potomac R	
WRF06	Potomac R at N confl of Woodbridge Research Fac. main X-trib	POTOM	Potomac R	
WRF07	Woodbridge Research Facility main compound NE side stormwater	POTOM	X-trib to Occoquan R to Potomac R	
WRF08	Woodbridge Research Facility main compound NW side stormwater	POTOM	X-trib to Occoquan R to Potomac R	
WRF09	Woodbridge Research Facility main compound S side stormwater	POTOM	X-trib to Occoquan R to Potomac R	
WRF-G3	**Stormwater discharge below IRP Site 3**			F
WRF01	Woodbridge Research Facility stormwater disch bel IRP Site 3	POTOM	X-trib to Occoquan R to Potomac R	
WRF-G4	**Stormwater discharge below IRP Site 6A**			F
WRF02	Woodbridge Research Facility stormwater disch bel IRP Site 6A	POTOM	X-trib to Occoquan R to Potomac R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Piedmont Region

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
CHESAPEAKE CORP.				
CC-G1	Outfall 001 to Pamunkey River			S
CC001	Chesapeake Corp. 001	YORK	Pamunkey R	
FORT A.P. HILL				
APH-G1	X-trib to Rappahannock R. 5m below Cooke Camp STP			F
APH1	X-trib to Rapp R 5m bel Cooke Camp STP, Ft. AP Hill	RAPP	X-trib to Rappahannock R	
APH-G2	X-trib to Rappahannock R. bel seep, 5m below Wilcox pumpwash			F
APH2	X-trib to Rapp R bel seep, 5m bel Wilcox pumpwash, Ft. AP Hill	RAPP	X-trib to Rappahannock R	
APH-G3	Doctor's Branch, above Boonale Branch			F
APH3	Doctor's Br ab Boonale Br, Ft. AP Hill	RAPP	Doctor's Br to Rappahannock R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Piedmont Region -- continued

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
APH-G4	X-trib above Mill Creek, off Wilderness Trail			F
APH4	X-trib ab Mill Cr, off Wilderness Tr, Ft. AP Hill	RAPP	X-trib to Mill Cr to Rappahannock R	
APH-G5	Burma Rd drainage below Sales Corner landfill			F
APH5	Burma Rd drainage bel Sales Corner Landfill, Ft. AP Hill	RAPP	Rappahannock R	
APH-G6	Mount Cr above West Branch at Ewell Rd			F
APH6	Mount Cr ab West Br at Ewell Rd, Ft. AP Hill	RAPP	Mount Cr to Rappahannock R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
ALLIED COLLOIDS				
ACL-G1	Outfall 001 to X-trib to Nansemond River			S
ACL001	Allied Colloids 001	JAMES	X-trib to Nansemond R	
ACL1	X-trib to Nansemond R, immed bel ACL001	JAMES	X-trib to Nansemond R	
ACL2	X-trib to Nansemond R, 70 m bel ACL001	JAMES	X-trib to Nansemond R	
ACL3	Nansemond R confl X-trib draining ACL001	JAMES	Nansemond R	
BOYKINS NARROW FABRICS CORP.				
BNF-G1	Outfall 001 to X-trib to Tarrara Creek			F
BNF001	Boykins Narrow Fabrics Corp. 001	CHOW	X-trib to Tarrara Cr to Meherrin R	
BNF1	X-trib to Tarrara Cr, immed bel BNF001	CHOW	X-trib to Tarrara Cr to Meherrin R	
BNF2	Tarrara Cr confl BNF001 X-trib	CHOW	Tarrara Cr to Meherrin R	
BNF4	Tarrara Cr 40 m bel confl BNF001 X-trib	CHOW	Tarrara Cr to Meherrin R	
BNF5	Tarrara Cr at Rt 35 bridge	CHOW	Tarrara Cr to Meherrin R	
BNF-G2	Tarrara Cr 40 yds ab confl BNF001 X-trib			F
BNF3	Tarrara Cr 40 m ab confl BNF001 X-trib	CHOW	Tarrara Cr to Meherrin R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
DRIVER NAVAL RADIO TRANSMITTING FACILITY				
DRI-G1	PCB site on X-trib to Star Creek			S
DRI001	Driver Naval Radio Transmitting Fac. PCB site treated effluent	JAMES	Nansemond R.	
DRI1	X-trib to Star Cr upstr bound. Driver PCB site	JAMES	X-trib to Star Cr to Nansemond R	
DRI2	X-trib to Star Cr upstr bound. Driver PCB site L/R Htideline	JAMES	X-trib to Star Cr to Nansemond R	
DRI3	X-trib to Star Cr 50 m ab Driver PCB site, wetlands	JAMES	X-trib to Star Cr to Nansemond R	
DRI301	Driver Naval Radio Transmitting Fac. PCB site influent	JAMES	Nansemond R	
DRI4	X-trib to Star Cr 100 m ab Driver PCB site, wetlands	JAMES	X-trib to Star Cr to Nansemond R	
DRI5	X-trib to Star Cr downstr bound. Driver PCB site	JAMES	X-trib to Star Cr to Nansemond R	
DRI6	X-trib to Star Cr 50 m bel Driver PCB site	JAMES	X-trib to Star Cr to Nansemond R	
DRI7	X-trib to Star Cr 100 m bel Driver PCB site	JAMES	X-trib to Star Cr to Nansemond R	
DRI8	Star Cr at confl Driver PCB site X-trib	JAMES	Star Cr to Nansemond R	
HAMPTON ROADS SANITATION DISTRICT - NANSEMOND STP				
HN-G1	Outfall 001 to Nansemond River			S
HN001	HRSD - Nansemond STP 001	JAMES	Nansemond R	
HN1	Nansemond R, 100 m N of HN001	JAMES	Nansemond R	
HN2	Nansemond R, 100 m NW of HN001	JAMES	Nansemond R	
HN3	Nansemond R, 100 m W of HN001	JAMES	Nansemond R	
HN4	Nansemond R, 100 m S of HN001	JAMES	Nansemond R	
HN5	Nansemond R, 100 m SE of HN001	JAMES	Nansemond R	
HN6	Nansemond R, 100 m E of HN001	JAMES	Nansemond R	
HN7	Nansemond R, 200 m S of HN001	JAMES	Nansemond R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
NASA GODDARD FLIGHT CENTER				
NSG-G1	NASA Goddard Flight Center 001			F
NSG001	NASA Goddard Flight Center 001	CHES	Fresh X-trib to Mosquito Cr to Atlantic	
NEW CHURCH ENERGY ASSOCIATES				
NCE-G1	Outfall 001 to X-trib to Pitt's Creek			F
NCE001	New Church Energy Associates 001	CHES	X-trib to Pitts Cr to Chesapeake Bay	
NCE2	X-trib to Pitt's Cr, immed bel NCE001	CHES	X-trib to Pitts Cr to Chesapeake Bay	
NCE3	X-trib to Pitt's Cr, 10 m bel NCE001	CHES	X-trib to Pitts Cr to Chesapeake Bay	
NCE301	New Church Energy Associates treatment lagoon immed ab 001	CHES	X-trib to Pitts Cr to Chesapeake Bay	
NCE4	X-trib to Pitt's Cr, 150 m bel NCE001	CHES	X-trib to Pitts Cr to Chesapeake Bay	
NCE5	X-trib to Pitt's Cr at RR, 30 m bel product silo storm outfall	CHES	X-trib to Pitts Cr to Chesapeake Bay	
YORKTOWN NAVAL WEAPONS STATION				
NWS-G1	East and west X-tribs to Roosevelt Pond			F
NWS06	X-trib to Roosevelt Pond, at E end bypass rd, Yorktown NWS	YORK	X-trib to Roosevelt Pond to York R	
NWS07	X-trib to Roosevelt Pond, at W end bypass rd, Yorktown NWS	YORK	X-trib to Roosevelt Pond to York R	
NWS09	Roosevelt Pond spillway, Yorktown NWS	YORK	Roosevelt Pond to York R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
NWS-G2	Skiff's Cr at facility perimeter fence			F
NWS01	Skiff's Cr at Yorktown Naval Weapons Station fence	YORK	Skiff's Cr to York R	
NWS-G3	Pond #10 spillway			F
NWS05	Yorktown Naval Weapons Station Pond #10 spillway	YORK	NWS Pond #10 to King Cr to York R	
NWS-G4	Pond #11 spillway			F
NWS04	Yorktown Naval Weapons Station Pond #11 spillway	YORK	NWS Pond #11 to King Cr to York R	
NWS-G5	Pond #11A spillway			F
NWS03	Yorktown Naval Weapons Station Pond #11A spillway	YORK	NWS Pond #11A to King Cr to York R	
NWS-G6	Pond #12 spillway			F
NWS02	Yorktown Naval Weapons Station Pond #12 spillway	YORK	NWS Pond #12 to King Cr to York R	

Table 1 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
NWS-G7	Seep at end of Barracks Rd			F
NWS08	Seep at end of Barracks Rd, Yorktown NWS	YORK	York R	
NWS-G8	Dredge spoil drainage pipe at Colonial Parkway			F
NWS10	Yorktown NWS dredge spoil drainage pipe at Colonial Parkway	YORK	York R	

Table 1 -- continued.

Notes:

[1]Abbreviations used within station names include the following: X-trib=unnamed tributary, ab=above, bel=below, confl=confluence, m=meters, mi=miles, R=river, Cr=creek, RR=railroad, IRP=U.S. Dept. of Defense Installation Restoration Program.

[2]Indicates whether the immediate receiving stream has been designated fresh water or salt water for the purposes of applying appropriate salinity-dependent standards and criteria within this report.

Results of Quality Control Analyses:

All CZM BI study Quality Control (QC) data are reported in Appendix C.

Effluent:

Detection levels reported for effluent organic analyses were 0.05-1.0 ppb. The detection level reported for Toxaphene was 5.0 ppb.

1) **Surrogate recoveries** - all surrogate recoveries were within QC limits (QCL) except the following:

Surrogate 1 (S1 - 1,1-binaphthyl):
- Allied Colloids - ACL001 (above QCL), Blank (above QCL)
- Fort A.P. Hill - Blank (above QCL)
- Woodbridge Research Facility - WRF03 (below QCL)
- Yorktown Naval Weapons Station - NWS06 (above QCl), NWS07 (above QCL)

Surrogate 2 (S2 - perinapthenone):
- Allied Colloids - Blank (above QCL)
- Dahlgren - DASTP001, DA3 (above QCL)
- Fort A.P. Hill - Blank (above QCL)
- HRSD - HN001 (below QCL)
- Quantico - QM060 (above QCL)
- Woodbridge Research Facility - WRF03 (below QCL)

Surrogate 3 (S3 - tribromophenol):
- Woodbridge Research Facility - WRF04 (below QCL)
- Yorktown Naval Weapons Station - NWS01 (above QCL), NWS05 (above QCL), NWS08 (above QCL), NWS10 (above QCL)

Surrogate 4 (S4 - decachlorobiphenyl):
- New Church Energy - NCE001 (below QCL)
- Quantico - QM360 (below QCL)

2) **Matrix spikes** - An organochlorine pesticide-PCB matrix spike is reported for HRSD sample HN001, and semi-volatile organics matrix spikes are reported for HN001 and DRI001. All other sample volumes were used for analyses which precluded matrix spiking. Therefore, method blank spikes were run for effluent quality control matrix spikes.

Pesticide-PCB matrix spike results from HN001 indicate all matrix spikes were detected at levels within the Quality Control Limits (40-131%). Only the 4,4'-DDT spike had an actual recovery greater than 100% (106%). Semi-volatile matrix spike results for HN001 report spike recoveries of 36-76%. Duplicate matrix spike results for HN001 report spike recoveries of 44-89%. The relative percent differences between the HN001 spike recoveries and duplicate spike recoveries were 5.1-46%. Semi-volatile

matrix spike results for DRI001 report spike recoveries of 60-82%. Duplicate matrix spike results for DRI001 report spike recoveries of 39-92%. The relative percent differences between the DRI001 spike recoveries were 4.9-57%.

3) **Matrix blanks** - all effluent matrix blanks had non-detectable levels of Polyaromatic Hydrocarbons and Compounds of Concern.

<u>Sediment/soil:</u>

Detection levels reported for sediment organic analyses were 0.05-0.5 ppb for halogenated compounds and 10.0 ppb for semi-volatile compounds.

Inorganic Analyses:

1) **Percent moisture:**
   a) duplicates - The relative percent difference between sample percent moisture and duplicate sample percent moisture was 0.4-6.0%.

2) **Acid Volatile Sulfides:**
   a) blanks - All AVS blanks had non-detectable levels of AVS.
   b) duplicates - the relative percent differences between sample AVS values and duplicate sample AVS values were 0-4.3%.
   c) spiked blanks - Recoveries for blank AVS spikes were 87.5-89.8%.
   d) matrix spikes - Recoveries for matrix AVS spikes were 87.7-104%.

3) **Total Organic Carbon:**
   a) blanks - All TOC blanks had non-detectable levels of TOC.
   b) matrix spikes - Recoveries for matrix TOC spikes were 90-96%. Recoveries for duplicate matrix TOC spikes were 89-94%.

Organic Analyses:

1) **Surrogate recoveries** - all surrogate recoveries were within QC limits (QCL) except the following:

Surrogate 1 (S1 - 1,1-binaphthyl):
   Allied Colloids - ACL1 (blank below QCL)
   Driver - DRI6 (above QCL)
   HRSD - HN5 (blank below QCL)
   New Church Energy - NCE301 (blank below QCL)
   Woodbridge Research Facility - WRF04A (below QCL), WRF04F (sample above QCL, blank below QCL), WRF08D (blank below QCL)
   Yorktown Naval Weapons Station - NWS06A (blank below QCL0, NWS06C (below QCL), NWS06F (blank below QCL), NWS07B (blank below QCL), NWS07C (blank below QCL), NWS07F (blank below QCL)

Surrogate 2 (S2 - perinapthenone):

Allied Colloids - ACL1 (above QCL), ACL2 (below QCL), ACL3A-B (below QCL).

Boykins Narrow Fabrics - BNF1-3 (blank below QCL), BNF5 (blank below QCL).

Dahlgren - DA4B (below QCL), DA5B (below QCL), DA5C (below QCL).

Driver - DRI1 (blank below QCL), DRI4 (blank below QCL), DRI5 (sample below QCL, blank below QCL), DRI6 (blank below QCL), DRI7 (sample below QCL, blank below QCL), DRI8A (below QCL).

Woodbrdige Research Facility - WRF03A-D (duplicate blank above QCL), WRF04A (below QCL), WRF04D-E (duplicate blank above QCL), WRF04G-H (duplicate blank above QCL).

HRSD - HN3 (Above QCL), HN5 (above QCL), HN6 (below QCL).

Surrogate 3 (S3 - tribromophenol):

Boykins Narrow Fabrics - BNF1-3 (blank below QCL), BNF4 (sample below QCL, blank below QCL), BNF5 (sample below QCL, blank below QCL).

Dahlgren - DA4A (below QCL), DA4D (below QCL), DA5C (below QCL), DA5E (below QCL).

Driver - DRI1 (sample above QCL, blank below QCL), DRI4 (blank below QCL), DRI5 (sample below QCL, blank below QCL), DRI6 (blank below QCL), DRI7 (sample below QCL, blank below QCL), DRI8A (below QCL), DRI8B (below QCL).

Woodbridge Research Facility - WRF03G (above QCL), WRF04A (below QCL).

HRSD - HN2-3 (blank below QCL), HN4 (sample below QCL, blank below QCL).

Surrogate 4 (S4 - decachlorobiphenyl):

Allied Colloids - ACL2 (above QCL), ACL3A-B (above QCL).

Dahlgren - DA5E (above QCL).

Driver - DRI8B (below QCL).

Woodbridge Research Facility - WRF04A (below QCL), WRF04F (above QCL), WRF04G (below QCL).

HRSD - HN4 (below QCL), HN6 (above QCL).

2) **Matrix Spikes:**

A) **Blank matrix spikes:** Pesticide-PCB blank matrix spike results report spike recoveries of 0-100%. Relative percent differences between spike recoveries and duplicate spike recoveries were 0-50%. Semi-volatile matrix spike results report spike recoveries of 0-80%. Relative percent differences between spike recoveries and duplicate spike recoveries were 5.1-147%.

B) **Matrix spikes:** Pesticide-PCB matrix spike results report spike recoveries of 0-106%. Relative percent differences between spike recoveries and duplicate spike recoveries were 42-156%. Samples with associated matrix spikes with greater than 100% recovery were: 1) HRSD - HN1. Compounds with recoveries above 100 percent were: 1) PCB (106%).

Semi-volatile matrix spike results report spike recoveries of 5-195%. Relative percent differences between spike recoveries and duplicate spike recoveries were 5.9-135%. Samples with associated matrix spikes with greater than 100% recovery were: 1) Dahlgren - DA4B, DA5C; and 2) Boykins Narrow Fabrics - BNF4. Compounds with recoveries above 100 percent in the Dahlgren associated matrix spike were: 1) Benzo(b)fluoranthene (113%); 2) Benzo(k)fluoranthene (118%); 3) Benzo(a)pyrene (123%); 4) Indeno(1,2,3-cd)pyrene (105-195%); 4) Dibenz(a,h)anthracene (134%); 5) Benzo(g,h,i)perylene (120%). Compounds with recoveries above 100 percent in the Boykins Narrow Fabrics associated matrix spike were: 1) Benzo(a)anthracene (111%).

3) **Matrix blanks** - All sediment matrix blanks had non-detectable levels of Polyaromatic Hydrocarbons and Compounds of Concern except the following:

Blank id #: VWC93-012-Blank0709. Compounds detected in the sediment blank were: 1) Lindane (0.5 ppb); 2) Dieldrin (0.3 ppb); 3) Endrin (0.4-0.9 ppb); 4) PCB (20 ppb). Sediment samples related to the sediment blank were: 1) Allied Colloids (ACL1); 2) HRSD (HN5); 3) New Church Energy (NCE301); 4) Woodbridge Research Facility (WRF04F, WRF08D); and 5) Yorktown Naval Weapons Station (NWS06A, NWS06F, NWS07B, NWS07C, NWS07F).

Blank id#: VWC93-012-Blank0712. Compounds detected in the sediment blank were: 1) Dieldrin (0.3 ppb); and 2) Endrin (0.4 ppb). Sediment samples related to the sediment blank were: 1) Allied Colloids (ACL2, ACL3A, ACL3B); and 2) HRSD (HN6).

Blank id#: VWC93-012-Blank0720. Compounds detected in the sediment blank were: 1) PCB (16 ppb). Sediment samples related to the sediment blank were: 1) HRSD (HN1).

Blank id#: VWC93-012-Blank0820 (LY). Compounds detected in the sediment blank were: 1) PCB (2.8-8.3 ppb). Sediment samples related to the sediment blank were: 1) Boykins Narrow Fabrics (BNF4).

Blank id#: VWC93-012-Blank0824. Compounds detected in the sediment blank were: 1) PCB (3.1-17 ppb). Sediment samples related to the sediment blank were: 1) Driver (DRI5).

Tissue:

Detection levels reported for tissue organic analyses were 0.05-0.5 ppb for halogenated compounds and 10 ppb for semi-volatile compounds.

Inorganic analyses:

1) **Percent moisture:**
   a) duplicates - The relative percent difference between sample percent moisture and duplicate sample percent moisture was 0.6-2.0%.

2) **Percent lipid:**
a) blanks - All percent lipid blanks had non-detectable levels of lipid.

Organic analyses:
1) **Surrogate recoveries** - all surrogate recoveries were within QC limits (QCL) except the following:

Surrogate 1 (S1 - 1,1-binaphthyl):
Boykins Narrow Fabrics - BNF5 (sunfish, above QCL).

Surrogate 2 (S2 - Perinapthenone):
Allied Colloids - ACL3 (minnows, crayfish, clams; blank below QCL).
Boykins Narrow Fabrics - BNF5 (eel, above QCL; sunfish, below QCL).
Driver - DRI5 (minnows, above QCL).
New Church Energy - NCE3 (sunfish, blank below QCL), NCE4 (sunfish, blank below QCL).
Woodbridge Research Facility - WRF03 (largemouth bass, largemouth bass viscera, sunfish, sunfish viscera, blue back herring, blue back herring viscera, gizzard shad, gizzard shad viscera, carp; blank below QCL); white perch viscera (above QCL).
Yorktown Naval Weapons Station - NWS06 (sunfish, blank below QCL), NWS07 (amphibians, sample above QCL, blank below QCL).

Surrogate 3 (S3 - tribromophenol):
Allied Colloids - ACL3 (minnows, crayfish, clams; blank below QCL).
Boykins Narrow Fabrics - BNF4 (bowfin, sample below QCL, blank below QCL; crayfish, sample above QCL, blank below QCL; catfish, sunfish, chain pickerel, pirate perch, blank below QCL;); BNF5 (eel, chain pickerel, sunfish, blank below QCL; pirate perch, sample below QCL; catfish, sample below QCL, blank below QCL).
Dahlgren - DA5 (menhaden viscera, below QCL).
HRSD - HN7 (crabs, above QCL; oyster toad, below QCL).
Woodbridge Research Facility - WRF03 (largemouth bass, largemouth bass viscera, sunfish, sunfish viscera, blue back herring, blue back herring viscera, gizzard shad, gizzard shad viscera, carp; blank below QCL; catfish below QCL).

Yorktown Naval Weapons Station - NWS06 (sunfish, blank below QCL), NWS07 (amphibians, sample below QCL, blank below QCL).

Surrogate 4 (S4 - decachlorobiphenyl):
Boykins Narrow Fabrics - BNF5 (pirate perch, below QCL).
Dahlgren - DA5 (eel, below QCL; menhaden, striped bass, crabs, blank below QCL).

Driver - DRI5 (minnow, crabs, blank below QCL); DRI8 (crabs, minnows, blank below QCL).
HRSD - HN7 (crabs, sample above QCL, blank below QCL; eel, shellfish, oyster toad, blank below QCL); HN1 (shellfish, blank below QCL).
New Church Energy - NCE3 (sunfish, blank above QCL), NCE4 (sunfish, blank above QCL).

2) **Matrix Spikes:**
A) **Blank matrix spikes:** Pesticide-PCB blank matrix spike results report spike recoveries of 0-90%. Relative percent differences between spike recoveries and duplicate spike recoveries were 6.4-110%. Semi-volatile matrix spike results report spike recoveries of 0.3-75%. Relative percent differences between spike recoveries and duplicate spike recoveries were 0-67%.

B) Matrix spikes: Pesticide-PCB matrix spike results report spike recoveries of 13-106%. Relative percent differences between spike recoveries and duplicate spike recoveries were 42-156%. Samples with associated matrix spikes with greater than 100% recovery were: 1) Woodbridge Research Facility - WRF03 (carp viscera, white perch, white perch viscera, catfish, catfish viscera). Compounds with recoveries above 100 percent were: 1) PCB (106%).

Semi-volatile matrix spike results report spike recoveries of 4-195%. Relative percent differences between spike recoveries and duplicate spike recoveries were 7-135%. Samples with associated matrix spikes with greater than 100% recovery were: 1) Yorktown Naval Weapons Station - NWS06 (amphibians). Compounds with recoveries above 100 percent were: 1) Benzo(b)fluoranthene (113%); 2) Benzo(k)fluoranthene (118%); 3) Benzo(a)pyrene (123%); 4) Indeno(1,2,3-cd)pyrene (105-195%); 4) Dibenz(a,h)anthracene (134%); 5) Benzo(g,h,i)perylene (120%).

3) **Matrix blanks** - All tissue matrix blanks had non-detectable levels of Polynuclear Aromatic Hydrocarbons and Compounds of Concern except the following:

Blank id #: VWC93-012-Blank0712. Compounds detected in the tissue blank were: 1) Dieldrin (0.3 ppb); 3) Endrin (0.4 ppb). Samples associated with the blank were: 1) New Church Energy - NCE3 (sunfish), NCE4 (sunfish).

Blank id #: VWC93-012-Blank0720. Compounds detected in the tissue blank were: 1) PCB (16 ppb). Samples associated with the blank were: 1) Woodbridge Research Facility - WRF03 (carp viscera, white perch, white perch viscera, catfish, catfish viscera).

Results of Quality Assurance Analyses:

The quality assurance (QA) data for the CZM BI phase II effluent splits are reported in Appendix A with the sample analytical data. The QA data for the CZM BI phase III sediment and tissue splits are reported in Appendix C.

Effluent:

The effluent samples used for QA analyses, the number of halogenated compounds identified by Spectrolytix / VIMS, the commonly identified compounds, the Spectrolytix / VIMS quantification (ppb) of commonly identified compounds, and the difference between quantitations (multiplicative difference) were:

Driver:
DRI001, 1 / 1, PCB, 10 / 3.14, 3.18

HRSD:
HN001, 2 / 0.

Woodbridge Research Facility:
WRF01 - 0 / 0.
WRF02 - 0 / 0.
WRF03 - 1 / 1, PCB, 15 / 6.88, 2.18
WRF08 - 1 / 1, PCB, 1.5 / 0.162, 9.26
WRF10 - 0 / 0.

Sediment:

The sediment samples used for QA analyses, the number of halogenated compounds identified by Spectrolytix / VIMS, the commonly identified compounds, the Spectrolytix / VIMS quantification (ppb) of commonly identified compounds, and the difference between quantitations (multiplicative difference) were:

QMSW1 - 6 / 8, PCB, 40.5 / 908.3, 22.4.
Chlordane, 1.2 / 29.3, 24.4.
4,4'-DDD, 130 / 341.7, 2.6.
4,4'-DDE, 53 / 312.0, 5.9.
4,4'-DDT, 29 / 104.1, 3.6.

QCC01 - 3 / 3, PCB, 10.0 / 10.8, 1.08.
4,4'-DDE, 14.6 / 11.0, 1.3.
4,4'-DDD, 11.3 / 3.4, 3.3.

QCC02A- 4 / 3, PCB, 2.9 / 23.1, 8.0.
4,4'-DDD, 15.3 / 8.9, 1.7.
4,4'-DDE, 15.0 / 15.2, 1.0.

QCC02B- 4 / 4, 4,4'-DDD, 13.6 / 29.7, 2.2.
4,4'-DDE, 12.2 / 37.0, 3.0.
4,4'-DDT, 6.2 / 24.7, 4.0.

QCC02C- 0 / 5.

QCC03 - 3 /3, 4,4'-DDD, 4.2 / 2.6, 1.6.
4,4'-DDE, 5.4 / 2.6, 2.1.

Tissue:

The tissue samples used for QA analyses, the number of halogenated compounds identified by Spectrolytix / VIMS, the commonly identified compounds, the Spectrolytix / VIMS quantification (ppb) of commonly identified compounds, and the difference between quantitations (multiplicative difference) were:

QMSW1 (carp fillet) - 4 / 7, PCB, 65.0 / 345.6, 5.3.
Chlordane, 5.4 / 1.7, 3.1.
4,4'-DDD, 27.4 / 155.9, 5.7.
4,4'-DDE, 27.8 / 177.0, 6.4.

QMCC01 (carp fillet) - 4 / 6, PCB, 59.0 / 248.0, 4.2.
Chlordane, 1.2 / 9.4, 7.8.
4,4'-DDD, 8.9 / 24.2, 2.7.
4,4'-DDE, 20.4 / 70.6, 3.5.

QMCC01 (carp viscera)- 4 / 7, PCB, 28.0 / 114.5, 4.1.
Chlordane, 0.4 / 0.5, 1.3.
4,4'-DDD, 3.7 / 10.3, 2.7.
4,4'-DDE, 11.0 / 31.9, 2.9.

QMCC01 (largemouth bass fillet) - 3 / 4, PCB, 16.0 / 83.7, 5.2.
4,4'-DDD, 1.9 / 5.2, 2.7.
4,4'-DDE, 6.1 / 19.7, 3.2.

QMCC01 (white perch fillet) - 5 / 8, PCB, 410.0 / 292.8, 1.4.
Chlordane, 25.5 / 16.7, 1.5.
4,4'-DDD, 57.0 / 17.3, 3.3.
4,4'-DDE, 130.0 / 62.7, 2.0

QMCC01 (yellow perch fillet) - 1 / 5, 4,4'-DDE, 1.4 / 4.2, 3.0.

QMCC01 (bluegill whole) - 3 / 9, PCB, 16.0 / 143.6, 9.0.
4,4'-DDD, 1.9 / 2.4, 1.3.
4,4'-DDE, 6.1 / 27.2, 4.5.

QMCC02 (goldfish fillet) - 4 / 5, PCB, 31.0 / 162.6, 5.2.
Chlordane,
cis + trans, 3.0 / 7.5, 2.5.
4,4'-DDD, 4.4 / 24.9, 5.6.
4,4'-DDE, 18.4 / 39.2, 2.1.

QMCC02 (sunfish fillet) - 5 / 6, PCB, 94.0 / 118.8, 1.3.
Chlordane, 2.3 / 2.6, 1.1.
4,4'-DDD, 16.8 / 9.2, 1.8.
4,4'-DDE, 56.0 / 30.7, 1.8.

QMCC02 (carp fillet) - 4 / 7, PCB, 14 / 48.1, 3.4.
4,4'-DDD, 3.6 / 4.3, 1.2.
4,4'-DDE, 7.0 / 14.6, 2.1.

QMCC02 (largemouth bass viscera) - 5 / 7, PCB, 540 / 1090.6, 2.0.
Chlordane,
cis + trans, 13.7 / 21.0, 1.5.
4,4'-DDD, 100 / 73.4. 1.4.
4,4'-DDE, 210 / 238.9, 1.1.

QMCC02 (largemouth fillet) - 6 / 5, PCB, 91 / 399.2, 4.4.
Chlordane,
cis + trans, 1.7 / 14.3, 8.3.
4,4'-DDD, 9.7 / 23.1, 2.3.
4,4'-DDE, 27.3 / 87.2, 3.2.

QMCC02 (white perch fillet) - 5 / 9, PCB, 360 / 384, 1.1.
Chlordane,
cis + trans, 1.7 / 14.3, 8.4.
4,4'-DDD, 9.7 / 23.1, 2.4.
4,4'-DDE, 27.3 / 87.2, 3.2.

QMCC03 (yellow perch fillet) - 6 / 4, PCB, 35.0 / 95.2, 2.7.
4,4'-DDD, 5.4 / 5.2, 1.0.
4,4'-DDE, 10.8 / 17.2, 1.6.

QMCC03 (largemouth fillet) - 2 / 5, PCB, 120.0 / 385.0, 3.2.
4,4'-DDE, 83.0 / 79.9, 1.

QMCC03 (largemouth viscera) - 1 / 6, PCB, 720.0 / 2905.0, 4.0.

QMCC03 (sunfish fillet) - 6 / 5, PCB, 86 / 157.7, 1.8.
Chlordane,
cis + trans, 2.0 / 7.3, 3.7.
4,4'-DDD, 16.5 / 13.9, 1.2.
4,4'-DDE, 31.4 / 42.1, 1.3.

Discussion

Distribution of bioconcentratable compounds in Virginia's CZM area.

Of the 276 compounds identified in the CZM BI study samples (table 2), 39 (Aroclors and chlorobiphenyl, poly- totaled as PCB, Chlordane cis, trans-, totaled as Chlordane, and 2,4'-DDE, 4,4'- DDE, totaled as DDE) were identified as CZM BI study COC (figure 2). There was insufficient information on most of the remaining 237 compounds to determine whether or not they should also be classified as COC. Certain generic groups such as aliphatic hydrocarbons and alcohols were assumed not to be COC based on the group's general quantitative structure-activity relationship. The patterns of occurrence of all 276 compounds identified in the CZM BI study samples is detailed in table 3 by DEQ region and sampling site.

Effluent/water.

The three COC with the highest frequency of occurrence in Phase II samples were, by decreasing frequency: 1) PCB; 2) Phthalic acid, di-(2-ethylhexyl) ester; and 3) Lindane (table 2). Remaining COC in Phase II samples had a frequency of 1 and were comprised of both halogenated compounds and poly-nuclear aromatic hydrocarbons (PAHs) (table 2). The number of COC (10) identified in Phase II samples was approximately 25% of the total number of COC identified in all matrices (table 2). These data indicate relatively few facilities are currently releasing COC. However, data indicate current releases of COC represent an exposure pathway for human health and environmental risk. Of the ten COC identified in Phase II samples, five were also identified in tissues samples (figure 2). The compounds, in order of frequency of occurrence in tissue samples were: 1-2) Endrin, PCB; 3-5) Heptachlor, Lindane, and Phthalic acid, diethyl ester- (table 2).

Sediment.

The eight COC with the highest frequency of occurrence in sediment samples were, by decreasing frequency: 1) Fluoranthene; 2) Pyrene; 3) PCB; 4) Benzo[b]fluoranthene; 5) Chrysene; 6) DDE; 7) Benz[a]anthracene; and 8) DDD, DDT (table 2). Remaining COC in sediment samples had a frequency $\leq$ 25 and are comprised of both halogenated compounds and PAHs (table 2). The number of COC (28) identified in the sediment matrix was almost three times the number of COC identified in Phase II samples (10) and tissue samples (12) (table 2). These numbers indicate sediments represent a substantial source of bioconcentratable compounds in the CZM Area of Virginia. The numbers also indicate that substantial amounts of bioconcentratable compounds have been

introduced to Virginia's CZM Area surface water environment through historical and/or episodic releases. The prevalence and persistence of the sediment COC create a potential for establishing exposure pathways through food chain mechanisms (bioaccumulation). Of the 28 COC identified in the CZM BI sediment samples, nine were identified in tissue samples of indigenous fish and shellfish (Figure 2). The compounds, by decreasing frequency of occurrence in tissue samples were: 1) Chlordane; 2/3) DDE, PCB; 4) DDD; 5) DDT; 6) Endrin; 7) Dieldrin; 8) Endrin aldehyde; and 9) Benzo[a]pyrene (table 2).

Tissue.

Of the 39 COC, 12 were identified in tissue samples of indigenous fish, shellfish, and amphibians (figure 2). The compounds, in order of frequency of occurrence in tissue samples were: 1) Chlordane; 2) DDE; 3) PCB; 4) DDD; 5) DDT; 6) Endrin; 7) Dieldrin; 8) Endrin aldehyde; 9-12) Heptachlor, Lindane, Phthalic acid, diethyl ester, and Benzo[a]pyrene (table 2). Data indicate sediments were the dominant source of tissue COC (figure 2) and that bioaccumulation of COC was a more prevalent exposure pathway than bioconcentration.

Soil.

The frequency of occurrence of COC in soil samples was not considered in overall prevalence analyses as the samples were collected at one site. These data are discussed below under the site specific risk assessments.

Distribution of bioconcentratable compounds in the DEQ Northern Region of Virginia's CZM area.

Of the 276 compounds identified in all CZM BI study samples, 200 were identified in CZM BI study samples from the DEQ Northern Region (NR) of the Virginia CZM area (table 2). Of the 39 compounds identified as COC in the CZM BI study, 35 were identified in samples collected in the NR (Figure 3).

Effluent/water.

Only two COC had frequencies of occurrence in the NR phase II samples greater than one (table 2). PCBs were identified in four samples, and Endrin aldehyde was identified in two samples (table 2). The remaining six compounds identified in NR Phase II samples consisted of a mixture of halogenated compounds and PAHs (Figure 3).

The percentage of COC identified in NR Phase II samples (23%) was slightly below the overall CZM area percentage. These data indicate few facilities in the NR currently release COC. However, data indicate current releases in the NR are a potential exposure pathway for human health and environmental risk. Of the eight COC identified in Phase II samples, two were also identified in tissues samples (figure 3). The compounds, by decreasing frequency of occurrence in tissue samples were: 1) PCBs; and 2) Endrin (table 2).

Sediment.

The nine COC with the highest frequency of occurrence in NR sediment samples were, by decreasing frequency: 1) PCB; 2-3) Pyrene, fluoranthene; 4-5) Chrysene, Benzo[b]fluoranthene; 6) DDE; 7) DDD; 8) Benz[a]anthracene; and 9) DDT (table 2). Remaining COC in sediment samples had a frequency $\leq$ 11 and were comprised of both halogenated compounds and PAHs (table 2). The number of COC (26) identified in the NR sediment matrix was over three times the number of COC identified in the NR Phase II samples (8) and tissue samples (8) (table 2). These numbers indicate NR sediments represent a substantial source of bioconcentratable compounds in the NR CZM Area of Virginia and that substantial amounts of COC in the NR CZM Area are attributable to historical and/or episodic releases. Tissue data (table 2) suggest bioaccumulation uptake from this source has created an exposure pathway for risk effects. All of the COC identified in NR sediment samples were identified in NR tissue samples (Figure 3). The compounds, by decreasing frequency of occurrence in NR tissue samples were: 1) Chlordane; 2) PCB; 3) DDE; 4) DDD; 5) DDT; 6) Endrin; 7) Dieldrin; 8) Benzo[a]pyrene (table 2).

Tissue.

The eight COC in NR tissue samples are reported above. Also as noted above, sediments appeared to be the dominant source of tissue COC.

Northern Region site specific risk assessments.

The following comments apply to all site specific risk assessments: 1) Additive risk from all COC exceeding human health standards and/or criteria is believed to be larger than risk for individual COC (EPA 1991f); 2) A general quality assurance problem associated with the analyses of Phase II samples was the potential for over quantification of halogenated compounds, specifically PCBs; 3) A general quality assurance problem associated with the analyses of sediment and tissue samples was

the potential for mis-identifications of halogenated compounds and under quantification of identified halogenated compounds, specifically PCBs; 4) Risk assessments of sediment and tissue data totaled DDD, DDE, and DDT as DDE, and Endrin and Endrin aldehyde as Endrin.

Study sites in the NR of Virginia's CZM Area which were sampled through phase III were the Dahlgren Naval Weapons Lab (DA), and the Woodbridge Research Facility (WRF). Both sites are Federal Facilities. The DA facility is currently in the Remedial Investigation / Feasibility Study phase of its IRP project. The WRF facility has recently completed the Preliminary Assessment phase of its IRP project. The WRF facility has been designated for base closure by 1997.

Dahlgren Naval Weapons Lab.

The DA site sampled through phase III (DA-G2) encompassed an area of the Potomac River bounded by a 50 yd arch with its focal point at the DASTP001 outfall (Appendix A). The site boundary was extended around DASTP001, into the adjacent wetlands, to encompass the drainage swale originating at the Dahlgren Pesticide Rinse Area IRP site (Appendix A). Of the 39 COC, 25 were identified in phase II and phase III samples from DA-G2 (figure 4).

Effluent/water risk estimates.

Of the five COC identified in the phase II DA-G2 samples (figure 4), one exceeded Virginia's Water Quality Standard for the protection of human health (VHHO, 10^{-5} risk level), two exceeded the Federal Water Quality Criteria for the protection of human health (FHHO, 10^{-6} risk level), five exceeded the Virginia Water Quality Standard for the chronic protection of aquatic life (VALC), and four exceeded the Federal Water Quality Criteria for the continuous protection of aquatic life (FALC) (table 4). The compounds, standards and/or criteria exceeded, and order of magnitude (OM) of the exceedences were: 1) Lindane, FHHO - 1 OM, VALC - 0 OM; 2) Endrin, VALC - 2 OM, FALC - 2 OM; 3) Heptachlor, VHHO - 2 OM, FHHO - 3 OM, VALC - 2 OM, FALC 2 OM; 4) Heptachlor epoxide, FHHO - 3 OM, FALC 2 OM; and 5) Methoxychlor, VALC - 2 OM (table 4). The maximum estimated risk level for a single COC identified in the DA-G2 phase II sample was 10^{-3} for both Heptachlor and Heptachlor epoxide.

Quality control problems associated with analyses of DA-G2 Phase II samples included: 1) recovery of the perinapthenone surrogate above the QCL.

Sediment risk estimates.

Currently there are no criteria or standards available for estimating risk from sediment bound COC. Criteria and guidance values currently available for the assessment of sediment contamination focus primarily on the acute and chronic protection of aquatic life.

Of the 20 COC identified in the phase III DA-G2 sediment samples (figure 4), seven exceeded the National Status and Trends Effects Range Low (NERL), and five exceeded the National Status and Trends Effects Range Medium (NERM). The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) PCB, NERL - 1 OM; 2) Chlordane, NERL - 1 OM, NERM - 0 OM; 3) DDD, NERL - 2 OM, NERM - 1 OM; 4) DDE, NERL - 2 OM, NERM 1 OM; 5) DDT, NERL - 2 OM, NERM 1 OM; 6) Dieldrin, NERL - 3 OM, NERM - 2 OM; and 7) Phenanthrene, NERL - 0 OM (table 4).

Maximum estimated risk levels for single COC identified in the DA-G2 phase III sediment samples could not be determined due to a lack of risk based criteria or standards. The risk from sediment contamination at DA-G2 may be inferable from the tissue risk estimates as eight of the COC in the DA-G2 sediments were identified in DA-G2 tissue samples (figure 4).

Quality control problems associated with analyses of DA-G2 sediment samples included: 1) recovery of the perinapthenone and tribromophenol surrogates below the QCL; 2) recovery of the decachlorobiphenyl surrogate above the QCL; and 3) greater than 100% recovery of semi-volatile matrix spikes.

Tissue risk estimates.

Of the six COC identified in the phase III DA-G2 tissue samples (figure 4), one exceeded the Virginia DEQ draft Screening Value for Tissue (VTSV, 10^{-5} risk level), and four exceeded the EPA III Risk Based Concentration screening values (FRBT, 10^{-6} risk level). The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) PCB, VTSV - 1 OM, FRBT - 3 OM; 2) Chlordane, FRBT - 0 OM; 3) Total DDE, FRBT - 1 OM; and 4) Dieldrin, FRBT - 1 OM (table 4). The maximum estimated risk level for a single COC identified in the DA-G2 phase III tissue samples was 10^{-3} for PCB.

Quality control problems associated with analyses of DA-G2 tissue samples included: 1) recovery of the tribromophenol surrogates below the QCL in the menhaden viscera sample; 2) recovery of the decachlorobiphenyl surrogate below the QCL in the eel sample; and 3) recovery of the decachlorobiphenyl surrogate below the QCL in the blank associated with the menhaden, striped bass, and crab sample.

Woodbridge Research Facility WRF-G1.

The WRF-G1 site sampled through phase III encompassed an area of the Potomac River bounded by a 70 yd arch with its focal point at the base of the old landfill designated as site #1 under the facility's IRP project (Appendix A). The site boundary was extended around, into the adjacent woods and field, to encompass the entire old landfill site (Appendix A). The terrestrial portion of the WRF-G1 site was included due to the presence of PCBs in the phase II samples and a general lack of knowledge as to the source of the PCBs. Surface soil samples were collected from the site in an attempt to identify and bracket the PCB source. Of the 39 COC, 31 were identified in phase II and phase III samples from WRF-G1 (figure 5).

Effluent/water risk estimates.

Of the two COC identified in the phase II WRF-G1 sample (figure 5) one (PCB) exceeded the VHHO by 5 OM, the FHHO by 6 OM, the VALC by 3 OM, and the FALC by 3 OM (table 4). The maximum estimated risk level for a single COC identified in the WRF-G1 phase II sample was 10^{-0} for PCB.

Quality control problems associated with analyses of WRF-G1 water/effluent samples included: 1) recovery of the 1,1-binaphthyl and perinapthenone surrogates below the QCL.

Sediment risk estimates.

Of the 24 COC identified in the phase III WRF-G1 sediment samples (figure 5), three exceeded the NERL. The compounds and OM of the exceedences were: 1) Chlordane - 1 OM; 2) Dieldrin - 1 OM; and 3) Endrin - 2 OM (table 4). Risk from sediment contamination at WRF-G1 may be inferable from the tissue risk estimates as nine of the COC in the WRF-G1 sediments were identified in WRF-G1 tissue samples (figure 5).

Quality control problems associated with analyses of WRF-G1 sediment samples included: 1) recovery of the perinapthenone and tribromophenol surrogates above the QCL in the duplicate blank; and 2) recovery of the tribromophenol surrogate above the QCL.

Tissue risk estimates.

Of the nine COC identified in the phase III WRF-G1 tissue samples (figure 5), four exceeded the VTSV and/or the FRBT. The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) PCB, VTSV - 2 OM, FRBT - 4 OM; 2) Chlordane, FRBT - 1 OM; 3) Total DDE, FRBT - 2 OM; and 4) Dieldrin, FRBT - 1 OM (table 4). The maximum estimated risk level for a single COC

identified in the WRF-G1 phase III tissue samples was 10^{-2} for PCB.

Quality Control problems associated with analyses of WRF-G1 tissue samples included: 1) recovery of the perinapthenone and tribromophenol surrogates below the QCL in the blank; 2) recovery of the perinapthenone surrogate above the QCL in the white perch sample; 3) recovery of the tribromophenol surrogate below the QCL in the catfish sample; 3) greater than 100% recovery (106%) of PCB in the matrix spike; and 4) detection of PCBs in the matrix blank.

Soil risk estimates.

Of the 23 COC identified in the phase III WRF-G1 soil samples (figure 5), two exceeded the FRBT. The compounds, and OM of the exceedences were: 1) PCB - 1 OM; and 2) Benzo[a]pyrene - 0 OM (table 4). The maximum estimated risk level for a single COC identified in the WRF-G1 phase III soil samples was 10^{-5} for PCB.

Quality Control problems associated with analyses of WRF-G1 soil samples included: 1) recovery of the 1,1-binaphthyl surrogate above the QCL; 2) recovery of the 1,1-binaphthyl surrogate below the QCL in the blank; 3) recovery of the perinapthenone surrogate below the QCL; 4) recovery of the perinapthenone surrogate above the QCL in the duplicate blank; 5) recovery of the tribromophenol surrogate below the QCL; 6) recovery of the decachlorobiphenyl below the QCL; and 7) recovery of the decachlorbiphenyl above the QCL; 8) detection of Lindane, Dieldrin, Endrin, and PCB in the matrix blank.

Woodbridge Research Facility WRF-G2.

The WRF-G2 site sampled through phase III encompassed approximately 0.25 miles of the upper section of an unnamed tributary receiving a point source discharge from the main compound of the Woodbridge Research Facility (Appendix A). Of the 39 COC, nine were identified in phase II and phase III samples from WRF-G2 (figure 6).

Effluent/water risk estimates.

The single COC identified in the phase II WRF-G2 sample, PCB, (figure 6) exceeded the VHHO by 4 OM, the FHHO by 5 OM, the VALC by 2 OM, and the FALC by 2 OM (table 4). The maximum estimated risk level for the PCB identified in the WRF-G2 phase II sample was 10^{-1} . No quality control problems were associated with analyses of WRF-G2 Phase II samples.

Sediment risk estimates.

Of the eight COC identified in the phase III WRF-G2 sediment samples (figure 6), one (PCB) exceeded the NERL by 4 OM and the NERM by 3 OM (table 4). Quality control problems associated with analyses of WRF-G2 sediment samples included: 1) recovery of the 1,1-binaphthyl below the QCL; 2) detection of Lindane, Dieldrin, Endrin, and PCB in the matrix blank.

Tissue risk estimates.

Attempts to collect tissue samples at WRF-G2 were unsuccessful.

Distribution of bioconcentratable compounds in the DEQ Piedmont Region of Virginia's CZM area.

Of the 276 compounds identified in all CZM BI study samples (table 2), four were identified in CZM BI study samples from the DEQ Piedmont Region (PR) of the Virginia CZM area (table 2). Of the 39 compounds identified as COC in the CZM BI study, two were identified in samples collected in the PR (table 2). Both COC were identified in phase II samples from Chesapeake Corporation (table 3).

The concentration of Phthalic acid, di-(2-ethylhexyl) ester in the Chesapeake Corporation phase II sample exceeded the VHHO by 1 OM and the FHHO by 2 OM (table 4). The maximum estimated risk level for the exceedence was 10^{-4}.

No quality control or quality assurance problems were associated with analyses of CC-G1 phase II samples. As described above, none of the PR sites sampled under phase II of the CZM BI study were sampled under phase III.

Distribution of bioconcentratable compounds in the DEQ Tidewater Region of Virginia's CZM area.

Of the 276 compounds identified in all CZM BI study samples, 161 were identified in CZM BI study samples from the DEQ Tidewater Region (TR) of the Virginia CZM Area (table 2). Of the 39 compounds identified as COC in the CZM BI study, 27 were identified in samples collected in the TR (figure 7).

Effluent/water.

Only one COC (PCB), had a frequency of occurrence in the TR phase II samples greater than one (table 2). PCBs were identified in

six samples (table 2). The remaining three compounds identified in the TR phase II samples consisted of a mixture of halogenated compounds and PAHs (figure 7).

The percentage of COC identified in TR Phase II samples (15%) was below the overall CZM area percentage. These data indicate few facilities in the TR currently release COC. However, data indicate current releases in the TR are a potential exposure pathway for human health and environmental risk. Of the four COC identified in Phase II samples, two were also identified in tissues samples (figure 7). The compounds, by decreasing frequency of occurrence in tissue samples were: 1) PCBs; and 2) Lindane (table 2).

Sediment.

The 11 COC with the highest frequency of occurrence in the TR sediment samples were, by decreasing frequency: 1) Fluoranthene; 2) Pyrene; 3) PCB; 4) Benzo[b]fluoranthene; 5) Chrysene; 6) DDE; 7) Benz[a]anthracene; 8) DDT; 9) Phenanthrene; 10) DDD; and 11) Chlordane (table 2). Remaining COC in sediment samples had a frequency $\leq$ 10 and were comprised of both halogenated compounds and PAHs (figure 7). The number of COC (22) identified in TR sediment samples was over five times the number of COC identified in TR Phase II samples (4) and over two times the number of COC identified in tissue samples (9) (table 2). These numbers indicate TR sediments represent a substantial source of bioconcentratable compounds in the TR CZM Area of Virginia and that substantial amounts of COC in the TR CZM Area are attributable to historical and/or episodic releases. Tissue data (table 2) suggest bioaccumulation uptake from this source has created an exposure pathway for risk effects. Of the nine COC identified in TR tissue samples, six were identified in TR sediment samples (Figure 7). The six compounds, by decreasing frequency of occurrence were: 1) DDE; 2) PCB; 3) DDD; 4) Chlordane; 5) DDT; 6) Dieldrin (table 2).

Tissue.

Lindane, and Phthalic acid, diethyl ester were identified in TR tissue samples in addition to the six COC reported above (figure 7). Sediments appeared to be the dominant source of tissue COC. Of the nine COC identified in the TR tissue samples, none were exclusively identified in TR phase II samples (figure 7).

Tidewater Region site specific risk assessments.

Risk assessment comments presented for NR site specific risk assessments are also applicable to TR site specific risk assessments.

Study sites in the TR of Virginia's CZM Area which were sampled through phase III were: 1) Allied Colloids; 2) Boykins Narrow Fabrics Corp.; 3) Driver Naval Transmitting Facility; 4) HRSD - Nansemond STP; 5) New Church Energy Associates; and 6) Yorktown Naval Weapons Station. Sites 3 and 6 are Federal Facilities, both of which are in the Remedial Investigation phase of their respective IRP projects. Site 3 has been designated for base closure. Sites 1, 2, and 5 are a chemical plant, a narrow fabrics plant, and a petroleum product manufacturing plant respectively. Site 4 is a regional sewage treatment plant.

Allied Colloids.

The Allied Colloids site sampled through phase III (ACL-G1) encompassed an unnamed tributary of the Nansemond River from the Allied Colloids 001 discharge to the confluence with the Nansemond River (Appendix A). Of the 39 COC, 12 were identified in phase II and phase III samples from ACL-G1 (Figure 8).

Effluent/water risk estimates.

No COC were identified in the phase II ACL-G1 samples (table 3), despite recoveries of the 1,1-biphenyl and perinapthenone surrogates above the QCL.

Sediment risk estimates.

Of the 12 COC identified in the ACL-G1 sediment samples (figure 8), four exceeded the NERL and two exceeded the NERM (table 4). The compounds, screening value exceeded, and OM of the exceedences were: 1) Chlordane, NERL - 2 OM, NERM - 1 OM; 2) DDD, NERL - 0 OM; 3) DDE, NERL - 0 OM; 4) DDT NERL - 0 OM, NERM - 0 OM. Risk from sediment contamination at ACL-G1 may be inferable from the tissue risk estimates as four of the COC in the ACL-G1 sediments were identified in DA-G2 tissue samples (figure 8).

Quality control problems associated with analyses of ACL-G1 sediment samples included: 1) recovery of the perinapthenone surrogate below the QCL in the blank; 2) recovery of the tribromophenol surrogate above the QCL; 3) recovery of the tribromophenol surrogate below the QCL; 4) recovery of the decachlorobiphenyl surrogate above the QCL; and 5) detection of Lindane, Dieldrin, Endrin, and PCB in the blank.

Tissue risk estimates.

Of the four COC identified in the phase III ACL-G1 tissue samples (figure 8), one (PCB) exceeded the FRBT by 2 OM (table 4). The maximum estimated risk level for the PCB identified in the ACL-G1

phase III tissue samples was 10^{-4}.

Quality control problems associated with analyses of ACL-G1 tissue samples included: 1) recovery of the perinapthenone and tribromophenol surrogates below the QCL in the minnows, crayfish, and clams blank.

Boykins Narrow Fabrics.

The Boykins Narrow Fabrics site sampled through phase III (BNF-G1) encompassed an unnamed tributary to Tarrara Creek from the Boykins Narrow Fabrics 001 discharge to the confluence with Tarrara Creek, and Tarrara Creek at the Rt. 35 bridge (approximately one mile below the unnamed tributary confluence) (Appendix A). Of the 39 COC, nine were identified in phase III samples from BNF-G1 (figure 9).

Effluent/water risk estimates.

No COC were identified in the phase II BNF-G1 samples (figure 9). No quality control problems were associated with the phase II sediment and tissue samples from BNF-G1.

Sediment risk estimates.

A background sediment sample was collected immediately above the confluence of the unnamed tributary with Tarrara Creek (BNF-G2, BNF3) to identify sediment contaminants with upstream sources. The BNF3 sediment sample contained one COC, DDD. The sample DDD concentration did not exceed any sediment evaluation criteria (table 4). Quality control problems associated with the BNF3 sediment sample included: 1) recovery of the perinapthenone and tribromophenol surrogates below the QCL.

Of the eight COC identified in the phase III BNF-G1 sediment samples (figure 9), three exceeded the NERL. The compounds and OM of the exceedences were: 1) DDE - 0 OM; 2) Dieldrin - 2 OM; and 3) PCB - 1 OM (table 4). Risk from sediment contamination at BNF -G1 may be inferable from the tissue risk estimates as three of the COC in the BNF-G1 sediments were identified in BNF-G1 tissue samples (figure 9).

Quality control problems associated with analyses of BNF-G1 sediment samples included: 1) recovery of the perinapthenone and tribromophenol surrogates below the QCL in the blank; and 2) recovery of the tribromophenol surrogate below the QCL; 3) greater than 100% recovery of semi-volatile matrix spikes; and 4) detection of PCB in the blank.

Tissue risk estimates.

Efforts to collect tissue samples in the unnamed tributary were generally unsuccessful with the exception of a couple of crayfish collected immediately below the 001 discharge. Therefore, most tissue data for BNF-G1 reflects tissue contamination levels at the confluence of the unnamed tributary and Tarrara Creek, and in Tarrara Creek at the Rt. 35 bridge.

Of the four COC identified in the phase III BNF-G1 tissue samples (figure 9), two exceeded the FRBT (table 4). The compounds and OM of the exceedences were: 1) Total DDT - 1 OM; and 2) PCB - 1 OM. The maximum estimated risk level for a single COC identified in the BNF-G1 phase III tissue samples was 10^{-5} for DDT and PCB.

Quality Control problems associated with analyses of BNF-G1 tissue samples included: 1) recovery of the 1,1-binapthyl surrogate below the QCL in the BNF5 sunfish sample; 2) recovery of the perinapthenone surrogate above the QCL in the BNF5 eel sample; 3) recovery of the perinapthenone surrogate below the QCL in the BNF5 sunfish sample; 4) recovery of the tribromophenol surrogate below the QCL for the BNF4 and BNF5 samples; 5) recovery of the tribromophenol surrogate below the QCL for the BNF4 bowfin and BNF5 pirate perch and catfish samples; 6) recovery of the tribromophenol surrogate above the QCL for the BNF4 crayfish sample; and 7) recovery of the decachlorobiphenyl surrogate below the QCL for the BNF5 pirate perch sample.

Driver Naval Transmitting Facility.

The Driver site sampled through phase III (DRI-G1) encompassed an unnamed tributary to Star Creek from the Driver IRP PCB site to the confluence of the unnamed tributary and Star Creek (Appendix A). Of the 39 COC, 12 were identified in phase II and phase III samples from DRI-G1 (figure 10).

Effluent/water risk estimates.

The phase II sample collected from the DRI-G1 site was an effluent sample from a PCB treatment plant which was on site to treat water drained from removed marsh sediments which were contaminated with PCBs. Only one COC, PCB, was identified in the phase II DRI-G1 sample (figure 10). The sample PCB concentration exceeded the VHHO by 5 OM, the FHHO by 6 OM, the VALC by 3 OM, and the FALC by 3 OM (table 4). The maximum estimated risk level for the PCB identified in the DRI-G1 phase II sample was 10^{-0}.

Quality control problems associated with analyses of DRI-G1 phase II samples included: 1) less than 100% recovery of semi-volatile matrix spikes.

Sediment risk estimates.

Of the 11 COC identified in the phase III DRI-G1 sediment samples (figure 10), one (PCB) exceeded the NERL by 2 OM and the NERM by 1 OM (table 4). Risk from sediment contamination at BNF -G1 may be inferable from the tissue risk estimates as one of the COC in the DRI-G1 sediments was identified in BNF-G1 tissue samples (figure 10).

Quality control problems associated with analyses of DRI-G1 sediment samples included: 1) recovery of the 1,1-binapthyl surrogate above the QCL in DRI6; 2) recovery of the perinapthenone surrogate below the QCL in the blank; 3) recovery of the perinapthenone surrogate below the QCL in DRI5 and DRI7; 4) recovery of the tribromophenol surrogate below the QCL in the blank; 5) recovery of the tribromophenol surrogate above the QCL in DRI1; 6) recovery of the tribromophenol surrogate below the QCL in DRI5, 7, 8A, 8B; 7) recovery of the decachlorobiphenyl surrogate below the QCl in DRI8B; 8) detection of PCBs in the DRI5 blank.

Tissue risk estimates.

Of the two COC identified in the phase III DRI-G1 tissue samples (figure 10), only PCB exceeded tissue assessment criteria. Tissue sample PCB concentration at DRI-G1 exceeded the VTSV by 3 OM, the Food and Drug Administration's Action Level (FDA 1988) by 1 OM, and the FRBT by 5 OM (table 4). The maximum estimated risk level for the PCB identified in the DRI-G1 phase II sample was 10^{-1}.

Quality Control problems associated with analyses of DRI-G1 tissue samples included: 1) recovery of the perinapthenone surrogate above the QCL in the DRI5 minnow sample; and 2) recovery of the decachlorobiphenyl surrogate below the QCL in the DRI5 and DRI8 blanks;

HRSD Nansemond-STP.

The HRSD Nansemond-STP site sampled through phase III (HN-G1) encompassed an area surrounding the Nansemond-STP 001 outfall in Virginia's Hampton Roads (Appendix A). Of the 39 COC, 18 were identified in phase II and phase III samples from HN-G1 (figure 11).

Effluent/water risk estimates.

Of the two COC identified in the phase II HN-G1 sample (figure

11), one (BHC, alpha-) exceeded the FHHO by 0 OM and one (Lindane) exceeded the VALC by 0 OM (table 4). The maximum estimated risk level for a single COC identified in the WRF-G1 phase II sample was 10^{-6} for both BHC, alpha- and Lindane.

Quality Control problems associated with analyses of HN-G1 phase II samples included: 1) BHC, alpha- and Lindane sample concentrations were estimated; 2) recovery of the perinapthenone surrogate below the QCL; 3) greater than 100% recovery of the DDT matrix spike; 4) less than 77% recovery of the semi-volatile matrix spike; and 5) non-confirmation of the BHC, alpha- and Lindane identifications in the quality assurance split.

Sediment risk estimates.

Of the 12 COC identified in the phase III HN1-G1 sediment samples (figure 11), one (PCB) exceeded the NERL by 0 OM (table 4). Risk from sediment contamination at HN-G1 may be inferable from the tissue risk estimates as PCBs were identified in HN-G1 tissue samples (figure 11).

Quality control problems associated with analyses of HN-G1 sediment samples included: 1) recovery of the 1,1-binapthyl surrogate below the QCL in the HN5 blank; 2) recovery of the tribromophenol surrogate below the QCL in the HN2-3 and HN4 blank; 3) recovery of the tribromophenol surrogate below the QCL in HN4; 4) recovery of the decachlorobiphenyl surrogate below the QCL in HN4 and HN6; 5) greater than 100% recovery of the PCB matrix spike in HN1; 6) detection of Lindane, Dieldrin, Endrin, and PCB in the HN5 blank; 7) detection of Dieldrin and Endrin in the HN6 blank; and 8) detection of PCB in the HN1 blank.

Tissue risk estimates.

Of the five COC identified in the phase III HN-G1 tissue samples (figure 11), four exceeded tissue assessment criteria (table 4). The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) Chlordane, FRBT - 0 OM; 2) Total DDT, FRBT - 1 OM; 3) Dieldrin, FRBT - 1 OM; 4) PCB, VTSV - 0 OM, FRBT - 0 OM. The maximum estimated risk level for a single COC identified in the HN-G1 phase III tissue samples was 10^{-5} for total DDT and Dieldrin.

Quality Control problems associated with analyses of HN-G1 tissue samples included: 1) recovery of the tribromophenol surrogate above the QCL in the HN7 crab sample; 2) recovery of the tribromphenol surrogate below the QCL in the HN7 oyster toad sample; 3) recovery of the decachlorobiphenyl surrogate above the QCL in the HN7 crab sample; 4) recovery of the decachlorobiphenyl surrogate below the QCL in the HN7 crab sample blank; 5) recovery of the decachlorobiphenyl surrogate below the QCL in the HN7 eel,

shellfish, and oyster toad blank, and the HN1 shellfish blank.

New Church Energy Associates.

The New Church Energy site sampled through phase III (NCE-G1) encompassed two areas of an unnamed tributary to Pitt's Creek. The furthest upstream area sampled was related to a storm water discharge from NCE-G1. The second area was approximately 0.75 miles downstream of the New Church Energy 001 discharge to the unnamed tributary (Appendix A). Of the 39 COC, 13 were identified in phase II and phase III samples from NCE-G1 (figure 12).

Effluent/water risk estimates.

The single COC identified in the phase II NCE-G1 sample, PCB, (figure 12) exceeded the VHHO by 3 OM, the FHHO by 4 OM, the VALC by 1 OM, and the FALC by 1 OM (table 4). The maximum estimated risk level for the PCB identified in the NCE-G1 phase II sample was 10^{-2}. PCBs were also found in the NCE-G1 tissue samples. Quality Control problems associated with analyses of NCE-G1 phase II samples included: 1) recovery of the decachlorobiphenyl surrogate below the QCL.

Sediment risk estimates.

Of the eight COC identified in the phase III NCE-G1 sediment samples (figure 12), two exceeded the NERL (table 4). The compounds and OM of the exceedences were: 1) DDE, 0 OM; 2) DDT, 0 OM. Risk from sediment contamination at NCE-G1 may be inferable from the tissue risk estimates as DDE was identified in NCE-G1 tissue samples (figure 12).

Quality control problems associated with analyses of NCE-G1 sediment samples included: 1) recovery of the 1,1-binapthyl surrogate below the QCL in the NCE301 blank; and 2) detection of Lindane, Dieldrin, Endrin, and PCB in the NCE301 blank.

Tissue risk estimates.

Of the six COC identified in the phase III NCE-G1 tissue samples (figure 12), three exceeded tissue assessment criteria (table 4). The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) Chlordane, FRBT - 0 OM; 2) DDE, FRBT -1 OM; 3) PCB, VTSV - 0 OM, FRBT - 2 OM. The maximum estimated risk level for a single COC identified in the NCE-G1 phase III tissue samples was 10^{-4} for PCB.

Quality Control problems associated with analyses of NCE-G1 tissue samples included: 1) recovery of the perinapthenone surrogate below the QCL in the NCE3 sunfish blank and NCE4 sunfish blank; 2) recovery of the decachlorobiphenyl surrogate above the QCL in the NCE3 sunfish blank and NCE4 sunfish blank; and 3) detection of Dieldrin and Endrin in the NCE3 and NCE4 sunfish blanks.

Yorktown Naval Weapons Station.

The NWS-G1 site sampled through phase III (NWS-G1) encompassed the two unnamed tributaries to Roosevelt Pond. Phase II samples were collected near the head of the two tributaries. Phase III samples were collected along the length of the two tributaries (Appendix A). Of the 39 COC, 18 were identified in phase II and phase III samples from NWS-G1 (figure 13).

Effluent/water risk estimates.

No COC were identified in the phase II NWS-G1 samples (NWS06, NWS07) (figure 13). Quality Control problems associated with analyses of NWS-G1 phase II samples included: 1) recovery of the 1,1-binapthyl surrogate above the QCL.

Sediment risk estimates.

Of the 17 COC identified in the phase III NWS-G1 sediment samples (figure 13), four exceeded sediment assessment values (table 4). The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) Chlordane, NERL - 1 OM, NERM - 0 OM; 2) DDD, NERL - 1 OM; 3) DDT, NERL - 1 OM, NERM - 1 OM; and 4) PCB, NERL - 1 OM. Risk from sediment contamination at NWS-G1 may be inferable from the tissue risk estimates as Chlordane, DDT (DDD, DDE), and PCBs were identified in NWS-G1 tissue samples (figure 13).

Quality control problems associated with analyses of NWS-G1 sediment samples included: 1) recovery of the 1,1-binapthyl surrogate below the QCL in blanks and NWS06C; and 2) detection of Lindane, Dieldrin, Endrin, and PCB in blanks.

Tissue risk estimates.

Of the six COC identified in the phase III NWS-G1 tissue samples (figure 13), three exceeded tissue assessment criteria (table 4). The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) Chlordane, FRBT - 0 OM; 2) Total DDT, FRBT - 1 OM; 3) PCB, VTSV - 0 OM, FRBT - 2 OM. The maximum estimated risk level for a single COC identified in the NWS-G1 phase III

tissue samples was 10^{-4} for PCB.

Quality Control problems associated with analyses of NWS-G1 tissue samples included: 1) recovery of the perinapthenone surrogate below the QCL in the NWS06 sunfish blank and NWS07 amphibian blank; 2) recovery of the perinapthenone surrogate above the QCL in the NWS07 amphibian sample; 3) recovery of the tribromophenol surrogate below the QCL in the NWS06 sunfish blank, NWS07 amphibian blank, and NWS07 amphibian sample; and 4) greater than 100% recovery of semi-volatile matrix spikes in the NWS06 amphibian sample.

Figure 2. Matrix specific occurrences of compounds of concern at all 1992 Coastal Zone Management - Bioaccumulation Initiative study sites. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

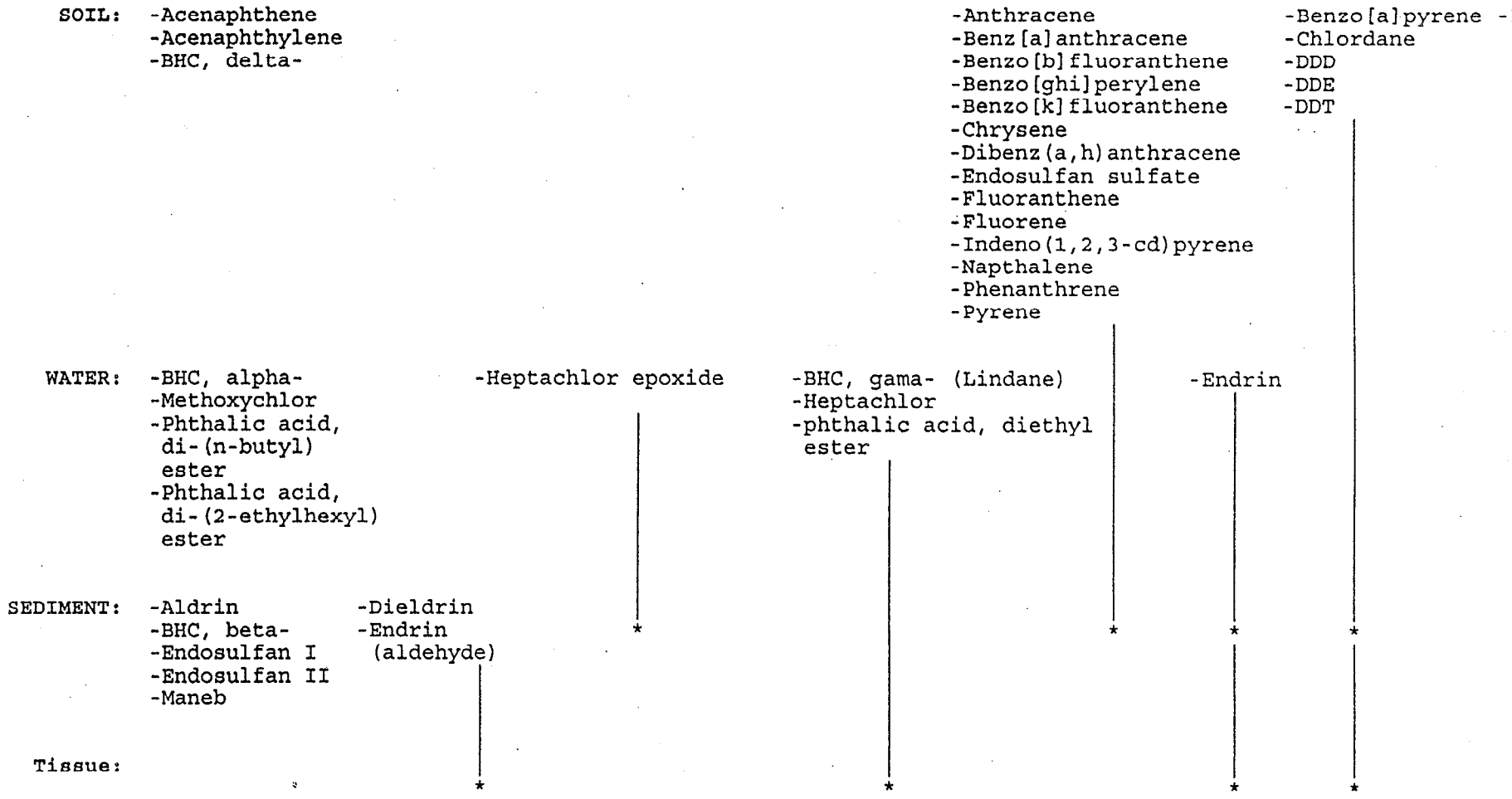


Figure 3. Matrix specific occurrences of compounds of concern at 1992 Bioaccumulation Initiative study sites in the Virginia Department of Environmental Quality's Northern Region of Virginia's Coastal Zone Management Area. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

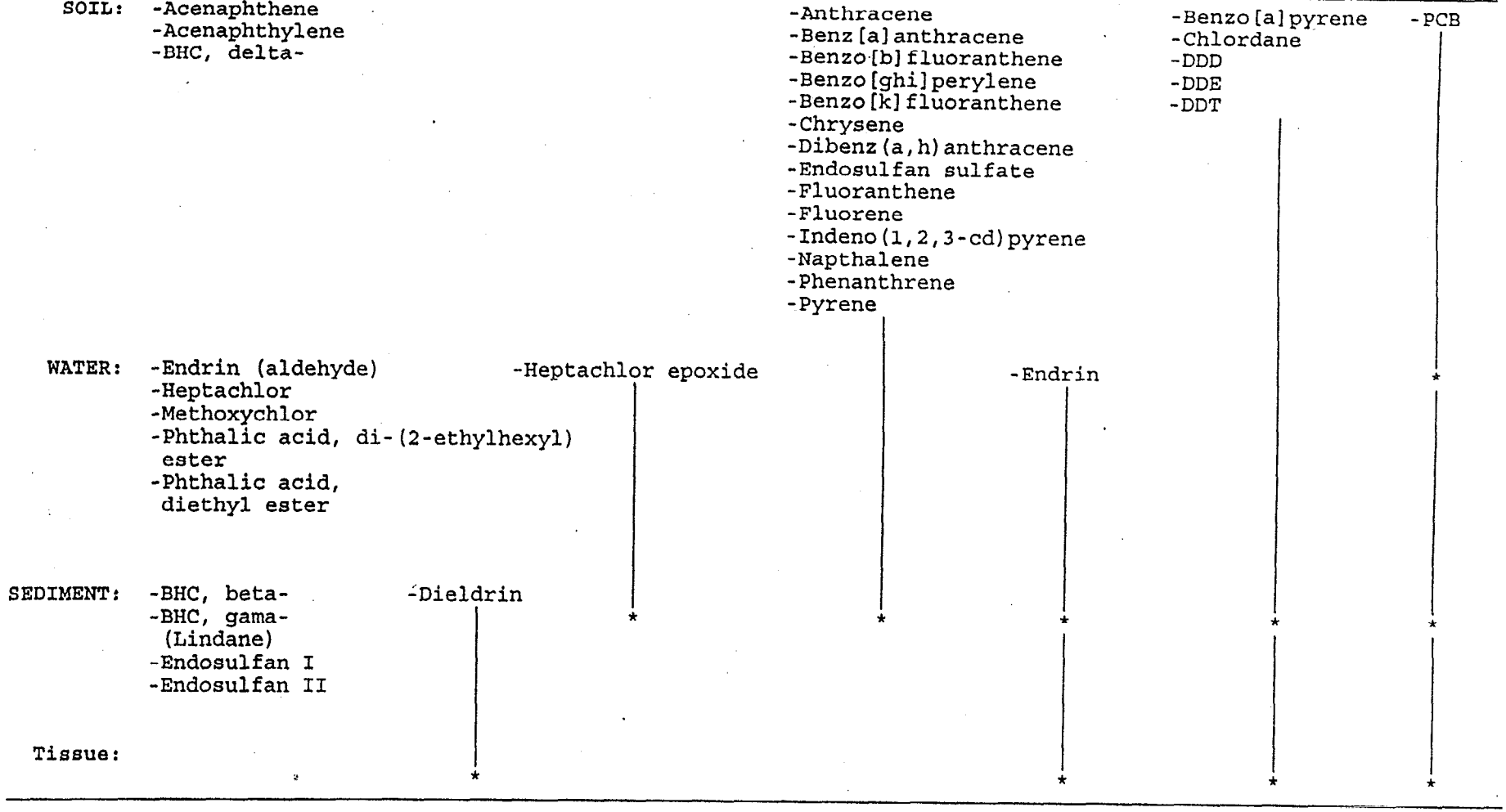


Figure 4. Matrix specific occurrences of compounds of concern at the Dahlgren DA-G2 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

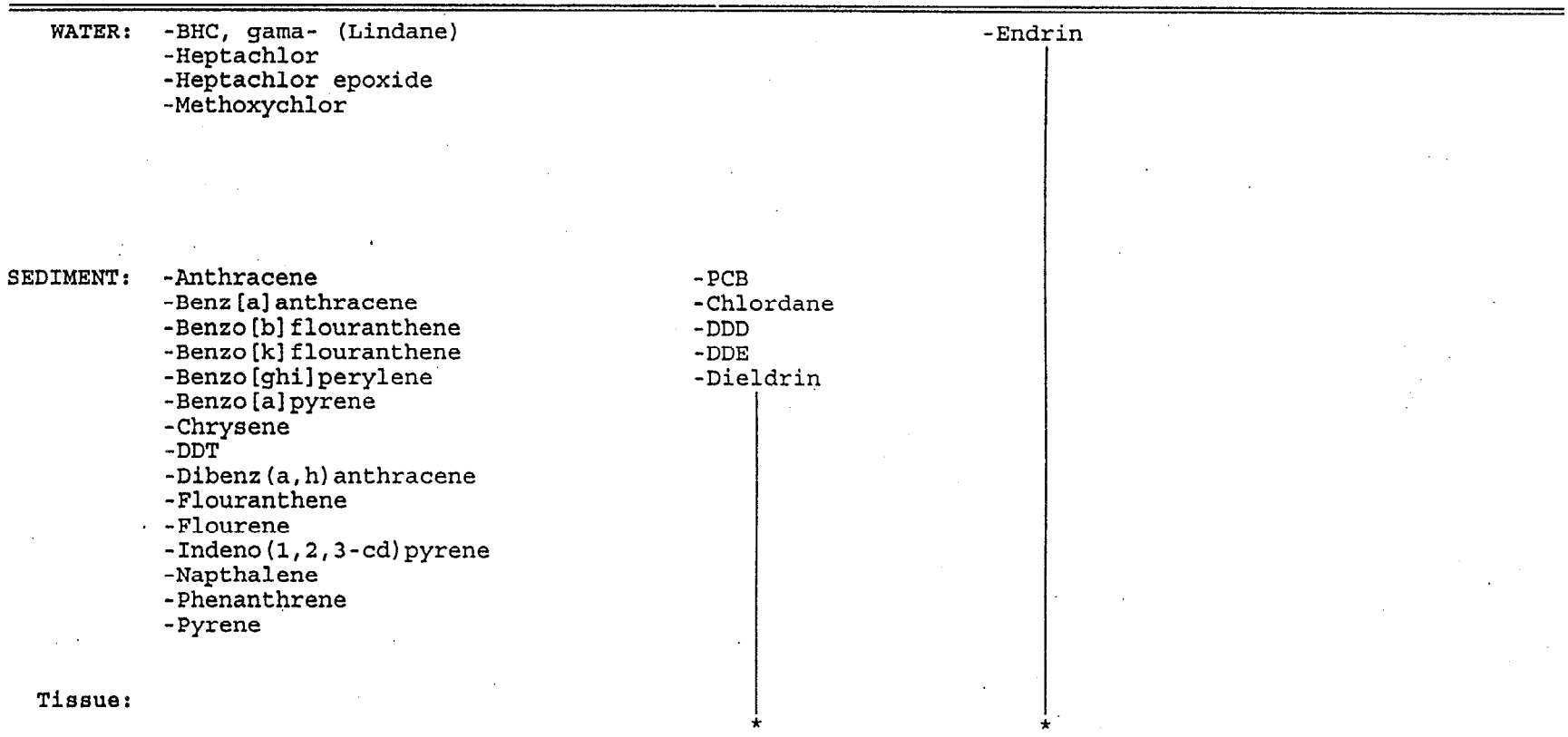


Figure 5. Matrix specific occurrences of compounds of concern at the Woodbridge Research Facility WRF-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

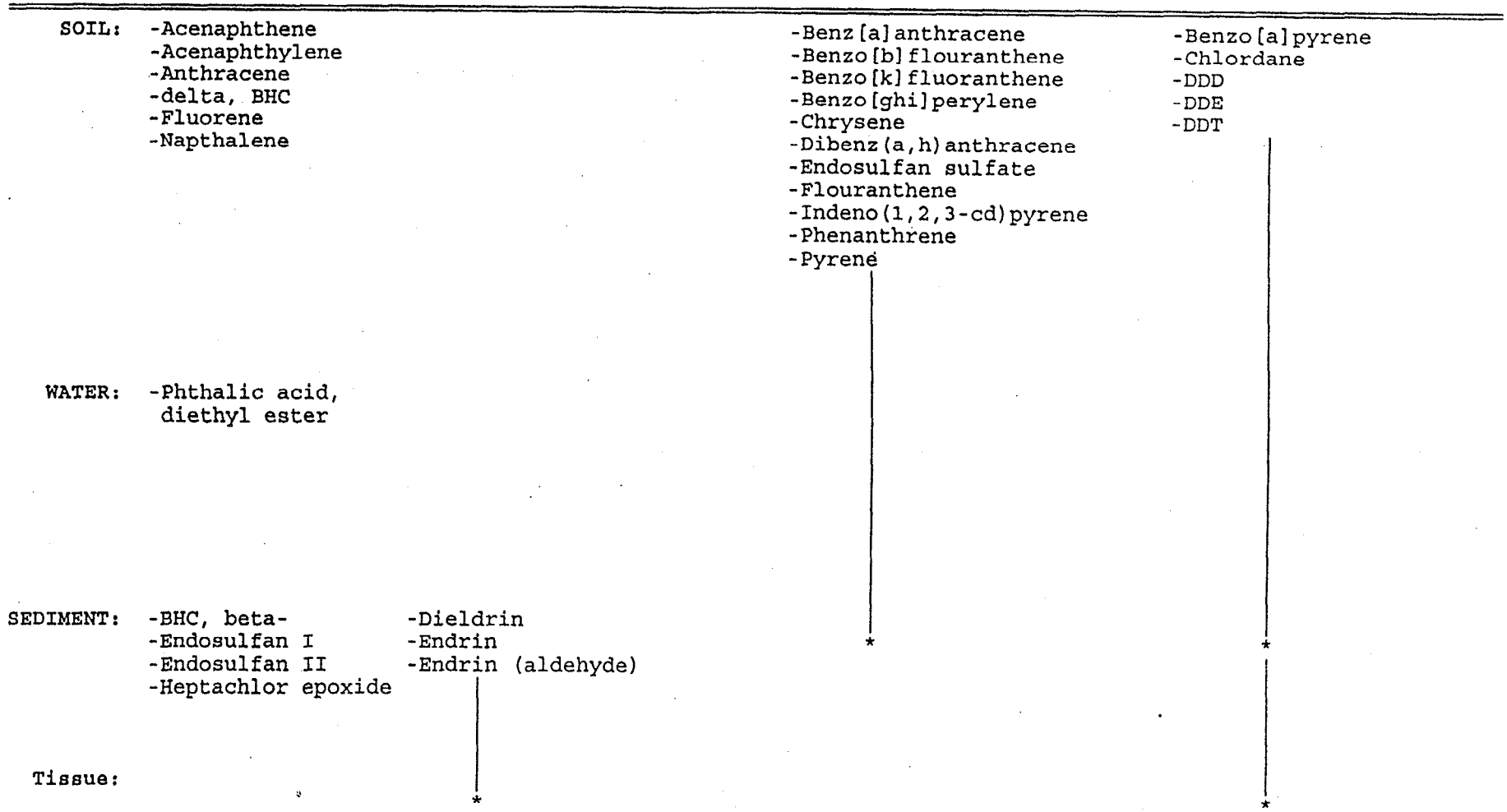


Figure 6. Matrix specific occurrences of compounds of concern at the Woodbridge Research Facility WRF-G2 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

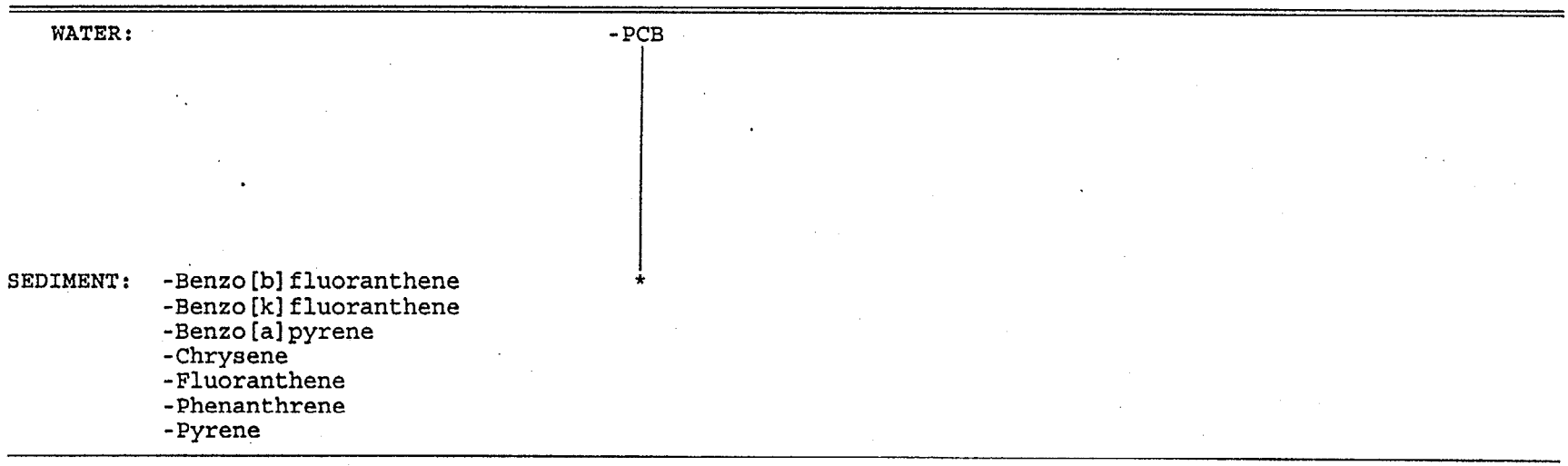


Figure 7. Matrix specific occurrences of compounds of concern at 1992 Bioaccumulation Initiative study sites in the Virginia Department of Environmental Quality's Tidewater Region of Virginia's Coastal Zone Management Area. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

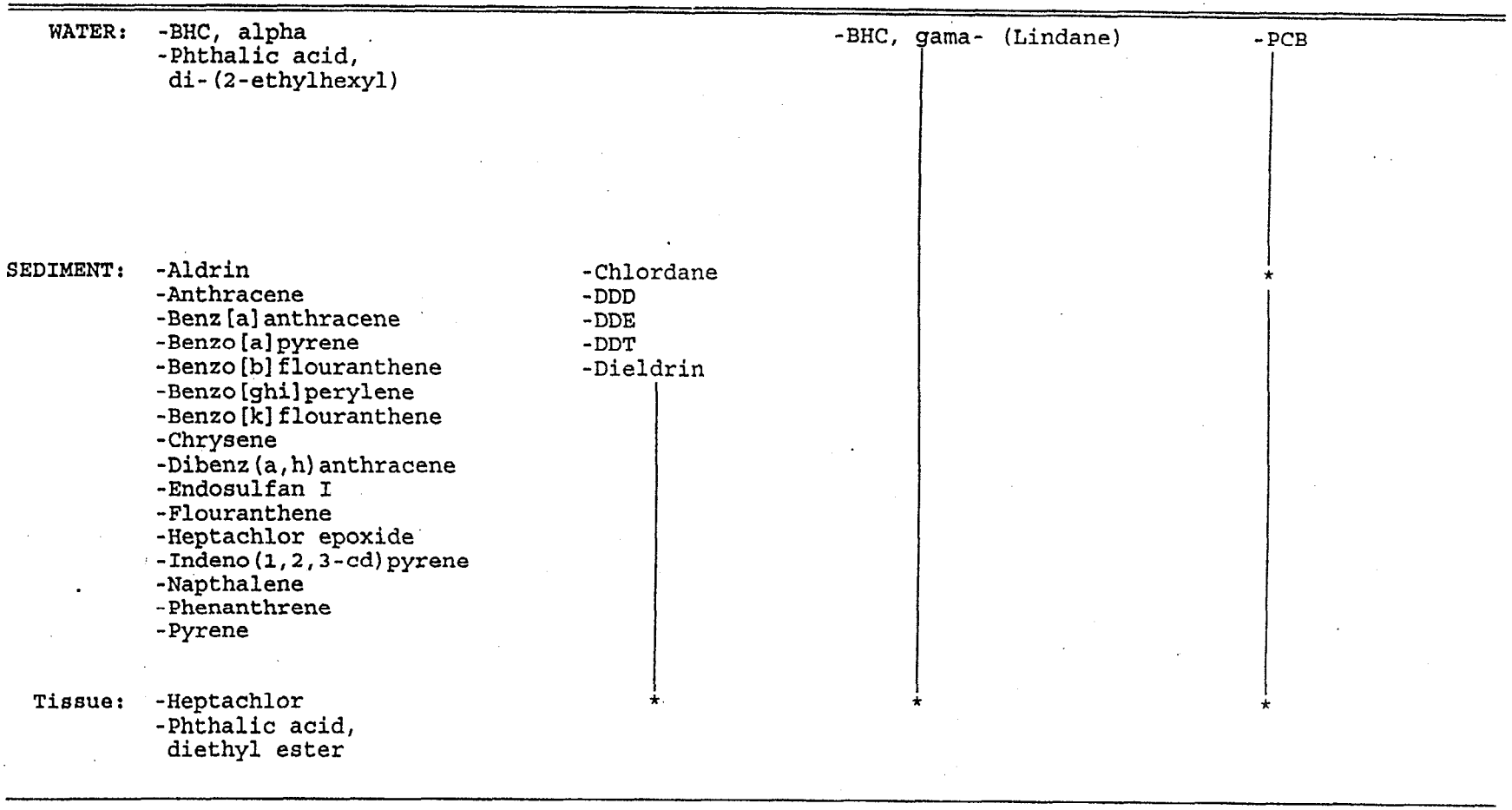


Figure 8. Matrix specific occurrences of compounds of concern at the Allied Colloids ACL-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

SEDIMENT:	-Aldrin	-PCB
	-Benzo[b]flouranthene	-DDD
	-Chlordane	-DDE
	-Dieldrin	-DDT
	-Endosulfan I	|
	-Flouranthene	|
	-Heptachlor epoxide	|
	-Pyrene	|
TISSUE:		*

Figure 9. Matrix specific occurrences of compounds of concern at the Boykins Narrow Fabrics Corp. BNF-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

SEDIMENT:	-Benzo[b]flouranthene	-DDD
	-Chrysene	-DDE
	-Dieldrin	-PCB
	-Flouranthene	|
	-Pyrene	|
		|
TISSUE:	-DDT	*

Figure 10. Matrix specific occurrences of compounds of concern at the Driver DRI-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

WATER:		-PCB
SEDIMENT:	-Benz[a]anthracene	*
	-Benzo[b]flouranthene	
	-Benzo[k]flouranthene	
	-Benzo[ghi]perylene	
	-Benzo[a]pyrene	
	-Chrysene	
	-Flouranthene	
	-Indeno(1,2,3-cd)pyrene	
	-Phenanthrene	
	-Pyrene	
TISSUE:	-DDE	*

Figure 11. Matrix specific occurrences of compounds of concern at the HRSD - Nansemond STP HN-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

WATER:	-BHC, alpha	
	-BHC, gamma (Lindane)	
SEDIMENT:	-Anthracene	-PCB
	-Benz[a]anthracene	|
	-Benzo[k]flouranthene	|
	-Benzo[ghi]perylene	|
	-Benzo[a]pyrene	|
	-Chrysene	|
	-Flouranthene	|
	-Indeno(1,2,3-cd)pyrene	|
	-Maneb	|
	-Phenanthrene	|
	-Pyrene	|
TISSUE:	-Chlordane	*
	-DDD	
	-DDE	
	-Dieldrin	

Figure 12. Matrix specific occurrences of compounds of concern at the New Church Energy NCE-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

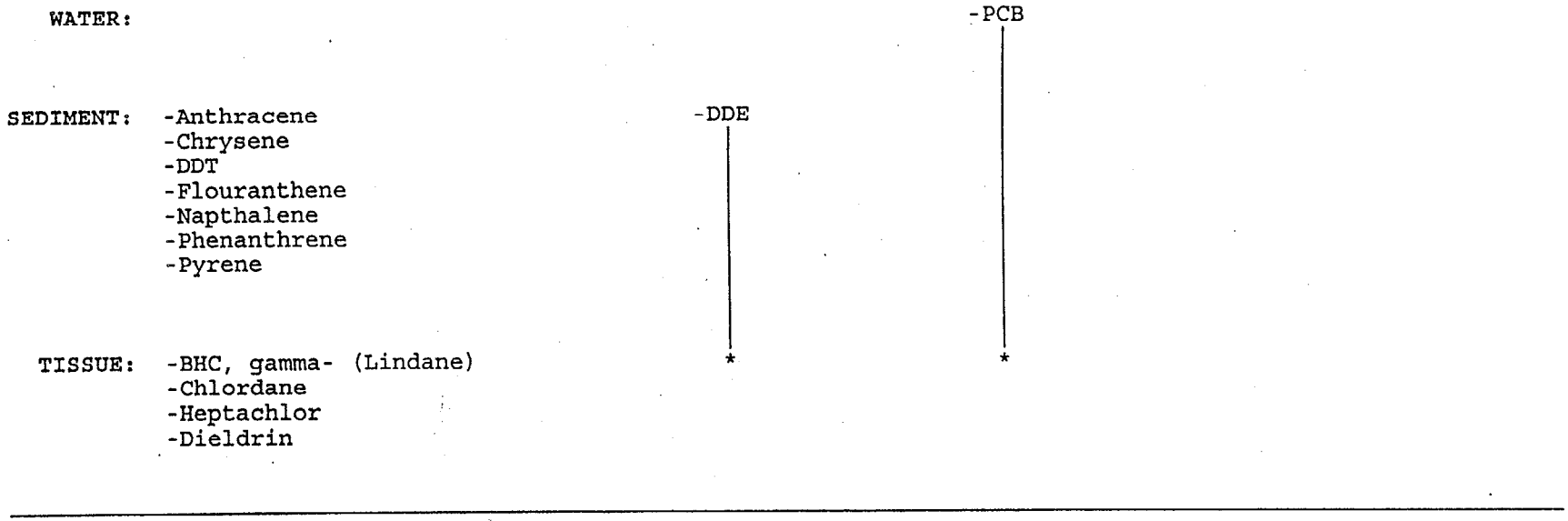


Figure 13. Matrix specific occurrences of compounds of concern at the Yorktown Naval Weapons Station NWS-G1 Coastal Zone Management - Bioaccumulation Initiative study site. Compound occurrences are reported for specific matrix, matrix couplet, triplet, or quadruplet associations only. Matrix specific occurrences are denoted by compound name or *.

SEDIMENT:	-Anthracene	-PCB
	-Benz[a]anthracene	-Chlordane
	-Benzo[b]flouranthene	-DDD
	-Benzo[k]flouranthene	-DDE
	-Benzo[ghi]perylene	-DDT
	-Benzo[a]pyrene	|
	-Chrysene	|
	-Dibenz(a,h)anthracene	|
	-Flouranthene	|
	-Indeno(1,2,3-cd)pyrene	|
	-Phenanthrene	|
	-Pyrene	|
TISSUE:	-Phthalic acid, diethyl ester	*

Table 2. Frequency of occurrence, as number of observations, of compounds detected in effluent, water, sediment, tissue, and soil under the 1993 Virginia Department of Environmental Quality's study of bioconcentratable compounds in the Coastal Zone Management Area of Virginia.

All sites sampled

CAS	Compound name[1]	Number of observations[2]			
		Wat	Sed	Tis	Sol
83-32-9	p *Acenaphthene	0	0	0	1
208-96-8	p *Acenaphthylene	0	0	0	1
877-95-2	Acetamide, N-(2-phenylethyl)-	0	0	1	0
98-86-2	Acetophenone (1-phenylethanone)	0	1	0	0
123-79-5	Adipic acid, dioctyl ester	0	1	0	0
4337-65-9	Adipic acid, (2-ethylhexyl) ester	0	1	3	0
	Alcohol, C7	2	0	0	0
309-00-2	vpc *Aldrin	0	1	0	0
	Aliphatic hydrocarbon, C9	1	0	0	0
	Aliphatic hydrocarbon, C10	1	0	0	0
	Aliphatic hydrocarbon, C10-C15	4	0	0	0
	Aliphatic hydrocarbon, C15-C20	2	0	0	0
29812-79-1	Amine, O-decylhydroxyl-	0	4	0	0
3091-35-8	Androstane-3,17-dione, bis-(O-methyloxime)-	0	0	2	0
120-12-7	vp *Anthracene	0	7	0	2
55133-89-6	Anthracene, 9-butyltetradecahydro-	0	1	0	0
55255-70-4	Anthracene, 9-cyclohexyltetradecahydro-	0	1	0	0
27765-96-4	Anthracene, 1,4-dihydro-1,4-etheno-	0	1	0	0
55401-75-7	Anthracene, 9-dodecyltetradecahydro-	0	2	0	0
613-12-7	Anthracene, 2-methyl-	0	2	0	0
84-65-1	Anthracenedione, 9,10- (Anthraquinone)	0	0	0	1
81-64-1	Anthracenedione, 1,4-dihydroxy-9,10-	0	1	0	0
12674-11-2	vpc *Aroclor 1016 (PCB-1016)	0	5	2	0
11104-28-2	vpc *Aroclor 1221 (PCB-1221)	1	0	0	0
11097-69-1	vpc *Aroclor 1254 (PCB-1254)	0	11	1	0
11096-82-5	vpc *Aroclor 1260 (PCB-1260)	3	30	44	5
	Aromatic hydrocarbon	1	0	0	0
3691-12-1	Azulene, octahydro-1,4-dimethyl-7-(1-methylethenyl)-	0	4	0	0
90-60-8	Benzaldehyde, 3,5-dichloro-2-hydroxy-	0	2	0	0
90-02-8	Benzaldehyde, 2-hydroxy-	0	1	0	0
123-08-0	Benzaldehyde, 4-hydroxy-	0	2	0	0
121-33-5	Benzaldehyde, 4-hydroxy-3-methoxy-	0	5	0	0
3376-32-7	Benzaldehyde, o-methyloxime-	0	1	0	0
56-55-3	vp *Benz[a]anthracene	0	29	0	2
57-97-6	Benz[a]anthracene, 7,12-dimethyl-	0	2	0	0
2498-76-2	Benz[a]anthracene, 2-methyl-	0	1	0	0
2381-31-9	Benz[a]anthracene, 8-methyl-	0	0	1	0
82-05-3	Benz[de]anthracen-7-one, 7H-	0	0	0	1
612-64-6	Benzenamine, N-ethyl-N-nitroso-	2	1	0	0

[1] V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

All sites sampled

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
2524-67-6		Benzenamine, 4-(4-morpholinyl)-	0	0	1	0
74672-05-2		Benzene, 1-(1,3-dimethyl-3-butenyl)-4-methoxy-	0	5	0	0
611-15-4		Benzene, 1-ethenyl-2-methyl	1	0	0	0
74810-75-6		Benzene, 3-ethenyl-5,5-dimethylhexyl-	0	0	1	0
3299-05-6		Benzene, 1-ethoxyethyl-	0	1	0	0
768-00-3		Benzene, (1-methyl-1-propenyl)-	1	0	0	0
42524-30-1		Benzene, 3-methyl-4-pentenyl-	0	1	0	0
2719-62-2		Benzene, 1-pentylheptyl-	0	1	0	0
527-53-7		Benzene, 1,2,3,5-tetramethyl-	1	0	0	0
95-63-6		Benzene, 1,2,4-trimethyl-	1	0	0	0
108-67-8		Benzene, 1,3,5-trimethyl-	2	0	0	0
41182-85-8		Benzenecarboximidoyl bromide, N-methyl-	1	0	0	0
39563-50-3		Benzenediamine, N-(1-methylheptyl)-1,4-	0	1	0	0
2-96-60-8		Benzenediol, 4-ethyl-1,3-	1	0	0	0
13398-94-2		Benzeneethanol, 3-hydroxy-	0	0	2	0
319-84-6	pc	*Benzenehexachloride, alpha- (alpha-BHC; alpha-hexachlorocyclohexane)	1	0	0	0
319-85-7	pc	*Benzenehexachloride, beta- (beta-BHC; beta-hexachlorocyclohexane)	0	1	0	0
319-86-8	p	*Benzenehexachloride, delta- (delta-BHC; delta-hexachlorocyclohexane)	0	0	0	1
58-89-9	vpc	*Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane;	2	0	1	0
6639-57-2		Benzenethiazolecarboxaldehyde, 2-	0	1	0	0
2622-67-5		Benzimidazole, 1,2-diphenyl-1H-	0	0	1	0
4173-59-5		Benzoate, 2-phenoxyethanol-	0	0	0	1
19195-17-6		Benzo[c]cinnoline, 2-ethoxy-	0	1	0	0
94-58-6		Benzodioxole, 5-propyl-1,3-	0	0	1	0
205-99-2	vp	*Benzo[b]fluoranthene (benz[e]acephenanthrylene)	0	38	0	3
205-82-3		Benzo[j]fluoranthene	0	11	0	2
207-08-9	vp	*Benzo[k]fluoranthene	0	19	0	2
238-84-6		Benzo[a]fluorene	0	3	0	1
243-17-4		Benzo[b]fluorene	0	1	0	0
14039-91-2		Benzofurandione, 4-(p-hydroxybenzyl)-6-methoxy-2,3-	0	0	1	0
65-85-0		Benzoic acid	0	0	0	1
191-24-2	p	*Benzo[ghi]perylene	0	7	0	2
195-19-7		Benzo[c]phenanthrene	0	0	0	2
24126-93-0		Benzopyran-4-one, 3-(3,4-dimethoxyphenyl)-6,7-dimethoxy-4H-1-	0	1	0	0
50-32-8	vp	*Benzo[a]pyrene	0	21	1	2
57652-66-1		Benzo[a]pyrene, 4,5-dihydro-	0	0	1	0
192-97-2		Benzo[e]pyrene	0	1	0	1
934-34-9		Benzothiazol-2-one, 3H-	0	1	0	0
215-58-7		Benzo[b]triphenylene	0	1	0	0
40458-77-3		Bicyclo[3.2.1]oct-6-en-3-one, 8-oxa-	0	1	0	0
13049-35-9		Biphenyl, 2,2'-diethyl-	0	4	0	0
507-45-9		Butane, 2,3-dichloro-2-methyl-	0	0	0	3

[1] V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

All sites sampled

CAS	Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
122-57-6	But-3-en-2-one, 4-phenyl-	0	0	2	0
105-60-2	Caprolactam	1	0	0	0
	Carbon, total organic	0	67	0	8
5103-71-9	vpc *Chlordane, alpha- (cis-chlordane)	0	13	29	0
5103-74-2	vpc *Chlordane, gamma- (trans-chlordane)	0	12	12	1
	Chlorinated hydrocarbon	2	0	0	0
	vpc *Chlorobiphenyl, poly-	6	0	0	0
40071-70-3	Cholestane, (5-alpha, 14-beta)	0	1	0	0
218-01-9	vp *Chrysene	0	35	0	2
3351-31-3	Chrysene, 3-methyl-	0	2	0	1
470-82-6	Cineole, 1,8-	0	1	0	0
98-82-8	Cumene ((1-methylethyl)-benzene)	1	0	0	0
53327-11-0	Cyanobenzoic acid, 4-, 3-methoxyphenyl ester	0	0	1	0
53327-12-1	Cyanobenzoic acid, 4-, 4-methoxyphenyl ester	0	0	2	0
55044-32-1	Cyclohexane, 1-1'-(oxydi-2,1-ethanediyl)bis[4-methyl-	0	1	0	0
2181-22-8	Cyclohexanedione, 2,2'-methylenebis[5,5-dimethyl-1,3-	0	1	0	0
13828-37-0	Cyclohexanemethanol, cis-4-(1-methylethyl)-	0	0	1	0
13491-79-7	Cyclohexanol, 2-(1,1-dimethylethyl)-	0	4	0	2
540-97-6	Cyclohexasiloxane, dodecamethyl-	1	0	0	0
13898-73-2	Cyclohexene, 1-methyl-5-(1-methylethenyl)-	0	0	1	0
5256-65-5	Cyclohexene, 3-methyl-6-(1-methylethyl)-	0	0	1	0
6376-92-7	Cyclopentanone, 2-(1-methylpropyl)-	1	0	0	0
203-64-5	Cyclopenta[def]phenanthrene, 4H-	0	2	0	2
541-02-6	Cyclopentasiloxane, decamethyl-	1	0	0	0
17384-72-4	Cyclopent[a]indene, 3,8-dihydro-1,2,3,3,8,8-hexamethyl-	0	0	1	0
72-54-8	vpc *DDD, 4,4'- (p,p'-DDD)	0	27	36	4
3424-82-6	v *DDE, 2,4'- (o,p'-DDE)	0	0	1	0
72-55-9	vpc *DDE, 4,4'- (p,p'-DDE)	0	33	46	2
50-29-3	vpc *DDT, 4,4'- (p,p'-DDT)	0	27	18	3
	vpc *DDD/DDE/DDT (calculated total)	0	37	50	5
25152-84-5	Deca-2,4-dienal, (E,E)-	0	0	18	0
62237-99-4	Decane, 2,2,7-trimethyl-	1	0	0	0
334-48-5	Decanoic acid	0	4	0	0
5746-58-7	Decanoic acid, 12-methyltetra-	0	1	0	0
21078-65-9	Decanol, 2-ethyl-	0	14	0	0
7320-37-8	Decyloxirane, tetra-	0	0	0	1
53-70-3	vp *Dibenz(a,h)anthracene	0	3	0	1
60-57-1	vpc *Dieldrin	0	9	6	0
	Diketone, C10-C15-	0	1	0	0
57633-63-3	Dioxaborolane, 2,4-dimethyl-1,3,2-	1	0	1	0
74793-11-6	Dioxolane, 2-cyclohexyl-4,5-dimethyl-1,3-	0	0	1	0
935-45-5	Dioxolane, 2-ethyl-2-isobutyl-1,3-	0	0	1	0

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[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

All sites sampled

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
4362-18-9		Dioxolane, 2-methyl-2-(phenylmethyl)-1,3-	0	0	1	0
21662-16-8		Dodecadienal, (E,E)-2,4-	0	0	1	0
1120-16-7		Dodecanamide	0	1	2	0
3891-98-3		Dodecane, 2,6,10-trimethyl-	1	0	0	0
143-07-7		Dodecanoic acid	0	2	0	0
120-40-1		Dodecylamine, N,N-di-(2-hydroxyethyl)-	0	1	0	0
959-98-8	vp	*Endosulfan I (alpha-endosulfan)	0	3	0	0
33213-65-9	vp	*Endosulfan II (beta-endosulfan)	0	1	0	0
1031-07-8	vp	*Endosulfan sulfate	0	2	0	1
72-20-8	vp	*Endrin	1	3	10	0
7421-93-4	p	*Endrin aldehyde	0	1	3	0
		Ester, C8	2	0	0	0
10224-91-6		Ethane, 1,1-bis(p-ethylphenyl)-	0	2	0	0
93-56-1		Ethanediol, 1-phenyl-1,2-	0	0	1	0
69078-80-4		Ethanethioic acid, S-(2-methylethyl) ester	0	0	1	0
124-17-4		Ethanol, 2-(2-butoxyethoxy)-, acetate	0	0	0	1
60-12-8		Ethanol, 2-phenyl-	0	0	2	0
551-93-9		Ethanone, 1-(2-aminophenyl)-	0	1	0	0
99-03-6		Ethanone, 1-(3-aminophenyl)-	0	0	1	0
206-44-0	vp	*Fluoranthene	0	48	0	5
86-73-7	vp	*Fluorene	0	2	0	2
17108-52-0		Furan, 2,3-dihydro-2,5-dimethyl-	0	1	0	0
3777-69-3		Furan, 2-pentyl-	0	1	0	0
2407-43-4		Furanone, 5-ethyl-2(5H)-	0	0	1	0
51262-24-9		Gona-1,3,5,7,9-pentaen-17-one, 13-ethyl-3-hydroxy-	0	1	0	0
76-44-8	vpc	*Heptachlor	1	0	1	0
1024-57-3	vpc	*Heptachlor epoxide	1	2	0	0
54105-67-8		Heptadecane, 2,6-dimethyl-	1	0	0	0
2922-51-2		Heptadecanone	0	1	0	0
59782-31-9		Heptadecylthiophene, 2-	0	1	0	0
4313-03-5		Hepta-2,4-dienal, (E,E)-	0	0	2	0
2432-82-8		Heptanethioic acid, S-methyl ester	0	0	1	0
41654-23-3		Heptenoic acid, 2-, 3-(1-methylethyl)-6-oxo-methyl ester	1	0	0	0
629-80-1		Hexadecanal	0	3	0	0
57-10-3		Hexadecanoic acid	1	0	0	0
38701-07-4		Hexadienoic acid, 2,3-, 2-methyl-4-phenylethyl ester	0	1	0	0
111-49-9		Hexahydro-1H-azepine	0	0	1	0
5932-91-2		Hexanal, 4,4-dimethyl-	0	3	0	0
16747-30-1		Hexane, 2,4,4-trimethyl-	1	0	0	0
103-23-1		Hexanedioic acid, bis(2-ethylhexyl) ester	0	18	0	4
37052-13-4		Imidazol-2-amine, 1H-phenanthro[9,10-D]	0	3	11	0
3034-42-2		Imidazole, 1-methyl-5-nitro-1H-	0	0	3	0

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[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

All sites sampled

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
696-23-1		Imidazole, 2-methyl-4-nitro-1H-	0	0	5	0
616-04-6		Imidazolinedione, 1-methyl-2,4-	0	0	1	0
4912-92-9		Indene, 2,3-dihydro-1,1-dimethyl-1H-	0	1	0	0
193-39-5	vp	*Indeno(1,2,3-cd)pyrene	0	10	0	2
62108-16-1		Indole, 2,3-dihydro-4-methyl-1H-	0	2	0	0
4757-69-1		Indole, 2-methyl-3-phenyl-1H-	0	1	0	0
1761-10-0		Indolizine, 3-methyl-	0	2	0	0
13618-93-4		Indolizine, octahydro-	0	0	1	0
119-38-0		Isolan	0	0	1	0
138-86-3		Limonene	0	33	55	1
		Lipid content, percent	0	0	64	0
12427-38-2		*Maneb	0	1	0	0
72-43-5	v	*Methoxychlor	1	0	0	0
		Moisture content, percent	0	67	64	8
91-20-3	p	*Naphthalene	0	2	0	2
473-13-2		Naphthalene, octahydro-1,4-dimethyl-2-(1-methylethenyl)-	0	1	0	0
612-94-2		Naphthalene, 2-phenyl-	0	2	0	0
2131-41-1		Naphthalene, 1,4,5-trimethyl-	0	1	0	0
118-46-7		Naphthalenol, 8-amino-2-	0	1	5	0
22738-31-4		Naphthalenone, octahydro-1,4a-dimethyl-2(1H)-	0	1	0	0
6831-17-0		Naphthalen-2-one, octahydro-2H-cyclopropa[a]-	0	1	0	0
16587-34-1		Naphtho(2,3-d)thiophene, 4,9-dimethyl-	0	1	0	0
586-96-9		Nitrosobenzene	0	0	1	0
5910-87-2		Nonadienal, (E,E)-2,4-	0	0	3	0
1120-07-6		Nonanamide	2	6	8	0
5129-63-5		Nonanoic acid, 7-methyl-, methyl ester	0	0	0	1
646-13-9		Octadecanoic acid, 2-methylpropyl ester	2	0	0	0
56554-96-2		Octadecenal, 2-	1	0	0	0
56554-91-7		Octadecenal, 12-	0	0	0	1
301-02-0		Octadecenamide, (Z)-9-	1	8	0	1
140-03-4		Octadecenoic acid, [R-(Z)]-12-(acetyloxy)-9-, methyl ester	0	0	3	0
30361-28-5		Octadienal, (E,E)-2,4-	0	0	1	0
16754-48-6		Orthoformic acid, tri-sec-butyl ester	0	0	4	0
15769-89-8		Oxzine, tetrahydro-2-methyl-6-phenyl-2H-1,2-	0	0	1	0
1002-84-2		Pentadecanoic acid	0	4	0	0
502-69-2		Pentadecanone, 6,10,14-trimethyl-2-	0	2	0	0
626-97-1		Pentanamide	0	0	1	0
1119-29-5		Pentanamide, 4-methyl-	0	0	3	0
19398-53-9		Pentane, 2,4-dibromo-	1	0	0	0
74685-46-4		Pentanol, 2-chloro-4-methyl-3-	0	11	0	1
292-46-6		Pentathiepane, 1,2,3,5,6- (Lenthionine)	0	1	0	0
3160-32-5		Penten-3-one, 4-methyl-1-phenyl-1-	0	1	0	0

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2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

All sites sampled

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
85-01-8	p	*Phenanthrene	0	26	0	2
55125-03-6		Phenanthrene, 3,9-bis(1,1-dimethylethyl)-	0	3	0	0
55334-01-5		Phenanthrene, 9-dodecyltetradecahydro-	0	10	0	0
2531-84-2		Phenanthrene, 2-methyl-	0	5	0	2
832-71-3		Phenanthrene, 3-methyl-	0	2	0	1
832-64-4		Phenanthrene, 4-methyl-	0	1	0	0
883-20-5		Phenanthrene, 9-methyl-	0	0	0	2
7396-38-5		Phenanthrene, 2,4,5,7-tetramethyl-	0	1	0	0
24035-50-5		Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1-	0	4	1	0
7715-44-8		Phenanthrenone, decahydro-1,1,4A,7,7-pentamethyl-2(1H)-	0	6	0	0
85-60-9		Phenol, 4,4'-butylidene bis[2-(1,1-dimethyl)-5-methyl-	4	5	0	0
26967-65-7		Phenol, diethyl-	0	1	0	0
5635-50-7		Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-	0	10	1	0
108-39-4		Phenol, 3-methyl- (m-cresol)	0	1	0	0
106-44-5		Phenol, 4-methyl- (p-cresol)	0	3	0	0
128-37-0		Phenol, 4-methyl-2,6-di-(t-butyl)-	0	0	1	0
88-24-4		Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-	0	10	1	0
25154-52-3		Phenol, nonyl-	0	4	0	0
104-40-5		Phenol, 4-nonyl-	0	11	1	1
140-66-9		Phenol, 4-(1,1,3,3-tetramethylbutyl)-	0	14	0	3
54932-78-4		Phenol, 4-(2,2,3,3-tetramethylbutyl)-	0	16	1	1
635-51-8		Phenylbutanedioic acid	0	1	0	0
2613-89-0		Phenylpropanedioic acid	0	0	1	0
117-82-8		Phthalic acid, bis(2-methoxyethyl) ester	0	14	2	0
17851-53-5		Phthalic acid, butyl isobutyl ester	0	8	3	2
84-74-2	p	*Phthalic acid, di-(n-butyl) ester	1	0	0	0
84-66-2	p	*Phthalic acid, diethyl ester	1	0	1	0
117-81-7	vp	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)	3	0	0	0
603-11-2		Phthalic acid, 3-nitro-	0	10	5	0
150-86-7		Phytol	0	7	0	0
675-20-7		Piperidin-2-one	0	0	2	0
30893-20-0		Propanamine, N-methyl-N-nitro-2-	0	0	1	0
74367-33-2		Propanoic acid, 2-methyl-,	0	10	0	3
55759-91-6		Propenal, 3-(2,2,6-trimethyl-7-oxabicyclo[4,1,0]hept-1-yl)-2-	2	0	0	0
23230-88-8		Propene, 3-t-butoxy-2-(isopropoxymethyl)-	0	1	0	1
501-52-0		Propionic acid, 3-phenyl-	0	0	1	0
5386-10-2		Propylate, chloro- (ACN)	0	1	0	0
26325-06-4		Purin-6-yl, N-phenyl-N'-1H-	0	0	1	0
18138-05-1		Pyrazine, 3,5-diethyl-2-methyl-	0	0	1	0
1124-11-4		Pyrazine, tetramethyl-	0	0	1	0
129-00-0	vp	*Pyrene	0	47	0	3
64401-21-4		Pyrene, 1,3-dimethyl-	0	1	0	0

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Table 2 - continued.

All sites sampled

CAS	Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
2381-21-7	Pyrene, 1-methyl-	0	1	0	1
3442-78-2	Pyrene, 2-methyl-	0	1	0	2
3029-19-4	1-Pyrenecarboxaldehyde	0	0	0	1
23003-22-7	Pyridinethione, 3-hydroxy-2(1H)-	0	0	3	0
20189-42-8	Pyrrolidinedione, 3-ethylidene-4-methyl-2,5-	0	1	0	0
872-50-4	Pyrrolidin-2-one, N-methyl-	1	0	0	0
13435-09-1	Silanediamine, 1,1-dimethyl-n-n'-diphenyl-	2	0	0	0
601-58-1	Stigmastane	0	1	0	0
	Sulfur, acid volatile	0	67	0	8
19812-64-7	Tetradecane-1,14-diol	0	2	0	0
544-63-8	Tetradecanoic acid	0	1	0	0
483-77-2	Tetralin, 1,6-dimethyl-4-(2-propyl)-	0	2	0	0
292-45-5	Tetrathiepane, 1,2,4,6-	0	1	0	0
5285-87-0	Thiocyanic acid, phenyl ester	0	1	0	0
23966-59-8	Toluamide, alpha-(1-hydroxycyclohexyl)-o-	0	0	1	0
56666-50-3	Tricyclo[2.2.01,4]heptan-2-one, 6-nitro-	0	1	1	0
638-53-9	Tridecanoic acid	0	1	0	0
6006-01-5	Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-	0	30	59	1
36237-69-1	Tridecatrienoic acid, 4,8,12-trimethyl-3,7,11-, methyl ester	0	0	1	0
217-59-4	Triphenylene; isochrysene; 9,10-benzphenanthrene	0	1	0	0
289-16-7	Trithiolane, 1,2,4-	0	2	0	0
30361-29-6	Undecadienal, (E,E)-2,4-	0	0	1	0
180-43-8	Undecane, spiro[5,5]-	1	0	0	0
112-37-8	Undecanoic acid	0	1	0	0
74630-38-9	Undecene, 5-methyl-1+	2	0	0	0
	Unidentified organic, extractable fraction	2	21	35	0
58-95-7	Vitamin E acetate (VAN)	0	0	1	0
95-47-6	Xylene, o- (1,2-dimethylbenzene, 1,2-dimethyl)	1	0	0	0
	Number compounds detected:[3]	53	158	92	59	All 276

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[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

[3] Aroclors, DDT products, Chlordane isomers counted separately.

Table 2 - continued.

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
83-32-9	p	*Acenaphthene	0	0	0	1
208-96-8	p	*Acenaphthylene	0	0	0	1
877-95-2		Acetamide, N-(2-phenylethyl)-	0	0	1	0
4337-65-9		Adipic acid, (2-ethylhexyl) ester	0	1	3	0
		Alcohol, C7	2	0	0	0
		Aliphatic hydrocarbon, C9	1	0	0	0
		Aliphatic hydrocarbon, C10	1	0	0	0
		Aliphatic hydrocarbon, C10-C15	4	0	0	0
		Aliphatic hydrocarbon, C15-C20	2	0	0	0
120-12-7	vp	*Anthracene	0	3	0	2
55133-89-6		Anthracene, 9-butyltetradecahydro-	0	1	0	0
55255-70-4		Anthracene, 9-cyclohexyltetradecahydro-	0	1	0	0
27765-96-4		Anthracene, 1,4-dihydro-1,4-etheno-	0	1	0	0
55401-75-7		Anthracene, 9-dodecyltetradecahydro-	0	2	0	0
613-12-7		Anthracene, 2-methyl-	0	1	0	0
84-65-1		Anthracenedione, 9,10- (Anthraquinone)	0	0	0	1
12674-11-2	vpc	*Aroclor 1016 (PCB-1016)	0	2	1	0
11097-69-1	vpc	*Aroclor 1254 (PCB-1254)	0	8	1	0
11096-82-5	vpc	*Aroclor 1260 (PCB-1260)	2	12	34	5
		Aromatic hydrocarbon	1	0	0	0
3691-12-1		Azulene, octahydro-1,4-dimethyl-7-(1-methylethenyl)-	0	2	0	0
90-60-8		Benzaldehyde, 3,5-dichloro-2-hydroxy-	0	1	0	0
123-08-0		Benzaldehyde, 4-hydroxy-	0	1	0	0
121-33-5		Benzaldehyde, 4-hydroxy-3-methoxy-	0	2	0	0
56-55-3	vp	*Benz[a]anthracene	0	13	0	2
57-97-6		Benz[a]anthracene, 7,12-dimethyl-	0	1	0	0
2498-76-2		Benz[a]anthracene, 2-methyl-	0	1	0	0
82-05-3		Benz[de]anthracen-7-one, 7H-	0	0	0	1
2524-67-6		Benzenamine, 4-(4-morpholinyl)-	0	0	1	0
74672-05-2		Benzene, 1-(1,3-dimethyl-3-butenyl)-4-methoxy-	0	1	0	0
611-15-4		Benzene, 1-ethenyl-2-methyl	1	0	0	0
74810-75-6		Benzene, 3-ethenyl-5,5-dimethylhexyl-	0	0	1	0
3299-05-6		Benzene, 1-ethoxyethyl-	0	1	0	0
768-00-3		Benzene, (1-methyl-1-propenyl)-	1	0	0	0
2719-62-2		Benzene, 1-pentylheptyl-	0	1	0	0
527-53-7		Benzene, 1,2,3,5-tetramethyl-	1	0	0	0
95-63-6		Benzene, 1,2,4-trimethyl-	1	0	0	0
108-67-8		Benzene, 1,3,5-trimethyl-	2	0	0	0
13398-94-2		Benzeneethanol, 3-hydroxy-	0	0	2	0
319-85-7	pc	*Benzenehexachloride, beta- (beta-BHC; beta-hexachlorocyclohexane)	0	1	0	0
319-86-8	p	*Benzenehexachloride, delta- (delta-BHC; delta-hexachlorocyclohexane)	0	0	0	1
58-89-9	vpc	*Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane;	1	0	0	0

[1] V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
2622-67-5		Benzimidazole, 1,2-diphenyl-1H-	0	0	1	0
4173-59-5		Benzoate, 2-phenoxyethanol-	0	0	0	1
94-58-6		Benzodioxole, 5-propyl-1,3-	0	0	1	0
205-99-2	vp	*Benzo[b]fluoranthene (benz[e]acephenanthrylene)	0	16	0	3
205-82-3		Benzo[j]fluoranthene	0	4	0	2
207-08-9	vp	*Benzo[k]fluoranthene	0	11	0	2
238-84-6		Benzo[a]fluorene	0	3	0	1
243-17-4		Benzo[b]fluorene	0	1	0	0
14039-91-2		Benzofurandione, 4-(p-hydroxybenzyl)-6-methoxy-2,3-	0	0	1	0
65-85-0		Benzoic acid	0	0	0	1
191-24-2	p	*Benzo[ghi]perylene	0	3	0	2
195-19-7		Benzo[c]phenanthrene	0	0	0	2
24126-93-0		Benzopyran-4-one, 3-(3,4-dimethoxyphenyl)-6,7-dimethoxy-4H-1-	0	1	0	0
50-32-8	vp	*Benzo[a]pyrene	0	11	1	2
57652-66-1		Benzo[a]pyrene, 4,5-dihydro-	0	0	1	0
192-97-2		Benzo[e]pyrene	0	0	0	1
934-34-9		Benzothiazol-2-one, 3H-	0	1	0	0
215-58-7		Benzo[b]triphenylene	0	1	0	0
13049-35-9		Biphenyl, 2,2'-diethyl-	0	3	0	0
507-45-9		Butane, 2,3-dichloro-2-methyl-	0	0	0	3
122-57-6		But-3-en-2-one, 4-phenyl-	0	0	2	0
		Carbon, total organic	0	26	0	8
5103-71-9	vpc	*Chlordane, alpha- (cis-chlordane)	0	6	25	0
5103-74-2	vpc	*Chlordane, gamma- (trans-chlordane)	0	5	12	1
	vpc	*Chlorobiphenyl, poly-	2	0	0	0
40071-70-3		Cholestane, (5-alpha, 14-beta)	0	1	0	0
218-01-9	vp	*Chrysene	0	16	0	2
3351-31-3		Chrysene, 3-methyl-	0	2	0	1
98-82-8		Cumene ((1-methylethyl)-benzene)	1	0	0	0
53327-12-1		Cyanobenzoic acid, 4-, 4-methoxyphenyl ester	0	0	2	0
55044-32-1		Cyclohexane, 1-1'-(oxydi-2,1-ethanediyl)bis[4-methyl-	0	1	0	0
2181-22-8		Cyclohexanedione, 2,2'-methylenebis[5,5-dimethyl-1,3-	0	1	0	0
13491-79-7		Cyclohexanol, 2-(1,1-dimethylethyl)-	0	0	0	2
13898-73-2		Cyclohexene, 1-methyl-5-(1-methylethenyl)-	0	0	1	0
5256-65-5		Cyclohexene, 3-methyl-6-(1-methylethyl)-	0	0	1	0
203-64-5		Cyclopenta[def]phenanthrene, 4H-	0	2	0	2
72-54-8	vpc	*DDD, 4,4'- (p,p'-DDD)	0	13	27	4
3424-82-6	v	*DDE, 2,4'- (o,p'-DDE)	0	0	1	0
72-55-9	vpc	*DDE, 4,4'- (p,p'-DDE)	0	15	30	2
50-29-3	vpc	*DDT, 4,4'- (p,p'-DDT)	0	12	14	3
	vpc	*DDD/DDE/DDT (calculated total)	0	16	32	5
25152-84-5		Deca-2,4-dienal, (E,E)-	0	0	10	0

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[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
334-48-5		Decanoic acid	0	2	0	0
7320-37-8		Decyloxirane, tetra-	0	0	0	1
53-70-3	vp	*Dibenz(a,h)anthracene	0	2	0	1
60-57-1	vpc	*Dieldrin	0	7	5	0
21662-16-8		Dodecadienal, (E,E)-2,4-	0	0	1	0
1120-16-7		Dodecanamide	0	0	2	0
120-40-1		Dodecylamine, N,N-di-(2-hydroxyethyl)-	0	1	0	0
959-98-8	vp	*Endosulfan I (alpha-endosulfan)	0	2	0	0
33213-65-9	vp	*Endosulfan II (beta-endosulfan)	0	1	0	0
1031-07-8	vp	*Endosulfan sulfate	0	2	0	1
72-20-8	vp	*Endrin	1	3	10	0
7421-93-4	p	*Endrin aldehyde	0	1	3	0
		Ester, C8	2	0	0	0
69078-80-4		Ethanethioic acid, S-(2-methylethyl) ester	0	0	1	0
124-17-4		Ethanol, 2-(2-butoxyethoxy)-, acetate	0	0	0	1
60-12-8		Ethanol, 2-phenyl-	0	0	2	0
99-03-6		Ethanone, 1-(3-aminophenyl)-	0	0	1	0
206-44-0	vp	*Fluoranthene	0	20	0	5
86-73-7	vp	*Fluorene	0	2	0	2
3777-69-3		Furan, 2-pentyl-	0	1	0	0
51262-24-9		Gona-1,3,5,7,9-pentaen-17-one, 13-ethyl-3-hydroxy-	0	1	0	0
76-44-8	vpc	*Heptachlor	1	0	0	0
1024-57-3	vpc	*Heptachlor epoxide	1	1	0	0
4313-03-5		Hepta-2,4-dienal, (E,E)-	0	0	2	0
2432-82-8		Heptanethioic acid, S-methyl ester	0	0	1	0
111-49-9		Hexahydro-1H-azepine	0	0	1	0
16747-30-1		Hexane, 2,4,4-trimethyl-	1	0	0	0
103-23-1		Hexanedioic acid, bis(2-ethylhexyl) ester	0	8	0	4
37052-13-4		Imidazol-2-amine, 1H-phenanthro[9,10-D]	0	1	7	0
3034-42-2		Imidazole, 1-methyl-5-nitro-1H-	0	0	3	0
696-23-1		Imidazole, 2-methyl-4-nitro-1H-	0	0	3	0
616-04-6		Imidazolinedione, 1-methyl-2,4-	0	0	1	0
193-39-5	vp	*Indeno(1,2,3-cd)pyrene	0	5	0	2
4757-69-1		Indole, 2-methyl-3-phenyl-1H-	0	1	0	0
1761-10-0		Indolizine, 3-methyl-	0	1	0	0
13618-93-4		Indolizine, octahydro-	0	0	1	0
119-38-0		Isolan	0	0	1	0
138-86-3		Limonene	0	12	31	1
		Lipid content, percent	0	0	37	0
72-43-5	v	*Methoxychlor	1	0	0	0
		Moisture content, percent	0	26	37	8
91-20-3	p	*Naphthalene	0	1	0	2

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[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
612-94-2		Naphthalene, 2-phenyl-	0	1	0	0
2131-41-1		Naphthalene, 1,4,5-trimethyl-	0	1	0	0
118-46-7		Naphthalenol, 8-amino-2-	0	1	4	0
586-96-9		Nitrosobenzene	0	0	1	0
5910-87-2		Nonadienal, (E,E)-2,4-	0	0	1	0
1120-07-6		Nonanamide	0	4	7	0
5129-63-5		Nonanoic acid, 7-methyl-, methyl ester	0	0	0	1
56554-91-7		Octadecenal, 12-	0	0	0	1
301-02-0		Octadecenamide, (Z)-9-	0	4	0	1
140-03-4		Octadecenoic acid, [R-(Z)]-12-(acetyloxy)-9-, methyl ester	0	0	3	0
30361-28-5		Octadienal, (E,E)-2,4-	0	0	1	0
16754-48-6		Orthoformic acid, tri-sec-butyl ester	0	0	2	0
626-97-1		Pentanamide	0	0	1	0
1119-29-5		Pentanamide, 4-methyl-	0	0	1	0
19398-53-9		Pentane, 2,4-dibromo-	1	0	0	0
74685-46-4		Pentanol, 2-chloro-4-methyl-3-	0	0	0	1
3160-32-5		Penten-3-one, 4-methyl-1-phenyl-1-	0	1	0	0
85-01-8	p	*Phenanthrene	0	11	0	2
55334-01-5		Phenanthrene, 9-dodecyltetradecahydro-	0	2	0	0
2531-84-2		Phenanthrene, 2-methyl-	0	2	0	2
832-71-3		Phenanthrene, 3-methyl-	0	2	0	1
883-20-5		Phenanthrene, 9-methyl-	0	0	0	2
7396-38-5		Phenanthrene, 2,4,5,7-tetramethyl-	0	1	0	0
24035-50-5		Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1-	0	1	0	0
7715-44-8		Phenanthrenone, decahydro-1,1,4A,7,7-pentamethyl-2(1H)-	0	2	0	0
5635-50-7		Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-	0	1	1	0
106-44-5		Phenol, 4-methyl- (p-cresol)	0	1	0	0
128-37-0		Phenol, 4-methyl-2,6-di-(t-butyl)-	0	0	1	0
88-24-4		Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-	0	7	0	0
25154-52-3		Phenol, nonyl-	0	3	0	0
104-40-5		Phenol, 4-nonyl-	0	5	1	1
140-66-9		Phenol, 4-(1,1,3,3-tetramethylbutyl)-	0	6	0	3
54932-78-4		Phenol, 4-(2,2,3,3-tetramethylbutyl)-	0	8	1	1
635-51-8		Phenylbutanedioic acid	0	1	0	0
2613-89-0		Phenylpropanedioic acid	0	0	1	0
117-82-8		Phthalic acid, bis(2-methoxyethyl) ester	0	5	2	0
17851-53-5		Phthalic acid, butyl isobutyl ester	0	6	2	2
84-66-2	p	*Phthalic acid, diethyl ester	1	0	0	0
117-81-7	vp	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)	1	0	0	0
603-11-2		Phthalic acid, 3-nitro-	0	4	5	0
150-86-7		Phytol	0	5	0	0
30893-20-0		Propanamine, N-methyl-N-nitro-2-	0	0	1	0

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Table 2 - continued.

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol	All
74367-33-2		Propanoic acid, 2-methyl-,	0	2	0	3	
23230-88-8		Propene, 3-t-butoxy-2-(isopropoxymethyl)-	0	0	0	1	
501-52-0		Propionic acid, 3-phenyl-	0	0	1	0	
5386-10-2		Propylate, chloro- (ACN)	0	1	0	0	
26325-06-4		Purin-6-yl, N-phenyl-N'-1H-	0	0	1	0	
18138-05-1		Pyrazine, 3,5-diethyl-2-methyl-	0	0	1	0	
1124-11-4		Pyrazine, tetramethyl-	0	0	1	0	
129-00-0	vp	*Pyrene	0	20	0	3	
64401-21-4		Pyrene, 1,3-dimethyl-	0	1	0	0	
2381-21-7		Pyrene, 1-methyl-	0	1	0	1	
3442-78-2		Pyrene, 2-methyl-	0	1	0	2	
3029-19-4		1-Pyrenecarboxaldehyde	0	0	0	1	
23003-22-7		Pyridinethione, 3-hydroxy-2(1H)-	0	0	3	0	
20189-42-8		Pyrrolidinedione, 3-ethylidene-4-methyl-2,5-	0	1	0	0	
601-58-1		Stigmastane	0	1	0	0	
		Sulfur, acid volatile	0	26	0	8	
483-77-2		Tetralin, 1,6-dimethyl-4-(2-propyl)-	0	2	0	0	
5285-87-0		Thiocyanic acid, phenyl ester	0	1	0	0	
23966-59-8		Toluamide, alpha-(1-hydroxycyclohexyl)-o-	0	0	1	0	
56666-50-3		Tricyclo[2.2.01,4]heptan-2-one, 6-nitro-	0	1	1	0	
6006-01-5		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-	0	11	35	1	
36237-69-1		Tridecatrienoic acid, 4,8,12-trimethyl-3,7,11-, methyl ester	0	0	1	0	
217-59-4		Triphenylene; isochrysene; 9,10-benzphenanthrene	0	1	0	0	
289-16-7		Trithiolane, 1,2,4-	0	1	0	0	
30361-29-6		Undecadienal, (E,E)-2,4-	0	0	1	0	
112-37-8		Undecanoic acid	0	1	0	0	
		Unidentified organic, extractable fraction	0	12	19	0	
58-95-7		Vitamin E acetate (VAN)	0	0	1	0	
95-47-6		Xylene, o- (1,2-dimethylbenzene, 1,2-dimethyl)	1	0	0	0	
		Number compounds detected:[3]	25	108	74	59	200

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3 Aroclors, DDT products, Chlordane isomers counted separately.

Table 2 - continued.

Va. Dept. of Environmental Quality's Piedmont Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol	All
2-96-60-8		Benzenediol, 4-ethyl-1,3-	1	0	0	0	
541-02-6		Cyclopentasiloxane, decamethyl-	1	0	0	0	
84-74-2	p	*Phthalic acid, di-(n-butyl) ester	1	0	0	0	
117-81-7	vp	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)	1	0	0	0	
		Number compounds detected:[3]	4	0	0	0	4

1 V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

3 Aroclors, DDT products, Chlordane isomers counted separately.

Table 2 - continued.

Va. Dept. of Environmental Quality's Tidewater Region

CAS	Compound name[1]	Number of observations[2]			
		Wat	Sed	Tis	Sol
98-86-2	Acetophenone (1-phenylethanone)	0	1	0	0
123-79-5	Adipic acid, dioctyl ester	0	1	0	0
309-00-2	vpc *Aldrin	0	1	0	0
29812-79-1	Amine, O-decylhydroxyl-	0	4	0	0
3091-35-8	Androstane-3,17-dione, bis-(O-methyloxime)-	0	0	2	0
120-12-7	vp *Anthracene	0	4	0	0
613-12-7	Anthracene, 2-methyl-	0	1	0	0
81-64-1	Anthracenedione, 1,4-dihydroxy-9,10-	0	1	0	0
12674-11-2	vpc *Aroclor 1016 (PCB-1016)	0	3	1	0
11104-28-2	vpc *Aroclor 1221 (PCB-1221)	1	0	0	0
11097-69-1	vpc *Aroclor 1254 (PCB-1254)	0	3	0	0
11096-82-5	vpc *Aroclor 1260 (PCB-1260)	1	18	10	0
3691-12-1	Azulene, octahydro-1,4-dimethyl-7-(1-methylethenyl)-	0	2	0	0
90-60-8	Benzaldehyde, 3,5-dichloro-2-hydroxy-	0	1	0	0
90-02-8	Benzaldehyde, 2-hydroxy-	0	1	0	0
123-08-0	Benzaldehyde, 4-hydroxy-	0	1	0	0
121-33-5	Benzaldehyde, 4-hydroxy-3-methoxy-	0	3	0	0
3376-32-7	Benzaldehyde, o-methyloxime-	0	1	0	0
56-55-3	vp *Benz[a]anthracene	0	16	0	0
57-97-6	Benz[a]anthracene, 7,12-dimethyl-	0	1	0	0
2381-31-9	Benz[a]anthracene, 8-methyl-	0	0	1	0
612-64-6	Benzenamine, N-ethyl-N-nitroso-	2	1	0	0
74672-05-2	Benzene, 1-(1,3-dimethyl-3-butenyl)-4-methoxy-	0	4	0	0
42524-30-1	Benzene, 3-methyl-4-pentenyl-	0	1	0	0
41182-85-8	Benzenecarboximidoyl bromide, N-methyl-	1	0	0	0
39563-50-3	Benzenediamine, N-(1-methylheptyl)-1,4-	0	1	0	0
319-84-6	pc *Benzenehexachloride, alpha- (alpha-BHC; alpha-hexachlorocyclohexane)	1	0	0	0
58-89-9	vpc *Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane;	1	0	1	0
6639-57-2	Benzenethiazolecarboxaldehyde, 2-	0	1	0	0
19195-17-6	Benzo[c]cinnoline, 2-ethoxy-	0	1	0	0
205-99-2	vp *Benzo[b]fluoranthene (benz[e]acephenanthrylene)	0	22	0	0
205-82-3	Benzo[j]fluoranthene	0	7	0	0
207-08-9	vp *Benzo[k]fluoranthene	0	8	0	0
191-24-2	p *Benzo[ghi]perylene	0	4	0	0
50-32-8	vp *Benzo[a]pyrene	0	10	0	0
192-97-2	Benzo[e]pyrene	0	1	0	0
40458-77-3	Bicyclo[3.2.1]oct-6-en-3-one, 8-oxa-	0	1	0	0
13049-35-9	Biphenyl, 2,2'-diethyl-	0	1	0	0
105-60-2	Caprolactam	1	0	0	0
	Carbon, total organic	0	41	0	0
5103-71-9	vpc *Chlordane, alpha- (cis-chlordane)	0	7	4	0
5103-74-2	vpc *Chlordane, gamma- (trans-chlordane)	0	7	0	0

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Table 2 - continued.

Va. Dept. of Environmental Quality's Tidewater Region

CAS	Compound name[1]	Number of observations[2]			
		Wat	Sed	Tis	Sol
	Chlorinated hydrocarbon	2	0	0	0
	vpc *Chlorobiphenyl, poly-	4	0	0	0
218-01-9	vp *Chrysene	0	19	0	0
470-82-6	Cineole, 1,8-	0	1	0	0
53327-11-0	Cyanobenzoic acid, 4-, 3-methoxyphenyl ester	0	0	1	0
13828-37-0	Cyclohexanemethanol, cis-4-(1-methylethyl)-	0	0	1	0
13491-79-7	Cyclohexanol, 2-(1,1-dimethylethyl)-	0	4	0	0
540-97-6	Cyclohexasiloxane, dodecamethyl-	1	0	0	0
6376-92-7	Cyclopentanone, 2-(1-methylpropyl)-	1	0	0	0
17384-72-4	Cyclopent[a]indene, 3,8-dihydro-1,2,3,3,8,8-hexamethyl-	0	0	1	0
72-54-8	vpc *DDD, 4,4'- (p,p'-DDD)	0	14	9	0
72-55-9	vpc *DDE, 4,4'- (p,p'-DDE)	0	18	16	0
50-29-3	vpc *DDT, 4,4'- (p,p'-DDT)	0	15	4	0
	vpc *DDD/DDE/DDT (calculated total)	0	21	18	0
25152-84-5	Deca-2,4-dienal, (E,E)-	0	0	8	0
62237-99-4	Decane, 2,2,7-trimethyl-	1	0	0	0
334-48-5	Decanoic acid	0	2	0	0
5746-58-7	Decanoic acid, 12-methyltetra-	0	1	0	0
21078-65-9	Decanol, 2-ethyl-	0	14	0	0
53-70-3	vp *Dibenz(a,h)anthracene	0	1	0	0
60-57-1	vpc *Dieldrin	0	2	1	0
	Diketone, C10-C15-	0	1	0	0
57633-63-3	Dioxaborolane, 2,4-dimethyl-1,3,2-	1	0	1	0
74793-11-6	Dioxolane, 2-cyclohexyl-4,5-dimethyl-1,3-	0	0	1	0
935-45-5	Dioxolane, 2-ethyl-2-isobutyl-1,3-	0	0	1	0
4362-18-9	Dioxolane, 2-methyl-2-(phenylmethyl)-1,3-	0	0	1	0
1120-16-7	Dodecanamide	0	1	0	0
3891-98-3	Dodecane, 2,6,10-trimethyl-	1	0	0	0
143-07-7	Dodecanoic acid	0	2	0	0
959-98-8	vp *Endosulfan I (alpha-endosulfan)	0	1	0	0
10224-91-6	Ethane, 1,1-bis(p-ethylphenyl)-	0	2	0	0
93-56-1	Ethanediol, 1-phenyl-1,2-	0	0	1	0
551-93-9	Ethanone, 1-(2-aminophenyl)-	0	1	0	0
206-44-0	vp *Fluoranthene	0	28	0	0
17108-52-0	Furan, 2,3-dihydro-2,5-dimethyl-	0	1	0	0
2407-43-4	Furanone, 5-ethyl-2(5H)-	0	0	1	0
76-44-8	vpc *Heptachlor	0	0	1	0
1024-57-3	vpc *Heptachlor epoxide	0	1	0	0
54105-67-8	Heptadecane, 2,6-dimethyl-	1	0	0	0
2922-51-2	Heptadecanone	0	1	0	0
59782-31-9	Heptadecylthiophene, 2-	0	1	0	0
41654-23-3	Heptenoic acid, 2-, 3-(1-methylethyl)-6-oxo-methyl ester	1	0	0	0

[1] V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

Va. Dept. of Environmental Quality's Tidewater Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
629-80-1		Hexadecanal	0	3	0	0
57-10-3		Hexadecanoic acid	1	0	0	0
38701-07-4		Hexadienoic acid, 2,3-, 2-methyl-4-phenylethyl ester	0	1	0	0
5932-91-2		Hexanal, 4,4-dimethyl-	0	3	0	0
103-23-1		Hexanedioic acid, bis(2-ethylhexyl) ester	0	10	0	0
37052-13-4		Imidazol-2-amine, 1H-phenanthro[9,10-D]	0	2	4	0
696-23-1		Imidazole, 2-methyl-4-nitro-1H-	0	0	2	0
4912-92-9		Indene, 2,3-dihydro-1,1-dimethyl-1H-	0	1	0	0
193-39-5	vp	*Indeno(1,2,3-cd)pyrene	0	5	0	0
62108-16-1		Indole, 2,3-dihydro-4-methyl-1H-	0	2	0	0
1761-10-0		Indolizine, 3-methyl-	0	1	0	0
138-86-3		Limonene	0	21	24	0
		Lipid content, percent	0	0	27	0
12427-38-2		*Maneb	0	1	0	0
		Moisture content, percent	0	41	27	0
91-20-3	p	*Naphthalene	0	1	0	0
473-13-2		Naphthalene, octahydro-1,4-dimethyl-2-(1-methylethenyl)-	0	1	0	0
612-94-2		Naphthalene, 2-phenyl-	0	1	0	0
118-46-7		Naphthalenol, 8-amino-2-	0	0	1	0
22738-31-4		Naphthalenone, octahydro-1,4a-dimethyl-2(1H)-	0	1	0	0
6831-17-0		Naphthalen-2-one, octahydro-2H-cyclopropa[a]-	0	1	0	0
16587-34-1		Naphtho(2,3-d)thiophene, 4,9-dimethyl-	0	1	0	0
5910-87-2		Nonadienal, (E,E)-2,4-	0	0	2	0
1120-07-6		Nonanamide	2	2	1	0
646-13-9		Octadecanoic acid, 2-methylpropyl ester	2	0	0	0
56554-96-2		Octadecenal, 2-	1	0	0	0
301-02-0		Octadecenamide, (Z)-9-	1	4	0	0
16754-48-6		Orthoformic acid, tri-sec-butyl ester	0	0	2	0
15769-89-8		Oxzine, tetrahydro-2-methyl-6-phenyl-2H-1,2-	0	0	1	0
1002-84-2		Pentadecanoic acid	0	4	0	0
502-69-2		Pentadecanone, 6,10,14-trimethyl-2-	0	2	0	0
1119-29-5		Pentanamide, 4-methyl-	0	0	2	0
74685-46-4		Pentanol, 2-chloro-4-methyl-3-	0	11	0	0
292-46-6		Pentathiepane, 1,2,3,5,6- (Lenthionine)	0	1	0	0
85-01-8	p	*Phenanthrene	0	15	0	0
55125-03-6		Phenanthrene, 3,9-bis(1,1-dimethylethyl)-	0	3	0	0
55334-01-5		Phenanthrene, 9-dodecyltetradecahydro-	0	8	0	0
2531-84-2		Phenanthrene, 2-methyl-	0	3	0	0
832-64-4		Phenanthrene, 4-methyl-	0	1	0	0
24035-50-5		Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1-	0	3	1	0
7715-44-8		Phenanthrenone, decahydro-1,1,4A,7,7-pentamethyl-2(1H)-	0	4	0	0
85-60-9		Phenol, 4,4'-butylidene bis[2-(1,1-dimethyl)-5-methyl-	4	5	0	0

[1] V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

Va. Dept. of Environmental Quality's Tidewater Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
26967-65-7		Phenol, diethyl-	0	1	0	0
5635-50-7		Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-	0	9	0	0
108-39-4		Phenol, 3-methyl- (m-cresol)	0	1	0	0
106-44-5		Phenol, 4-methyl- (p-cresol)	0	2	0	0
88-24-4		Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-	0	3	1	0
25154-52-3		Phenol, nonyl-	0	1	0	0
104-40-5		Phenol, 4-nonyl-	0	6	0	0
140-66-9		Phenol, 4-(1,1,3,3-tetramethylbutyl)-	0	8	0	0
54932-78-4		Phenol, 4-(2,2,3,3-tetramethylbutyl)-	0	8	0	0
117-82-8		Phthalic acid, bis(2-methoxyethyl) ester	0	9	0	0
17851-53-5		Phthalic acid, butyl isobutyl ester	0	2	1	0
84-66-2	p	*Phthalic acid, diethyl ester	0	0	1	0
117-81-7	vp	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)	1	0	0	0
603-11-2		Phthalic acid, 3-nitro-	0	6	0	0
150-86-7		Phytol	0	2	0	0
675-20-7		Piperidin-2-one	0	0	2	0
74367-33-2		Propanoic acid, 2-methyl-,	0	8	0	0
55759-91-6		Propenal, 3-(2,2,6-trimethyl-7-oxabicyclo[4,1,0]hept-1-yl)-2-	2	0	0	0
23230-88-8		Propene, 3-t-butoxy-2-(isopropoxymethyl)-	0	1	0	0
129-00-0	vp	*Pyrene	0	27	0	0
872-50-4		Pyrrolidin-2-one, N-methyl-	1	0	0	0
13435-09-1		Silanediamine, 1,1-dimethyl-n-n'-diphenyl-	2	0	0	0
		Sulfur, acid volatile	0	41	0	0
19812-64-7		Tetradecane-1,14-diol	0	2	0	0
544-63-8		Tetradecanoic acid	0	1	0	0
292-45-5		Tetrathiepane, 1,2,4,6-	0	1	0	0
638-53-9		Tridecanoic acid	0	1	0	0
6006-01-5		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-	0	19	24	0
289-16-7		Trithiolane, 1,2,4-	0	1	0	0
180-43-8		Undecane, spiro[5,5]-	1	0	0	0
74630-38-9		Undecene, 5-methyl-1-	2	0	0	0
		Unidentified organic, extractable fraction	2	9	16	0
						All
		Number compounds detected:[3]	29	113	39	0 161

1 V=Va. water quality standard (Commonwealth of Virginia 1992), p=federal priority contaminant (EPA 1986c), c=federal contaminant of concern (EPA 1991d), *=CZM compound of concern.

2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

3 Aroclors, DDT products, Chlordane isomers counted separately.

Table 3. Compounds detected in water (w, ambient or effluent), sediment (s), tissue (t), and soil (l) samples collected under the 1993 Virginia Department of Environmental Quality's study of bioconcentratable compounds in the Coastal Zone Management area of Virginia. Detections are reported by facility group. Asterisk (*) indicates CZM compound of concern.

Virginia Dept. of Environmental Quality's Northern Region

DAHLGREN NAVAL WEAPONS LAB

DA-G1 Gambo Creek bel IRP Sites 2,9,12,19 and Hideaway Pond

		w	Aliphatic hydrocarbon, C10-C15

DA-G2 STP outfall 001 to Potomac R

	t		Adipic acid, (2-ethylhexyl) ester
		w	Aliphatic hydrocarbon, C10-C15
		w	Aliphatic hydrocarbon, C15-C20
s			*Anthracene
s			Anthracene, 1,4-dihydro-1,4-etheno-
s			Anthracene, 2-methyl-
s	t		*Aroclor 1016 (PCB-1016)
s	t		*Aroclor 1254 (PCB-1254)
s	t		*Aroclor 1260 (PCB-1260)
s			Benzaldehyde, 4-hydroxy-3-methoxy-
s			*Benz[a]anthracene
s			Benzene, 1-ethoxyethyl-
		w	*Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane; Lindane)
s			*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s			Benzo[j]fluoranthene
s			*Benzo[k]fluoranthene
s			Benzo[a]fluorene
s			Benzo[b]fluorene
s			*Benzo[ghi]perylene
s			*Benzo[a]pyrene
s			Benzothiazol-2-one, 3H-
s			Biphenyl, 2,2'-diethyl-
s	t		*Chlordane, alpha- (cis-chlordane)
s	t		*Chlordane, gamma- (trans-chlordane)
s			*Chrysene
s			Chrysene, 3-methyl-
	t		Cyclohexene, 3-methyl-6-(1-methylethyl)-
s			Cyclopenta[def]phenanthrene, 4H-
s	t		*DDD, 4,4'- (p,p'-DDD)
s	t		*DDE, 4,4'- (p,p'-DDE)
s			*DDT, 4,4'- (p,p'-DDT)
	t		Deca-2,4-dienal, (E,E)-
s			*Dibenz(a,h)anthracene
s	t		*Dieldrin
	t	w	*Endrin
	t		Ethanol, 2-phenyl-

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

DAHLGREN NAVAL WEAPONS LAB -- continued

DA-G2 STP outfall 001 to Potomac R -- continued

s			*Fluoranthene
s			*Fluorene
		w	*Heptachlor
		w	*Heptachlor epoxide
	t		Hepta-2,4-dienal, (E,E)-
	t		Hexahydro-1H-azepine
	t		Imidazole, 2-methyl-4-nitro-1H-
s			*Indeno(1,2,3-cd)pyrene
s			Indole, 2-methyl-3-phenyl-1H-
	t		Isolan
s	t		Limonene
		w	*Methoxychlor
s			*Naphthalene
s			Naphthalene, 2-phenyl-
	t		Octadecenoic acid, [R-(Z)]-12-(acetyloxy)-9-, methyl ester
		w	Pentane, 2,4-dibromo-
s			*Phenanthrene
s			Phenanthrene, 3-methyl-
s			Phenol, 4-methyl- (p-cresol)
s			Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-
s			Phenol, nonyl-
s			Phenol, 4-nonyl-
s			Phenol, 4-(1,1,3,3-tetramethylbutyl)-
s			Phenol, 4-(2,2,3,3-tetramethylbutyl)-
s			Phthalic acid, bis(2-methoxyethyl) ester
s			Phthalic acid, butyl isobutyl ester
		w	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)
s	t		Phthalic acid, 3-nitro-
s			Phytol
s			Propylate, chloro- (ACN)
s			*Pyrene
s			Pyrene, 1-methyl-
s	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
s	t		Unidentified organic, extractable fraction

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

QUANTICO MARINE BASE

QM-G1 Outfall 060 and internal sampling point 360

			W	Alcohol, C7
			W	Aliphatic hydrocarbon, C9
			W	Aliphatic hydrocarbon, C10
			W	Benzene, 1-ethenyl-2-methyl
			W	Benzene, (1-methyl-1-propenyl)-
			W	Benzene, 1,2,3,5-tetramethyl-
			W	Benzene, 1,2,4-trimethyl-
			W	Benzene, 1,3,5-trimethyl-
			W	Ester, C8
			W	Hexane, 2,4,4-trimethyl-

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

WOODBRIDGE RESEARCH FACILITY (HARRY DIAMOND LABS)

WRF-G1 Old landfill, IRP Site 1 to Occoquan Bay

			l	*Acenaphthene
			l	*Acenaphthylene
	t			Acetamide, N-(2-phenylethyl)-
s	t			Adipic acid, (2-ethylhexyl) ester
			l	*Anthracene
			l	Anthracenedione, 9,10- (Anthraquinone)
s				*Aroclor 1254 (PCB-1254)
s	t	w	l	*Aroclor 1260 (PCB-1260)
		w		Aromatic hydrocarbon
s				Azulene, octahydro-1,4-dimethyl-7-(1-methylethenyl)-
s				Benzaldehyde, 4-hydroxy-
s			l	*Benz[a]anthracene
s				Benz[a]anthracene, 7,12-dimethyl-
s				Benz[a]anthracene, 2-methyl-
			l	Benz[de]anthracen-7-one, 7H-
	t			Benzenamine, 4-(4-morpholinyl)-
s				Benzene, 1-(1,3-dimethyl-3-butenyl)-4-methoxy-
	t			Benzene, 3-ethenyl-5,5-dimethylhexyl-
s				*Benzenehexachloride, beta- (beta-BHC; beta-hexachlorocyclohexane)
			l	*Benzenehexachloride, delta- (delta-BHC; delta-hexachlorocyclohexane)
	t			Benzimidazole, 1,2-diphenyl-1H-
			l	Benzoate, 2-phenoxyethanol-
s			l	*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s			l	Benzo[j]fluoranthene
s			l	*Benzo[k]fluoranthene
s			l	Benzo[a]fluorene
	t			Benzofurandione, 4-(p-hydroxybenzyl)-6-methoxy-2,3-
			l	Benzoic acid
s			l	*Benzo[ghi]perylene
			l	Benzo[c]phenanthrene
s	t		l	*Benzo[a]pyrene
			l	Benzo[e]pyrene
s				Benzo[b]triphenylene
			l	Butane, 2,3-dichloro-2-methyl-
	t			But-3-en-2-one, 4-phenyl-
s	t			*Chlordane, alpha- (cis-chlordane)
s	t		l	*Chlordane, gamma- (trans-chlordane)
		w		*Chlorobiphenyl, poly-
s			l	*Chrysene
s			l	Chrysene, 3-methyl-
	t			Cyanobenzoic acid, 4-, 4-methoxyphenyl ester
			l	Cyclohexanol, 2-(1,1-dimethylethyl)-
	t			Cyclohexene, 1-methyl-5-(1-methylethenyl)-
s			l	Cyclopenta[def]phenanthrene, 4H-
s	t		l	*DDD, 4,4'- (p,p'-DDD)
s	t		l	*DDE, 4,4'- (p,p'-DDE)
s	t		l	*DDT, 4,4'- (p,p'-DDT)

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

WOODBRIDGE RESEARCH FACILITY (HARRY DIAMOND LABS) -- continued

WRF-G1 Old landfill, IRP Site 1 to Occoquan Bay -- continued

	t		Deca-2,4-dienal, (E,E)-
s			Decanoic acid
		l	Decyloxirane, tetra-
s		l	*Dibenz(a,h)anthracene
s	t		*Dieldrin
	t		Dodecanamide
s			*Endosulfan I (alpha-endosulfan)
s			*Endosulfan II (beta-endosulfan)
s		l	*Endosulfan sulfate
s	t		*Endrin
s	t		*Endrin aldehyde
	t		Ethanethioic acid, S-(2-methylethyl) ester
		l	Ethanol, 2-(2-butoxyethoxy)-, acetate
s		l	*Fluoranthene
		l	*Fluorene
s			*Heptachlor epoxide
	t		Hepta-2,4-dienal, (E,E)-
	t		Heptanethioic acid, S-methyl ester
s		l	Hexanedioic acid, bis(2-ethylhexyl) ester
s	t		Imidazol-2-amine, 1H-phenanthro[9,10-D]
	t		Imidazole, 1-methyl-5-nitro-1H-
	t		Imidazole, 2-methyl-4-nitro-1H-
	t		Imidazolinedione, 1-methyl-2,4-
s		l	*Indeno(1,2,3-cd)pyrene
s	t	l	Limonene
		l	*Naphthalene
	t		Naphthalenol, 8-amino-2-
	t		Nitrosobenzene
s	t		Nonanamide
		l	Nonanoic acid, 7-methyl-, methyl ester
		l	Octadecenal, 12-
s		l	Octadecenamide, (Z)-9-
	t		Octadecenoic acid, [R-(Z)]-12-(acetyloxy)-9-, methyl ester
	t		Orthoformic acid, tri-sec-butyl ester
	t		Pentanamide
	t		Pentanamide, 4-methyl-
		l	Pentanol, 2-chloro-4-methyl-3-
s		l	*Phenanthrene
		l	Phenanthrene, 2-methyl-
		l	Phenanthrene, 3-methyl-
		l	Phenanthrene, 9-methyl-
s			Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-
	t		Phenol, 4-methyl-2,6-di-(t-butyl)-
s		l	Phenol, 4-nonyl-
s		l	Phenol, 4-(1,1,3,3-tetramethylbutyl)-
s		l	Phenol, 4-(2,2,3,3-tetramethylbutyl)-
	t		Phenylpropanedioic acid

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

WOODBRIDGE RESEARCH FACILITY (HARRY DIAMOND LABS) -- continued

WRF-G1 Old landfill, IRP Site 1 to Occoquan Bay -- continued

	t			Phthalic acid, bis(2-methoxyethyl) ester
			l	Phthalic acid, butyl isobutyl ester
		w		*Phthalic acid, diethyl ester
	t			Phthalic acid, 3-nitro-
s				Phytol
	t			Propanamine, N-methyl-N-nitro-2-
s			l	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
			l	Propene, 3-t-butoxy-2-(isopropoxymethyl)-
	t			Propionic acid, 3-phenyl-
s			l	*Pyrene
s				Pyrene, 1,3-dimethyl-
			l	Pyrene, 1-methyl-
s			l	Pyrene, 2-methyl-
			l	1-Pyrenecarboxaldehyde
s				Pyrrolidinedione, 3-ethylidene-4-methyl-2,5-
	t			Toluamide, alpha-(1-hydroxycyclohexyl)-o-
	t			Tricyclo[2.2.01,4]heptan-2-one, 6-nitro-
s	t		l	Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
	t			Tridecatrienoic acid, 4,8,12-trimethyl-3,7,11-, methyl ester
s				Triphenylene; isochrysene; 9,10-benzphenanthrene
	t			Unidentified organic, extractable fraction
	t			Vitamin E acetate (VAN)

WRF-G2 Main compound to storm drainages to Potomac River

s				Anthracene, 9-butyltetradecahydro-
s				Anthracene, 9-cyclohexyltetradecahydro-
s				Anthracene, 9-dodecyltetradecahydro-
s		w		*Aroclor 1260 (PCB-1260)
		w		Aromatic hydrocarbon
s				*Benz[a]anthracene
		w		Benzene, 1,3,5-trimethyl-
s				*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s				*Benzo[k]fluoranthene
s				Benzopyran-4-one, 3-(3,4-dimethoxyphenyl)-6,7-dimethoxy-4H-1-
s				*Benzo[a]pyrene
		w		*Chlorobiphenyl, poly-
s				Cholestane, (5-alpha, 14-beta)
s				*Chrysene
		w		Cumene ((1-methylethyl)-benzene)
s				Cyclohexane, 1-1'-(oxydi-2,1-ethanediyl)bis[4-methyl-
s				Decanoic acid
s				Dodecylamine, N,N-di-(2-hydroxyethyl)-
s				*Fluoranthene
s				Gona-1,3,5,7,9-pentaen-17-one, 13-ethyl-3-hydroxy-

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

WOODBRIDGE RESEARCH FACILITY (HARRY DIAMOND LABS) -- continued

WRF-G2 Main compound to storm drainages to Potomac River -- continued

s			Hexanedioic acid, bis(2-ethylhexyl) ester
s			Limonene
s			Naphthalenol, 8-amino-2-
s			Nonanamide
s			Octadecenamide, (Z)-9-
s			Penten-3-one, 4-methyl-1-phenyl-1-
s			*Phenanthrene
s			Phenanthrene, 9-dodecyltetradecahydro-
s			Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1- (dehydroabietaldehyde)
s			Phytol
s			*Pyrene
s			Stigmastane
s			Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
s			Undecanoic acid
		w	Xylene, o- (1,2-dimethylbenzene, 1,2-dimethyl)

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Piedmont Region

CHESAPEAKE CORP.

CC-G1 Outfall 001 to Pamunkey River

		W	Benzenediol, 4-ethyl-1,3-
		W	Cyclopentasiloxane, decamethyl-
		W	*Phthalic acid, di-(n-butyl) ester
		W	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region

ALLIED COLLOIDS

ACL-G1 Outfall 001 to X-trib to Nansemond River

s			*Aldrin
s	t		*Aroclor 1260 (PCB-1260)
s			Benzene, 1-(1,3-dimethyl-3-butenyl)-4-methoxy-
s			Benzenediamine, N-(1-methylheptyl)-1,4-
s			*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
		w	Caprolactam
s			*Chlordane, alpha- (cis-chlordane)
s			*Chlordane, gamma- (trans-chlordane)
s			Cineole, 1,8-
	t		Cyclohexanemethanol, cis-4-(1-methylethyl)-
s	t		*DDD, 4,4'- (p,p'-DDD)
s	t		*DDE, 4,4'- (p,p'-DDE)
s	t		*DDT, 4,4'- (p,p'-DDT)
	t		Deca-2,4-dienal, (E,E)-
		w	Decane, 2,2,7-trimethyl-
s			*Dieldrin
	t		Dioxolane, 2-methyl-2-(phenylmethyl)-1,3-
		w	Dodecane, 2,6,10-trimethyl-
s			*Endosulfan I (alpha-endosulfan)
s			*Fluoranthene
s			*Heptachlor epoxide
		w	Heptadecane, 2,6-dimethyl-
s			Heptadecylthiophene, 2-
		w	Heptenoic acid, 2-, 3-(1-methylethyl)-6-oxo-methyl ester
s			Hexanedioic acid, bis(2-ethylhexyl) ester
s			Imidazol-2-amine, 1H-phenanthro[9,10-D]
s	t		Limonene
s			Octadecenamide, (Z)-9-
	t		Orthoformic acid, tri-sec-butyl ester
	t		Pentanamide, 4-methyl-
s			Phenanthrene, 3,9-bis(1,1-dimethylethyl)-
s			Phenanthrene, 9-dodecyltetradecahydro-
s			Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-
s			Phenol, 4-nonyl-
s			Phenol, 4-(1,1,3,3-tetramethylbutyl)-
s			Phenol, 4-(2,2,3,3-tetramethylbutyl)-
s			*Pyrene
	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
	t		Unidentified organic, extractable fraction

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

BOYKINS NARROW FABRICS CORP.

BNF-G1 Outfall 001 to X-trib to Tarrara Creek

s			Anthracenedione, 1,4-dihydroxy-9,10-
s			*Aroclor 1016 (PCB-1016)
s	t		*Aroclor 1260 (PCB-1260)
s		w	Benzenamine, N-ethyl-N-nitroso-
		w	Benzenecarboximidoyl bromide, N-methyl-
s			Benzenethiazolecarboxaldehyde, 2-
s			Benzo[c]cinnoline, 2-ethoxy-
s			*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s			*Chrysene
	t		*DDD, 4,4'- (p,p'-DDD)
s	t		*DDE, 4,4'- (p,p'-DDE)
	t		*DDT, 4,4'- (p,p'-DDT)
	t		Deca-2,4-dienal, (E,E)-
s			*Dieldrin
		w	Dioxaborolane, 2,4-dimethyl-1,3,2-
s			*Fluoranthene
		w	Hexadecanoic acid
	t		Imidazol-2-amine, 1H-phenanthro[9,10-D]
	t		Imidazole, 2-methyl-4-nitro-1H-
	t		Limonene
	t		Naphthalenol, 8-amino-2-
s			Naphthalen-2-one, octahydro-2H-cyclopropa[a]-
	t		Nonadienal, (E,E)-2,4-
	t	w	Nonanamide
		w	Octadecanoic acid, 2-methylpropyl ester
		w	Octadecenal, 2-
		w	Octadecenamide, (Z)-9-
	t		Oxzine, tetrahydro-2-methyl-6-phenyl-2H-1,2-
s			Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1- (dehydroabietaldehyde)
s		w	Phenol, 4,4'-butylidene bis[2-(1,1-dimethyl)-5-methyl-
s			Phenol, diethyl-
s			Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-
s			Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-
s			Phthalic acid, bis(2-methoxyethyl) ester
s			Phthalic acid, 3-nitro-
		w	Propenal, 3-(2,2,6-trimethyl-7-oxabicyclo[4,1,0]hept-1-yl)-2-
s			*Pyrene
		w	Pyrrolidin-2-one, N-methyl-
		w	Silanediamine, 1,1-dimethyl-n-n'-diphenyl-
s	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
		w	Undecene, 5-methyl-1-
s	t	w	Unidentified organic, extractable fraction

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

BOYKINS NARROW FABRICS CORP. -- continued

BNF-G2	Tarrara Cr 40 yds ab confl BNF001 X-trib			
s				*DDD, 4,4'- (p,p'-DDD)
s				Limonene
s				Phenol, 3-methyl- (m-cresol)
s				Unidentified organic, extractable fraction

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

DRIVER NAVAL RADIO TRANSMITTING FACILITY

DRI-G1 PCB site on X-trib to Star Creek

s			Anthracene, 2-methyl-
s	t		*Aroclor 1016 (PCB-1016)
s			*Aroclor 1254 (PCB-1254)
s	t	w	*Aroclor 1260 (PCB-1260)
s			Benzaldehyde, 3,5-dichloro-2-hydroxy-
s			Benzaldehyde, 2-hydroxy-
s			Benzaldehyde, 4-hydroxy-3-methoxy-
s			Benzaldehyde, o-methyloxime-
s			*Benz[a]anthracene
s			*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s			Benzo[j]fluoranthene
s			*Benzo[k]fluoranthene
s			*Benzo[ghi]perylene
s			*Benzo[a]pyrene
s			Biphenyl, 2,2'-diethyl-
		w	*Chlorobiphenyl, poly-
s			*Chrysene
	t		*DDE, 4,4'- (p,p'-DDE)
	t		Dioxaborolane, 2,4-dimethyl-1,3,2-
s			Ethane, 1,1-bis(p-ethylphenyl)-
	t		Ethanediol, 1-phenyl-1,2-
s			*Fluoranthene
	t		Furanone, 5-ethyl-2(5H)-
s			*Indeno(1,2,3-cd)pyrene
s			Indole, 2,3-dihydro-4-methyl-1H-
s	t		Limonene
s			Pentathiepane, 1,2,3,5,6- (Lenthionine)
s			*Phenanthrene
s			Phenanthrene, 3,9-bis(1,1-dimethylethyl)-
s			Phenanthrene, 9-dodecyltetradecahydro-
s			Phenanthrene, 2-methyl-
s			Phenol, 4,4'-butylidene bis[2-(1,1-dimethyl)-5-methyl-
s			Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-
s			Phenol, 4-methyl- (p-cresol)
s	t		Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-
s			Phenol, nonyl-
s			Phenol, 4-nonyl-
s			Phenol, 4-(1,1,3,3-tetramethylbutyl)-
s			Phenol, 4-(2,2,3,3-tetramethylbutyl)-
s			Phthalic acid, bis(2-methoxyethyl) ester
s			Phthalic acid, butyl isobutyl ester
s			*Pyrene
s			Tetrathiepane, 1,2,4,6-
s	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
s			Trithiolane, 1,2,4-
s	t		Unidentified organic, extractable fraction

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

HAMPTON ROADS SANITATION DISTRICT - NANSEMOND STP

HN-G1 Outfall 001 to Nansemond River

s			*Anthracene
s	t		*Aroclor 1260 (PCB-1260)
s			Azulene, octahydro-1,4-dimethyl-7-(1-methylethenyl)-
s			*Benz[a]anthracene
s			Benz[a]anthracene, 7,12-dimethyl-
	t		Benz[a]anthracene, 8-methyl-
s			Benzene, 1-(1,3-dimethyl-3-butenyl)-4-methoxy-
		w	*Benzenehexachloride, alpha- (alpha-BHC; alpha-hexachlorocyclohexane)
		w	*Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane; Lindane)
s			*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s			Benzo[j]fluoranthene
s			*Benzo[k]fluoranthene
s			*Benzo[ghi]perylene
s			*Benzo[a]pyrene
s			Benzo[e]pyrene
s			Bicyclo[3.2.1]oct-6-en-3-one, 8-oxa-
	t		*Chlordane, alpha- (cis-chlordane)
		w	Chlorinated hydrocarbon
s			*Chrysene
	t		*DDD, 4,4'- (p,p'-DDD)
	t		*DDE, 4,4'- (p,p'-DDE)
	t		Deca-2,4-dienal, (E,E)-
	t		*Dieldrin
	t		Dioxolane, 2-cyclohexyl-4,5-dimethyl-1,3-
s			Dodecanamide
s			*Fluoranthene
s			Hexanedioic acid, bis(2-ethylhexyl) ester
s			Imidazol-2-amine, 1H-phenanthro[9,10-D]
	t		Imidazole, 2-methyl-4-nitro-1H-
s			*Indeno(1,2,3-cd)pyrene
s	t		Limonene
s			*Maneb
s			Naphthalene, 2-phenyl-
s			Naphthalenone, octahydro-1,4a-dimethyl-2(1H)-
s			Naphtho(2,3-d)thiophene, 4,9-dimethyl-
s			Nonanamide
s			Octadecenamide, (Z)-9-
	t		Orthoformic acid, tri-sec-butyl ester
s			*Phenanthrene
s			Phenanthrene, 9-dodecyltetradecahydro-
s			Phenanthrene, 2-methyl-
s			Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-
s			Phenol, 4-nonyl-
s			Phenol, 4-(1,1,3,3-tetramethylbutyl)-
s			Phenol, 4-(2,2,3,3-tetramethylbutyl)-
s			Phthalic acid, bis(2-methoxyethyl) ester
s	t		Phthalic acid, butyl isobutyl ester

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

HAMPTON ROADS SANITATION DISTRICT - NANSEMOND STP -- continued

HN-G1 Outfall 001 to Nansemond River -- continued

s			*Pyrene
s	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
	t		Unidentified organic, extractable fraction

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

NASA GOODARD FLIGHT CENTER

NSG-G1 NASA Goddard Flight Center 001

Chlorinated hydrocarbon

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

NEW CHURCH ENERGY ASSOCIATES

NCE-G1 Outfall 001 to X-trib to Pitt's Creek

s			Adipic acid, dioctyl ester
	t		Androstane-3,17-dione, bis-(O-methyloxime)-
s			*Anthracene
		w	*Aroclor 1221 (PCB-1221)
	t		*Aroclor 1260 (PCB-1260)
s			Azulene, octahydro-1,4-dimethyl-7-(1-methylethenyl)-
s			Benzene, 3-methyl-4-pentenyl-
	t		*Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane; Lindane)
	t		*Chlordane, alpha- (cis-chlordane)
s			*Chrysene
		w	Cyclohexasiloxane, dodecamethyl-
		w	Cyclopentanone, 2-(1-methylpropyl)-
	t		*DDD, 4,4'- (p,p'-DDD)
s	t		*DDE, 4,4'- (p,p'-DDE)
s			*DDT, 4,4'- (p,p'-DDT)
s			Decanoic acid
s			Decanol, 2-ethyl-
s			Diketone, C10-C15-
	t		Dioxolane, 2-ethyl-2-isobutyl-1,3-
s			Dodecanoic acid
s			*Fluoranthene
	t		*Heptachlor
s			Hexadecanal
s			Hexanedioic acid, bis(2-ethylhexyl) ester
	t		Imidazol-2-amine, 1H-phenanthro[9,10-D]
s	t		Limonene
s			*Naphthalene
s			Naphthalene, octahydro-1,4-dimethyl-2-(1-methylethenyl)-
s			Pentadecanoic acid
	t		Pentanamide, 4-methyl-
s			Pentanol, 2-chloro-4-methyl-3-
s			*Phenanthrene
s			Phenanthrene, 9-dodecyltetradecahydro-
s			Phytol
	t		Piperidin-2-one
s			Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
s			*Pyrene
s			Tetradecanoic acid
s			Tridecanoic acid
s	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
		w	Undecane, spiro[5,5]-

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

YORKTOWN NAVAL WEAPONS STATION

NWS-G1 East and west X-tribs to Roosevelt Pond

s			Acetophenone (1-phenylethanone)
s			Amine, O-decylhydroxyl-
s			*Anthracene
s	t		*Aroclor 1260 (PCB-1260)
s			Benzaldehyde, 4-hydroxy-
s			Benzaldehyde, 4-hydroxy-3-methoxy-
s			*Benz[a]anthracene
s			*Benzo[b]fluoranthene (benz[e]acephenanthrylene)
s			Benzo[j]fluoranthene
s			*Benzo[k]fluoranthene
s			*Benzo[ghi]perylene
s			*Benzo[a]pyrene
s	t		*Chlordane, alpha- (cis-chlordane)
s			*Chlordane, gamma- (trans-chlordane)
s			*Chrysene
	t		Cyanobenzoic acid, 4-, 3-methoxyphenyl ester
s			Cyclohexanol, 2-(1,1-dimethylethyl)-
	t		Cyclopent[a]indene, 3,8-dihydro-1,2,3,3,8,8-hexamethyl-
s	t		*DDD, 4,4'- (p,p'-DDD)
s	t		*DDE, 4,4'- (p,p'-DDE)
s	t		*DDT, 4,4'- (p,p'-DDT)
	t		Deca-2,4-dienal, (E,E)-
s			Decanoic acid
s			Decanoic acid, 12-methyltetra-
s			Decanol, 2-ethyl-
s			*Dibenz(a,h)anthracene
s			Dodecanoic acid
s			Ethane, 1,1-bis(p-ethylphenyl)-
s			Ethanone, 1-(2-aminophenyl)-
s			*Fluoranthene
s			Furan, 2,3-dihydro-2,5-dimethyl-
s			Heptadecanone
s			Hexadecanal
s			Hexadienoic acid, 2,3-, 2-methyl-4-phenylethyl ester
s			Hexanal, 4,4-dimethyl-
	t		Imidazol-2-amine, 1H-phenanthro[9,10-D]
s			Indene, 2,3-dihydro-1,1-dimethyl-1H-
s			*Indeno(1,2,3-cd)pyrene
s			Indolizine, 3-methyl-
s	t		Limonene
s			Pentadecanoic acid
s			Pentadecanone, 6,10,14-trimethyl-2-
s			Pentanol, 2-chloro-4-methyl-3-
s			*Phenanthrene
s			Phenanthrene, 9-dodecyltetradecahydro-
s			Phenanthrene, 4-methyl-
s	t		Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1- (dehydroabietaldehyde)

Table 3 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

YORKTOWN NAVAL WEAPONS STATION -- continued

NWS-G1 East and west X-tribs to Roosevelt Pond -- continued

s			Phenanthrenone, decahydro-1,1,4A,7,7-pentamethyl-2(1H)-
	t		*Phthalic acid, diethyl ester
s			Phthalic acid, 3-nitro-
s			Phytol
s			Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
s			Propene, 3-t-butoxy-2-(isopropoxymethyl)-
s			*Pyrene
s			Tetradecane-1,14-diol
s	t		Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-
	t		Unidentified organic, extractable fraction

NWS-G7 Seep at end of Barracks Rd

		w	*Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)

Table 4. Comparison of sample concentrations of compounds of concern to assessment criteria and standards[1]. Comparisons are based on the maximum compound concentration in each matrix sampled. An asterisk (*) beneath a standard or criteria indicates the sample's concentration of the compound of concern exceeds the standard or criteria.

Virginia Dept. of Environmental Quality's Northern Region

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Acenaphthene														
Facil. group	Max. conc.	Site FSSC	.15000E+3	.65000E+3	Max. conc.	.65340E+6		.81000E+5	Max. conc.		.27000E+4			Max. conc.	.61000E+8
WRF-G1		.45538E+3												.14000E+3	
Acenaphthylene														
Facil. group	Max. conc.	Site FSSC			Max. conc.				Max. conc.		.31000E-1			Max. conc.	
WRF-G1														.18000E+2	
Anthracene														
Facil. group	Max. conc.	Site FSSC	.85000E+2	.96000E+3	Max. conc.	.33000E+7		.41000E+6	Max. conc.	.11000E+6	.11000E+6			Max. conc.	.31000E+9
DA-G2	.76000E+2														
WRF-G1														.18000E+3	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Benz[a]anthracene														
Facil. group	Max. conc.	Site FSSC	.23000E+3	.16000E+4	Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+4
DA-G2	.48000E+2														
WRF-G1	.17000E+3													.66000E+3	
WRF-G2	.12000E+3														
Benzenehexachloride, beta- (beta-BHC; beta-hexachlorocyclohexane)														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.59800E+1		.18000E+1	Max. conc.		.46000E-1			Max. conc.	.16000E+4
WRF-G1	.55000E+0														
Benzenehexachloride, delta- (delta-BHC; delta-hexachlorocyclohexane)														
Facil. group	Max. conc.	Site FSSC			Max. conc.				Max. conc.					Max. conc.	
WRF-G1														.15900E+1	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
	NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT

Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane; Lindane)

Facil. group	Max. conc.	Site FSSC			Max. conc.	.32500E+4		.24000E+1	Max. conc.	.25000E+2	.63000E-1	.10000E-1		Max. conc.	.22000E+4
DA-G2									.12000E+0		*	*			

Benzo[b]fluoranthene (benz[e]acephenanthrylene)

Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+4
DA-G2	.59000E+2														
WRF-G1	.40000E+3													.11000E+4	
WRF-G2	.38000E+3														

Benzo[k]fluoranthene

Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+2	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+5
DA-G2	.73000E+2														
WRF-G1	.12000E+3													.30000E+3	
WRF-G2	.55000E+2														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Benzo[a]pyrene														
Facil. group	Max. conc.	Site FSSC	.40000E+3	.25000E+4	Max. conc.	.93300E+1		.43000E+0	Max. conc.	.31100E+0	.31100E-1			Max. conc.	.39000E+
DA-G2	.38000E+2														
WRF-G1	.25000E+3				.14000E+3	*		*						.53000E+3	*
WRF-G2	.19000E+3														
Chlordane, total														
Facil. group	Max. conc.	Site FSSC	.50000E+0	.60000E+1	Max. conc.	.83190E+2	.30000E+3	.24000E+1	Max. conc.	.59000E-2	.59000E-3	.40000E-2	.40000E-2	Max. conc.	.22000E+4
DA-G2	.71200E+1		*	*	.38900E+1			*							
WRF-G1	.23100E+1		*		.24480E+2			*						.31900E+1	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Chrysene														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+3	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+6
DA-G2	.45000E+2														
WRF-G1	.18000E+3													.60000E+3	
WRF-G2	.14000E+3														
Cumene ((1-methylethyl)-benzene)														
Facil. group	Max. conc.	Site FSSC			Max. conc.			.54000E+5	Max. conc.					Max. conc.	.41000E+8
WRF-G2									.10000E+1						
DDD, total														
Facil. group	Max. conc.	Site FSSC	.20000E+1	.20000E+2	Max. conc.				Max. conc.					Max. conc.	
DA-G2	.32000E+3		*	*											
WRF-G1	.18000E+1														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
DDE, total														
Facil. group	Max. conc.	Site FSSC	.20000E+1	.15000E+2	Max. conc.				Max. conc.					Max. conc.	
DA-G2	.12000E+3		*	*											
WRF-G1	.89000E+0														
DDT, total														
Facil. group	Max. conc.	Site FSSC	.10000E+1	.70000E+1	Max. conc.				Max. conc.					Max. conc.	
DA-G2	.31000E+2		*	*											
WRF-G1	.69000E+0														
DDD/DDE/DDT, calculated total															
Facil. group	Max. conc.	Site FSSC			Max. conc.	.31624E+3	.50000E+4	.93000E+1	Max. conc.	.59000E-2	.59000E-3	.10000E-2	.10000E-2	Max. conc.	.84000E+4
DA-G2					.26470E+2			*							
WRF-G1					.12660E+3			*						.16600E+2	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Dibenz(a,h)anthracene														
Facil. group	Max. conc.	Site FSSC	.60000E+2	.26000E+3	Max. conc.	.93300E+1		.43000E+0	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+3
DA-G2	.39000E+2														
WRF-G1	.41000E+2													.16000E+3	
Dieldrin														
Facil. group	Max. conc.	Site FSSC	.20000E-1	.80000E+1	Max. conc.	.65380E+1		.20000E+0	Max. conc.	.14000E-2	.14000E-3	.19000E-2	.19000E-2	Max. conc.	.18000E+3
DA-G2	.60000E+2	.37690E+3	*	*	.11400E+1			*							
WRF-G1	.44000E+0	.10545E+2	*		.28200E+1			*							
Endosulfan, total plus endosulfan sulfate														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.54000E+3		.81000E+4	Max. conc.	.20000E+1	.20000E+1	.56000E-1	.56000E-1	Max. conc.	.61000E+7
WRF-G1	.95000E+0													.29000E+0	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Endrin plus endrin aldehyde														
Facil. group	Max. conc.	Site FSSC	.20000E-1	.45000E+2	Max. conc.	.32157E+4	.30000E+3	.41000E+3	Max. conc.	.81000E+0	.81000E+0	.23000E-2	.23000E-2	Max. conc.	.31000E+(
DA-G2					.53000E+1				.21000E+0			*	*		
WRF-G1	.10400E+1	.39786E+1	*		.29100E+2										
Fluoranthene															
Facil. group	Max. conc.	Site FSSC	.60000E+3	.36000E+4	Max. conc.	.42550E+6		.54000E+5	Max. conc.	.37000E+3	.37000E+3			Max. conc.	.41000E+8
DA-G2	.68000E+2	.11874E+4													
WRF-G1	.11000E+3	.17456E+4												.12000E+4	
WRF-G2	.46000E+2	.16172E+4													

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Fluorene														
Facil. group	Max. conc.	Site FSSC	.35000E+2	.64000E+3	Max. conc.	.42000E+6		.54000E+5	Max. conc.	.14000E+5	.14000E+5			Max. conc.	.41000E+8
DA-G2	.28000E+2														
WRF-G1														.93000E+2	
Heptachlor															
Facil. group	Max. conc.	Site FSSC			Max. conc.	.23520E+2	.30000E+3	.70000E+0	Max. conc.	.21000E-2	.21000E-3	.36000E-2	.36000E-2	Max. conc.	.64000E+3
DA-G2									.38000E+0	*	*	*	*		
Heptachlor epoxide															
Facil. group	Max. conc.	Site FSSC			Max. conc.	.12320E+1	.30000E+3	.35000E+0	Max. conc.		.11000E-3		.36000E-2	Max. conc.	.31000E+3
DA-G2									.20000E+0		*		*		
WRF-G1	.10000E+0														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry w
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC	FRBT
Indeno(1,2,3-cd)pyrene													
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+
DA-G2	.16000E+2														
WRF-G1	.19000E+3													.53000E+3	
Methoxychlor													
Facil. group	Max. conc.	Site FSSC			Max. conc.			.68000E+4	Max. conc.			.30000E-1		Max. conc.	.51000E+
DA-G2									.23000E+1			*			
Naphthalene													
Facil. group	Max. conc.	Site FSSC	.34000E+3	.21000E+4	Max. conc.			.54000E+5	Max. conc.					Max. conc.	.41000E+
DA-G2	.14000E+2														
WRF-G1														.32000E+2	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
PCBs, calculated total (Aroclor 1260 criteria used)														
Facil. group	Max. conc.	Site FSSC	.50000E+2	.40000E+3	Max. conc.	.14040E+2	.20000E+4	.41000E+0	Max. conc.	.45000E-3	.45000E-4	.30000E-1	.30000E-1	Max. conc.	.37000E+3
DA-G2	.25000E+3		*		.44000E+3	*		*							
WRF-G1	.34000E+2				.15000E+4	*		*	.15000E+2	*	*	*	*	.11000E+4	*
WRF-G2	.10000E+6		*	*					.15000E+1	*	*	*	*		
Phenanthrene															
Facil. group	Max. conc.	Site FSSC	.22500E+3	.13800E+4	Max. conc.				Max. conc.					Max. conc.	
DA-G2	.28000E+3	.43187E+3	*												
WRF-G1	.35000E+2	.62415E+3												.95000E+3	
WRF-G2	.94000E+2	.26343E+4													

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Phthalic acid, diethyl ester														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.87600E+7		.11000E+7	Max. conc.		.12000E+6			Max. conc.	.82000E+9
WRF-G1									.90000E+1						
Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.76700E+4		.23000E+3	Max. conc.	.59000E+2	.59000E+1			Max. conc.	.20000E+6
DA-G2									.30000E+1						
Pyrene														
Facil. group	Max. conc.	Site FSSC	.35000E+3	.22000E+4	Max. conc.	.33000E+6		.41000E+5	Max. conc.	.11000E+5	.11000E+5			Max. conc.	.31000E+8
DA-G2	.59000E+2														
WRF-G1	.14000E+3													.10000E+4	
WRF-G2	.23000E+3														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Northern Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Xylene, o- (1,2-dimethylbenzene, 1,2-dimethyl)														
Facil. group	Max. conc.	Site FSSC			Max. conc.			.27000E+7	Max. conc.					Max. conc.	.1000E+10
WRF-G2									.30000E+1						
Total regional exceedances:	0	11	6		3	0	9		3	5	6	5		2	

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Piedmont Region

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Phthalic acid, di-(n-butyl) ester														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.10680E+7		.14000E+6	Max. conc.		.12000E+5			Max. conc.	.10000E+9
CC-G1									.11000E+2						
Phthalic acid, di-(2-ethylhexyl) ester (bis(2-ethylhexl)phthalate)														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.76700E+4		.23000E+3	Max. conc.	.59000E+2	.59000E+1			Max. conc.	.20000E+6
CC-G1									.12000E+3	*	*				
Total regional exceedances:		0	0	0		0	0	0		1	1	0	0		0

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Aldrin														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.65380E+1		.19000E+0	Max. conc.	.14000E-2	.14000E-3	.13000E+0		Max. conc.	.17000E+3
ACL-G1	.29500E+1														
Anthracene															
Facil. group	Max. conc.	Site FSSC	.85000E+2	.96000E+3	Max. conc.	.33000E+7		.41000E+6	Max. conc.	.11000E+6	.11000E+6			Max. conc.	.31000E+9
HN-G1	.28000E+2														
NCE-G1	.17000E+2														
NWS-G1	.22000E+2														
Benz[a]anthracene															
Facil. group	Max. conc.	Site FSSC	.23000E+3	.16000E+4	Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+4
DRI-G1	.54000E+2														
HN-G1	.13000E+3														
NWS-G1	.18000E+3														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Benzenehexachloride, alpha- (alpha-BHC; alpha-hexachlorocyclohexane)														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.16900E+1		.50000E+0	Max. conc.		.13000E-1			Max. conc.	.45000E+3
HN-G1									.18000E-1		*				
Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane; Lindane)														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.32500E+4		.24000E+1	Max. conc.	.25000E+2	.63000E-1	.10000E-1		Max. conc.	.22000E+4
HN-G1									.21000E-1			*			
NCE-G1					.77000E+0										
Benzo[b]fluoranthene (benz[e]acephenanthrylene)														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+4
ACL-G1	.10500E+3														
BNF-G1	.65000E+2														
DRI-G1	.16000E+3														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Benzo[b]fluoranthene (benz[e]acephenanthrylene) -- continued														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+4
HN-G1	.28000E+3														
NWS-G1	.36000E+3														
Benzo[k]fluoranthene														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+2	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+5
DRI-G1	.53000E+2														
HN-G1	.87000E+2														
NWS-G1	.14000E+3														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Benzo[a]pyrene														
Facil. group	Max. conc.	Site FSSC	.40000E+3	.25000E+4	Max. conc.	.93300E+1		.43000E+0	Max. conc.	.31100E+0	.31100E-1			Max. conc.	.3900E+
DRI-G1	.63000E+2														
HN-G1	.15000E+3														
NWS-G1	.28000E+3														
Caprolactam														
Facil. group	Max. conc.	Site FSSC			Max. conc.			.68000E+6	Max. conc.					Max. conc.	.51000E+9
ACL-G1									.80000E+1						
Chlordane, total														
Facil. group	Max. conc.	Site FSSC	.50000E+0	.60000E+1	Max. conc.	.83190E+2	.30000E+3	.24000E+1	Max. conc.	.59000E-2	.59000E-3	.40000E-2	.40000E-2	Max. conc.	.22000E+4
ACL-G1	.39000E+2		*	*											
HN-G1					.32000E+1			*							
NCE-G1					.27000E+1			*							

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Chlordane, total -- continued														
Facil. group	Max. conc.	Site FSSC	.50000E+0	.60000E+1	Max. conc.	.83190E+2	.30000E+3	.24000E+1	Max. conc.	.59000E-2	.59000E-3	.43000E-2	.43000E-2	Max. conc.	.22000E+4
NWS-G1	.94500E+1		*	*	.68000E+1			*							
Chrysene															
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+3	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+6
BNF-G1	.37000E+2														
DRI-G1	.10000E+3														
HN-G1	.14000E+3														
NCE-G1	.30000E+2														
NWS-G1	.26000E+3														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
DDD, total														
Facil. group	Max. conc.	Site FSSC	.20000E+1	.20000E+2	Max. conc.				Max. conc.					Max. conc.	
ACL-G1	.49400E+1		*												
BNF-G2	.60000E+0														
NWS-G1	.19900E+2		*												
DDE, total														
Facil. group	Max. conc.	Site FSSC	.20000E+1	.15000E+2	Max. conc.				Max. conc.					Max. conc.	
ACL-G1	.26500E+1		*												
BNF-G1	.81000E+1		*												
NCE-G1	.40000E+1		*												
NWS-G1	.10800E+2		*												

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
DDT, total														
Facil. group	Max. conc.	Site FSSC	.10000E+1	.70000E+1	Max. conc.				Max. conc.					Max. conc.	
ACL-G1	.95200E+1		*	*											
NCE-G1	.11100E+1		*												
NWS-G1	.12700E+2		*	*											
DDD/DDE/DDT, calculated total															
Facil. group	Max. conc.	Site FSSC			Max. conc.	.31624E+3	.50000E+4	.93000E+1	Max. conc.	.59000E-2	.59000E-3	.10000E-2	.10000E-2	Max. conc.	.84000E+4
ACL-G1					.38000E+1										
BNF-G1					.32880E+2			*							
DRI-G1					.32000E+1										
HN-G1					.12900E+2			*							
NCE-G1					.15900E+2			*							
NWS-G1					.42200E+2			*							

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry w	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Dibenz(a,h)anthracene														
Facil. group	Max. conc.	Site FSSC	.60000E+2	.26000E+3	Max. conc.	.93300E+1		.43000E+0	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+
NWS-G1	.38000E+2														
Dieldrin														
Facil. group	Max. conc.	Site FSSC	.20000E-1	.80000E+1	Max. conc.	.65380E+1		.20000E+0	Max. conc.	.14000E-2	.14000E-3	.19000E-2	.19000E-2	Max. conc.	.18000E+
ACL-G1	.13600E+1	.12733E+3	*												
BNF-G1	.47300E+1	.12766E+3	*												
HN-G1					.32000E+1			*							
Endosulfan, total plus endosulfan sulfate														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.54000E+3		.81000E+4	Max. conc.	.20000E+1	.20000E+1	.87000E-2	.87000E-2	Max. conc.	.61000E+
ACL-G1	.26100E+1														

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Fluoranthene														
Facil. group	Max. conc.	Site FSSC	.60000E+3	.36000E+4	Max. conc.	.42550E+6		.54000E+5	Max. conc.	.37000E+3	.37000E+3			Max. conc.	.41000E+8
ACL-G1	.12500E+3	.41229E+4													
BNF-G1	.27000E+2	.12065E+5													
DRI-G1	.18000E+3	.12566E+5													
HN-G1	.19000E+3	.21109E+4													
NCE-G1	.24000E+2	.46207E+3													
NWS-G1	.33000E+3	.20023E+4													
Heptachlor														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.23520E+2	.30000E+3	.70000E+0	Max. conc.	.21000E-2	.21000E-3	.38000E-2	.38000E-2	Max. conc.	.64000E+3
NCE-G1					.50000E+0										

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT
Heptachlor epoxide														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.12320E+1	.30000E+3	.35000E+0	Max. conc.		.11000E-3		.36000E-2	Max. conc.	.31000E+3
ACL-G1	.29600E+1													
Indeno(1,2,3-cd)pyrene														
Facil. group	Max. conc.	Site FSSC			Max. conc.	.93300E+1		.43000E+1	Max. conc.	.31100E+0	.31000E-1			Max. conc.	.39000E+4
DRI-G1	.42000E+2													
HN-G1	.12000E+3													
NWS-G1	.20000E+3													
Naphthalene														
Facil. group	Max. conc.	Site FSSC	.34000E+3	.21000E+4	Max. conc.			.54000E+5	Max. conc.					Max. conc.	.41000E+8
NCE-G1	.12000E+2													

Table 4 -- continued.

Virginia Dept. of Environmental Quality's Tidewater Region -- continued

	Sediment, ug/kg (ppb) dry weight			Tissue, ug/kg (ppb) wet weight				Water (ambient or effluent), ug/L (ppb)					Soil, ug/kg dry wt	
		NERL	NERM		VTSV	FDA	FRBT		VHHO	FHHO	VALC	FALC		FRBT

PCBs, calculated total (Aroclor 1260 criteria used)

Facil. group	Max. conc.	Site FSSC	.50000E+2	.40000E+3	Max. conc.	.14040E+2	.20000E+4	.41000E+0	Max. conc.	.45000E-3	.45000E-4	.30000E-1	.30000E-1	Max. conc.	.37000E+3
ACL-G1	.40000E+2				.13000E+2			*							
BNF-G1	.21900E+3		*		.73000E+1			*							
DRI-G1	.43300E+4		*	*	.28000E+5	*	*	*	.96500E+2	*	*	*	*		
HN-G1	.71000E+2		*		.39000E+2	*		*							
NCE-G1					.16000E+2	*		*	.14000E+0	*	*	*	*		
NWS-G1	.27000E+3		*		.18000E+2	*		*							

Phenanthrene

Facil. group	Max. conc.	Site FSSC	.22500E+3	.13800E+4	Max. conc.				Max. conc.					Max. conc.	
DRI-G1	.35000E+2	.45706E+4													
HN-G1	.78000E+2	.76776E+3													
NCE-G1	.41000E+2	.16521E+3													
NWS-G1	.13000E+3	.71594E+3													

Table 4 -- continued.

Notes:

[1] Standards and criteria used in this table are listed in Table B-1. Sources are listed below:

FSSC Draft national sediment quality criteria values, U.S. Environmental Protection Agency, 8/12/92. Values are site-specific, based upon sample TOC.

NERL The potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program, effects range low, National Oceanic and Atmospheric Administration, 1991.

NERM The potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program, effects range median, National Oceanic and Atmospheric Administration, 1991.

VTSV Virginia Dept. Environmental Quality draft screening values for tissue, 11/26/93.
Calculated by multiplying Virginia water quality standard (see VHHO below) by bioaccumulation factor.
For EPA 304(a) compounds without Virginia water quality standards, EPA's 304(a) criteria were used (see FHHO below).

FDA National seafood safety manual - appendix D: action levels, tolerances and other values for poisonous or deleterious substances in seafood, U.S. Food and Drug Administration, 1988.

FRBT EPA Region III risk-based concentrations, ver. 7.0, 10/5/93. Based upon target cancer risk of 10^{-6}.

VHHO Virginia water quality standards - human health: other surface waters (non-water supply), VR680-21-01, Commonwealth of Virginia, 5/20/92.
For Virginia-classified carcinogens, standards are based upon target cancer risk of 10^{-5}.

FHHO Human health criteria for consumption of organisms only; EPA's Section 304(a) criteria for priority toxic pollutants.
U.S. Environmental Protection Agency, 40 CFR Part 131 Section 131.36, 12/22/92.
For EPA-classified carcinogens, criteria are based upon target cancer risk of 10^{-6}.

VALC Virginia water quality standards - aquatic life: chronic, VR680-21-01, Commonwealth of Virginia, 5/20/92.

FALC Aquatic life criteria -- continuous; EPA's Section 304(a) criteria for priority toxic pollutants.
U.S. Environmental Protection Agency, 40 CFR Part 131 Section 131.36, 12/22/92.

Summary

Sources of bioconcentratable compounds in Virginia's CZM area.

Phase II and phase III sample data indicate that relatively few bioconcentratable compounds are currently being released through point and non-point source discharges. However, significant exceptions were identified. Data further indicate that sediments in the Virginia CZM Area represent a potentially substantial source of bioconcentratable compounds, apparently due to historical and/or episodic releases of bioconcentratable compounds. Tissue data indicate sediment related compounds are concentrating in indigenous fish and shellfish to an extent which may increase human health risks. These data suggest bioaccumulation of sediment compounds through the food chain is a more immediate problem with regard to human health risk than bioconcentration of water borne compounds. Direct correlations between water borne compounds and compounds identified in tissue samples were identified. However, their frequency of occurrence was low in relation to sediment-tissue correlations.

Compounds of Concern in Virginia's CZM area.

From the standpoint of indigenous fish and shellfish contamination, the halogenated compounds are of most concern. Chlordane, PCB, DDE, DDD, DDT, Endrin, and Dieldrin were the seven most common tissue contaminants identified in the study.

As reported above, the study was able to target 39 of the 276 compounds identified in the study as compounds of concern (COC). The remaining 237 compounds identified in the study contained many compounds whose parent structures were targeted as COC. However, their toxicological profiles have not been described fully enough to include them as COC.

Site specific summaries.

Dahlgren Naval Weapons Lab

Phase II samples from station DA-G2 indicate there was an active release of Lindane, Endrin, Heptachlor, Heptachlor epoxide, and Methoxychlor. Concentrations of these compounds in the DA-G2 sample exceed one or more of Virginia's Water Quality Standards. None of the above compounds were identified in the DA-G2 sediment samples. Endrin was identified in the DA-G2 tissue samples below tissue assessment values.

Sediment concentrations of PCB, Chlordane, DDD, DDE, DDT,

Dieldrin and Phenanthrene exceeded one or more sediment assessment values. PCBs, Chlordane, DDE, and Dieldrin were also identified in DA-G2 tissue samples at levels exceeding one or more tissue assessment values.

Quality control and quality assurance data indicate the quantitation of DA-G2 COC may be low.

Overall human health risks at DA-G2 were estimated at 10^{-3} for the water borne concentrations of Heptachlor and Heptachlor epoxide. Overall human health risks at DA-G2 were estimated at 10^{-3} for PCB levels in tissue. Additive risk for all COC at DA-G2 may be higher than 10^{-3} (EPA 1991f).

Woodbridge Research Facility WRF-G1

Phase II samples from station WRF-G1 indicate there was an active release of PCBs. Concentrations of PCBs in the WRF-G1 sample exceed one or more of Virginia's Water Quality Standards. PCBs were identified in the WRF-G1 sediment samples below sediment assessment values. PCBs were identified in the WRF-G1 tissue samples above tissue assessment values.

Sediment concentrations of Chlordane, Dieldrin, and Endrin exceeded one or more sediment assessment values. Chlordane and Dieldrin were also identified in WRF-G1 tissue samples at levels exceeding one or more tissue assessment values.

Of the 31 COC identified in the phase II and phase III WRF-G1 samples, 23 were identified in soil samples from the old Landfill designated as site #1 in the Woodbridge Research Facility IRP.

Most quality control and quality assurance data indicate the quantitation of WRF-G1 COC, specifically PCBs, may be high.

Overall human health risks at WRF-G1 were estimated at 10^{0} for the water borne concentrations of PCB. Overall human health risks at WRF-G1 were estimated at 10^{-2} for PCB levels in tissue. Additive risk for all COC at DA-G2 may be higher than 10^{0} (EPA 1991f).

Woodbridge Research Facility WRF-G2.

Phase II samples from station WRF-G2 indicate there was an active release of PCBs. Concentrations of PCBs in the WRF-G2 sample exceed one or more of Virginia's Water Quality Standards. PCBs were identified in the WRF-G2 sediment samples above sediment assessment values. Efforts to collect tissue sample at WRF-G2 were unsuccessful.

No quality control problems were associated with the WRF-G2 phase

II samples. Quality control and quality assurance data indicate the quantitation of WRF-G2 sediment COC, specifically PCBs, may be high.

Overall human health risks at WRF-G2 were estimated at 10^{-1} for the water borne concentrations of PCB. Additive risk for all COC at WRF-G2 may be higher than 10^{-1} (EPA 1991f).

Allied Colloids.

No COC were identified in phase II samples from station ACL-G1 . The ACL-G1 sediment concentrations of Chlordane, DDD, DDE, and DDT exceeded one or more of the sediment assessment values. PCBs were also identified in ACL-G1 sediment samples but below assessment values. However, PCBs were also identified in ACL-G1 tissue samples at levels exceeding tissue assessment values.

Quality control and quality assurance data indicate the quantitation of ACL-G1 sediment COC, specifically PCBs, may be high and quantitation of ACL-G1 tissue COC may be low.

Overall human health risks at ACL-G1 were estimated at 10^{-4} for PCB levels in tissue. Additive risk for all COC at ACL-G1 may be higher than 10^{-1} (EPA 1991f).

Boykins Narrow Fabrics.

No COC were identified in phase II samples from station BNF-G1 . The BNF-G1 sediment concentrations of DDE, Dieldrin, and PCB exceeded one or more of the sediment assessment values. PCBs and DDT were identified in BNF-G1 tissue samples at levels exceeding tissue assessment values.

Quality control and quality assurance data indicate the quantitation of BNF-G1 sediment COC, specifically PCBs, may be high and quantitation of BNF-G1 tissue COC may be low.

Overall human health risks at BNF-G1 were estimated at 10^{-5} for PCB and DDT levels in tissue. Additive risk for all COC at BNF-G1 may be higher than 10^{-5} (EPA 1991f).

Driver Naval Transmitting Facility.

Phase II samples from station DRI-G1 indicate there may be an active release of PCBs from sediment associated water. Concentrations of PCBs in the DRI-G1 sample exceed one or more of Virginia's Water Quality Standards. PCBs were identified in the DRI-G1 sediment samples above sediment assessment values. PCBs were identified in the DRI-G1 tissue samples above tissue assessment values.

Quality control and quality assurance data indicate the quantitation of DRI-G1 water borne PCBs may be high and quantitation of semi-volatile COC may be low. Quality control and quality assurance data indicate the quantitation of DRI-G1 sediment PCBs may be high.

Overall human health risks at DRI-G1 were estimated at 10^{0} for the water borne concentrations of PCB. Overall human health risks at DRI-G1 were estimated at 10^{-1} for PCB levels in tissue. Additive risk for all COC at WRF-G1 may be higher than 10^{-0} (EPA 1991f).

HRSD Nansemond-STP.

Phase II samples from station HN-G1 indicate there was an active release of BHC, alpha- and Lindane. Concentrations of these compounds in the HN-G1 sample were estimated to exceed one or more of Virginia's Water Quality Standards. PCBs were identified in the HN-G1 sediment samples above sediment assessment values. Chlordane, Total DDT, and Dieldrin were identified in HN-G1 tissue samples above tissue assessment values.

Quality control and quality assurance data indicate the quantitation of HN1-G1 water borne BHC, alpha- and Lindane were estimated and non-confirmed in a split sample. Quality control and quality assurance data indicate the quantitation of HN-G1 sediment COC may be high.

Overall human health risks at HN-G1 were estimated at 10^{-6} for the water borne concentrations of BHC, alpha- and Lindane. Overall human health risks at HN-G1 were estimated at 10^{-5} for total DDT and DIeldrin levels in tissue. Additive risk for all COC at HN-G1 may be higher than 10^{-5} (EPA 1991f).

New Church Energy Associates.

Phase II samples from station NCE-G1 indicate there was an active release of PCBs. Concentrations of PCBs in the NCE-G1 sample were estimated to exceed one or more of Virginia's Water Quality Standards. No PCBs were identified in the NCE-G1 sediment samples. However, DDE and DDT were identified in the NCE-G1 sediment samples above sediment assessment values. Chlordane, total DDT, and PCBs were identified in NCE-G1 tissue samples above tissue assessment values.

Quality control and quality assurance data indicate the quantitation of NCE-G1 water borne COC may be low.

Overall human health risks at NCE-G1 were estimated at 10^{-2} for the water borne concentrations of PCB. Overall human health risks at NCE-G1 were estimated at 10^{-4} for PCB levels in tissue.

Additive risk for all COC at NCE-G1 may be higher than 10^{-2} (EPA 1991f).

Yorktown Naval Weapons Station.

No COC were identified in phase II samples from station NWS-G1 . The NWS-G1 sediment concentrations of Chlordane, DDD, DDT, and PCB exceeded one or more of the sediment assessment values. Chlordane, Total DDT, and PCBs were identified in NWS-G1 tissue samples at levels exceeding tissue assessment values.

Quality control and quality assurance data indicate the quantitation of NWS-G1 sediment COC, specifically PCBs, may be high.

Overall human health risks at NWS-G1 were estimated at 10^{-4} for PCB levels in tissue. Additive risk for all COC at NWS-G1 may be higher than 10^{-4} (EPA 1991f).

Conclusions

Study objectives.

Objectives of the 1993 Virginia DEQ CZM BI study were to: 1) assess risks at study sites; 2) assess and refine monitoring protocols; and 3) assess contract laboratory abilities. The 1993 Virginia DEQ CZM BI study met the identified objectives. Human health risks were identified and estimated at eight sites in Virginia's CZM area. The range of human health risks was estimated to be 10^{0}-10^{-6}.

Tissue monitoring protocols were assessed and potential refinements were identified. Specifically, the use of live box studies, surrogate organism studies, or shellfish surveys, at sites with large, open water environments should be used to assess maximum attainable tissue concentrations of compounds of concern (COC). The collection of indigenous fish species for screening purposes at such sites tend to be inconclusive due to questions about species residence times in the impact area. Live box, surrogate organism, and shellfish studies should be used as a first tier in a multi-tiered monitoring plan. If tissue levels of COC were found to exceed a pre-determined action level in the first tier of monitoring, the monitoring plan would initiate a second, more comprehensive, tier of monitoring such as an indigenous fish survey. The logistics of a second tier indigenous fish survey could be formulated to minimize concerns about species residence times by targeting appropriate species and appropriate collection periods as outlined in EPA's Guidance for Assessing Chemical Contamination Data for use in Fish Advisories. Volume 1: Fish Sampling and Analysis (EPA 1993).

The performance of the study's contract laboratory was assessed through the use of split samples with the Virginia Institute of Marine Science, as well as with sample blanks, matrix spikes, analytical surrogates, and other internal quality control mechanisms. Laboratory ability was concluded to be highly variable, and tended to correlate with particular sample matrices and project time periods. Laboratory ability tended to be best with water samples, and less with biota and sediment samples due to interferences inherent in the biota and sediment matrices. Laboratory ability also tended to improve with time as experience with specific matrix contamination problems was gained and used to implement appropriate procedure modifications.

Issues highlighted during the course of the CZM BI study included: 1) A lack of toxicology information and environmental risk information on a large number of environmentally persistent compounds, making evaluations of total risk from bioconcentratable compounds difficult; 2) Control strategies for bioconcentratable pollutants will need to include sediment standards and a consistent set of risk assessment criteria; and 3) Risk based programs for monitoring indigenous fish and

shellfish tissues will need to be established and supported in conjunction with the establishment of risk based assessment criteria.

Recommendations.

Overall recommendations for future study of bioconcentratable compounds in Virginia's CZM Area would be to: 1) screen additional sites, particularly those known to be, or suspected to be, releasing COC; and 2) Conduct follow up investigations at sites identified in the present study as having elevated risk levels. The present study's sites are ranked below according to study risk estimates (highest to lowest):

1) Driver Naval Transmitting Facility, station DRI-G1 (10^0 risk estimate).
2) Woodbridge Research Facility, station WRF-G1 (10^0 risk estimate).
3) Woodbridge Research Facility, station WRF-G2 (10^{-1} risk estimate).
4) New Church Energy Associates, station NCE-G1 site (10^{-2} risk estimate).
5) Dahlgren Naval Weapons Lab, station DA-G2 (10^{-3} risk estimate).
6) Yorktown Naval Weapons Station, station NWS-G1 (10^{-4} risk estimate).
7) Allied Colloids, station ACL-G1 (10^{-4} risk estimate).
8) Boykins Narrow Fabrics, station BNF-G1 (10^{-5} risk estimate).
9) HRSD Nansemond-STP, station HN-G1 (10^{-5} risk estimate).

Specific recommendations for further study at each of the above sites are presented below.

Driver Naval Transmitting Facility.

The tissue samples at the DRI-G1 site were the only CZM BI study tissue samples to exceed the FDA's PCB action level of 2 ppm. Maximum PCB tissue concentrations at DRI-G1 approached 30 ppm. The site is associated with the Nansemond River and has a small to medium, tidal, open-water environment. Because of the site's high risk estimate (10^0), future study should include follow up water sampling complemented by live box and/or surrogate organism system studies.

Woodbridge Research Facility WRF-G1.

The WRF-G1 site is on the shore of the Potomac River and has a large, tidal, open-water environment. Because of the site's high risk estimate (10^0), future study should include follow up stormwater sampling complemented by live box and/or surrogate organism system studies.

Woodbridge Research Facility WRF-G2.

The WRF-G2 site is basically a small stream site. However, two problems exist with its current state of characterization: 1) the source of PCBs has not been identified; and 2) no tissue samples have been screened. Because of the site's high risk estimate (10^{-1}) follow up studies should include additional water sampling to identify input sources, re-attempting to collect indigenous organism tissue samples, and deploying liveboxes and/or surrogate organism systems.

New Church Energy Associates.

Data are generally inconclusive about bioconcentratable compound problems at the NCE-G1 site. However, data indicate a potential problem with PCBs, Chlordane, and DDT. Because of the site's high risk estimate (10^{-2}) follow up water sampling should be done to identify sources. Water sampling should be complemented with a live box and/or surrogate organism study.

Dahlgren Naval Weapons Lab.

The DA-G2 site is situated on the shore of the Potomac River, a large, tidal and open-water environment. Consequently, fish may not be sufficiently resident in the impact area to establish maximum tissue concentrations of COC. Because of the high risk estimates (10^{-3}) for this site, follow up sampling of stormwater from the pesticide rinse area drainage swale should be done in order to determine if pesticides are migrating off site. Stormwater sampling should be complemented by live box studies, using shellfish species and/or surrogate organism systems, to determine the maximum potential tissue concentrations for the COC.

Yorktown Naval Weapons Station.

Problems at NWS-G1 appear to be attributable to sediment contamination. Sediment data indicate historical and/or episodic releases of COC have occurred around the Roosevelt Pond tributaries. Follow up studies to identify: 1) PCB sources; 2) maximum potential tissue levels; and 3) tissue contamination levels in Roosevelt Pond fish should be made to determine if the CZM BI study risk estimate (10^{-4}) is accurate.

Allied Colloids

Problems at ACL-G1 appear to be attributable to sediment contamination. The ACL-G1 site is in association with the Nansemond River and therefore must be considered a large, tidal, open-water environment. Because of the site's moderately high risk estimate (10^{-4}) a follow up study using live boxes, surrogate organism systems, and/or a thorough indigenous benthic survey is recommended.

Boykins Narrow Fabrics.

Problems at BNF-G1 appear to be attributable to sediment contamination. Background sediment data indicate historical and/or episodic releases of COC have occurred from the Boykins Narrow Fabrics facility. Follow up studies using live boxes and/or surrogate organisms systems should be made to determine if the moderate CZM BI study risk estimate (10^{-5}) is accurate.

HRSD Nansemond-STP

Data are generally inconclusive about bioconcentratable compound problems at the HN-G1 site. Due to: 1) the numerous potential input sources of COC in Hampton Roads; and 2) the low correlation between HN-G1 water, sediment, and tissue data. Because of these factors, and the site's moderate risk estimate (10^{-5}), follow up study's should be reserved for inclusion in a broader study of bioconcentratable compounds in Hampton Roads.

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