FY 1992 **FINAL PRODUCT** Task 19

Bioaccum. Initiative- Phase III

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY'S BIOACCUMULATION INITIATIVE IN THE COASTAL ZONE MANAGEMENT AREA.

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SUBMITTED BY

OFFICE OF ENVIRONMENTAL RESEARCH AND STANDARDS

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Table of Contents

DRAFT

List of Tables

List of Figures

DRAFT

Appendices

A. Sample analytical data and sampling station maps.

B. Compound evaluation criteria and standards.

C. Quality control and quality assurance data.

DRAFT

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DRAFT

Introduction

DRAFT

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 NPDES program.

Studies performed under the DEQ BI have been conducted using a three phase approach. The three phases consist of: 1) a 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:

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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 first phase in place of the alternative log P field screens. Data examined during the site selection phase included:

- -Department of Defense Installation Restoration Program 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

The proposed list of study sites was then 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 a detailed GC-MS analysis of the compounds present in the sample. The objective of phase II sampling was to determine if any of the study sites were actively discharging or releasing bioconcentratable compounds. Sites documented as discharging or releasing compounds of concern (Appendix B) 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. 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.

Sediment and Tissue:

The eight phase II sites discharging or releasing bioconcentratable compounds of concern, or discharging high numbers of bioconcentratable compounds, were 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, into stripped stainless steel buckets and then transferred to stripped glass jars with Teflon lined lids.

Whenever possible, species collected included 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

DRAFT

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 effluent, sediment, and tissue samples were analyzed by Spectralytix of Gaithersburg, Maryland. Approximately 25% of the samples were split with the Virginia Institute of Marine Science for quality assurance. The semi-volatile, extractable, and halogenated organic compounds in the CZM BI effluent/water, sediment, and tissue 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 (NBS 19XX, Super INCOS v 6.5 - Finnegan). Spectra with fits of 70% or greater were considered tentatively-identified. For tentatively identified spectra the five best identifications 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.

Confirmed identifications were reported with percent fit values, CAS number, GC retention time, concentration, and relative retention index (VIMS 1991). Spectra with fits of less than 70% were reported as unknown. Unknown compounds were reported with the relative retention index and concentration. Analytical data summaries were reported in hard copy. Full analytical data reports were reported digitally for storage in the DEQ-OERS Virginia Toxics Database (VTDB).

Effluent/Water:

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

DRAFT

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 Scope Of Work (EPA CLP SOW, EPA 1990), EPA 415.1 (EPA as appended), 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 (VIMS 1991). Extracted samples 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. Identification and quantification of sample compounds were accomplished using methods described for effluent/water samples.

Tissue:

Moisture and total lipid content were determined for all tissue samples using the EPA CLP SOW (1990) 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. 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.

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Effluent/water:

In addition to the quality control steps generally described above, 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 and matrix spikes were also included with each batch of AVS analyses to assess recovery rates. 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 quality control steps generally described above for organic analyses, sodium sulfate method blanks were extracted and analyzed for each batch of sediment samples.

Tissue:

Sample blanks were run for percent lipid determinations. Additional tissue sample quality controls followed those described for sediment samples.

Data Analyses:

The overall prevalence of bioconcentratable compounds in Virginia's CZM area was assessed using a frequency distribution 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 distribution analyses. Analyses determined if compounds were partitioning through all sampled matrices, or concentrating in specific matrices.

Human health and environmental risks were assessed by comparing sample contaminant concentrations to risk-based State and Federal standards and criteria (Appendix B). 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.

Effluent/water data were screened against: 1) Virginia water quality standards (VWQS) (Virginia Water Control Board 1992); 2) EPA 304(a) criteria (EPA 1991); 3) EPA Compounds of Concern (EPA 1993); 4) EPA Region III Risk Based Concentrations (RBC)

DRAFT

(EPA III 1993); 5) Compound information from the EPA IRIS database (EPA 1993), the National Library of Medicine's MEDLARS databases (National Library of Medicine 1993), and the Numerica databases (Technical Database Services 1993) (Appendix B); and 6) Existing Recieving Stream Characterization Reports (Federal Facility Installation Restoration Program (IRP) reports, Bioaccummulation Initiative site files, 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; 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 (DEQ 1992).

Analytical Quality Assurance:

Previous DEQ BI studies have 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, related to the CZM BI study, 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 1990), and the EPA CLP.

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 detected, identified, halogenated compounds, and quantitation of these compounds, to VIMS data for the quality assurance split samples.

DRAFT

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.

Results

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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 DEQ's CZM Area regions (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 (Table 1) for matrix correlation analyses. 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 are reported separately 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 for analysis. The 49 phase II 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** (6), and **NASA Goddard - NSG-G1** (1) indicated no compounds were being discharged or released into CZM Area waters in concentrations greater than 1 ppb (1 ppb = detection level).

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

DRAFT

ppb) were being discharged. The two phthalic acid esters identified in the Chesapeake Corporation discharge are listed on the Federal Priority Pollutant list (EPA 19XX) and one is listed as a known carcinogen in the Numerica database QSAR (TDS 19XX). 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 alcohol (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 on the effluent/water screening lists.

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. Therefore, these sites were not included in the CZM BI phase III studies.

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 compounds on one or more of the effluent/water screening lists were being discharged or released from these sites. The five sites, number of samples per site, compounds of concern at each site, 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 (WRF10), 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 human health and environmental risks in 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 to be done. 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 to be done.

4) Phase II data from three of the 12 study sites did not indicate the discharge or release of compounds on the effluent/water screening list. 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.

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Sediment/soil:

1) Under phase III of the CZM BI study 69 sediment/soil samples were collected for analysis from eight sites. 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 due to the Phase II data showing an active release of PCBs, and the general lack of information as to potential sources.

2) All Phase III sediment/soil samples contained compounds on the sediment/soil screening lists. The eight sites, number of samples per site, compounds of concern at each site, 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;

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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 for analysis from eight sites.

2) All Phase III tissue samples contained compounds on the tissue screening lists. The eight sites, number of samples per site, compounds of concern at each site, 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; gama-BHC, 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;

DRAFT

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.

Quality Control:

All CZM BI study Quality Control (QC) data are reported in Appendix C. Sample quality control identifier information is also 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

DRAFT

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.

Sediment/soil:

Detection levels reported for sediment organic analyses were 0.05-0.5 ppb for halogenated compounds and 10.0 ppb for semi-volatile compounds. All compound concentrations are reported on a dry weight basis.

Inorganic Analyses:

1) Percent moisture:

a) duplicates - The relative percent difference between sample percent moistures and duplicate sample percent moistures 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:

DRAFT

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).

DRAFT

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).

DRAFT

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. All compound concentrations are reported on a wet weight basis.

Inorganic analyses:

1) Percent moisture:

a) duplicates - The relative percent difference between sample percent moistures and duplicate sample percent moistures 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

DRAFT

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%).

DRAFT

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).

Quality Assurance:

The quality assurance (QA) data for the CZM BI phase II effluent splits are reported in Appendix A with the study's analytical results. The QA data for the DEQ BI 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:

DRAFT

Quantico Marine Base:
QMSW1 - 6 /13, PCB, 40.5 / 643, 15.9.
Chlordane, 1.2 / 2.4, 2.
4,4'-DDD, 130 / 56, 5.8.
4,4'-DDE, 53 / 175.6, 53.
4,4'-DDT, 29 / 218.1, 7.5.
Dieldrin, 0.6 / 3.1, 5.2.

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:

Quantico Marine Base:

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 / 9,	PCB, 59.0 / 248.0, 4.2. 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. 4,4'-DDD, 3.7 / 10.3, 2.7. 4,4'-DDE, 11.0 / 31.9, 2.9.
QMCC01 (largemouth bass fillet)	- 3 / 10,	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 / 9,	PCB, 410.0 / 292.8, 1.4. Chlordane, 25.5 / 12.3, 3.3. 4,4'-DDD, 57.0 / 19.2, 3.0. 4,4'-DDE, 130.0 / 62.7, 2.0
QMCC01 (yellow perch fillet)	- 1 / 5,	4,4'-DDE, 1.4 / 4.2, 3.0.
QMCC02 (goldfish fillet)	- 4 / 6,	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 / 7,	PCB, 94.0 / 118.8, 1.3. 4,4'-DDD, 16.8 / 9.2, 1.8. 4,4'-DDE, 56.0 / 30.7, 1.8.

DRAFT

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 / 11,	PCB, 540 / 1090.6, 2.0 Chlordane, cis + trans, 13.7 / 1.6, 8.5 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 / 13,	PCB, 360 / 384, 1.1. Chlordane, cis + trans, 17.4 / 1.3, 13.8. 4,4'-DDD, 7.4 / 21.9, 3.0. 4,4'-DDE, 93.2 / 78.7, 1.2.
QMCC03 (yellow perch viscera)	- 6 / 14,	PCB, 140.0 / 1074.2, 7.7. Chlordane, cis + trans, 2.4 / 0.2, 14.1. 4,4'-DDD, 19.4 / 62.8, 3.2. 4,4'-DDE, 31.8 / 172.5, 5.4.
QMCC03 (largemouth fillet)	- 2 / 8,	PCB, 120.0 / 385.0, 3.2. 4,4'-DDE, 83.0 / 79.9, 1.
QMCC03 (largemouth viscera)	- 1 / 12,	PCB, 720.0 / 2905.0, 4.0.
QMCC03 (sunfish fillet)	- 6 / 14,	PCB, 86 / 157.7, 1.8. Chlordane, cis + trans, 2.0 / 6.1, 3. 4,4'-DDD, 16.5 / 13.9, 1.2. 4,4'-DDE, 31.4 / 42.1, 1.3.

Table 1. Stations sampled under the 1993 Virginia Department of Environmental Quality's study of bioconcentratable compounds in the Coastal Zone Management area of Virginia. Within each facility, sampling stations have been grouped by potential for pollutant transport interconnection. Station maps are provided in Appendix A.

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	Potomac R, 20 m bel DASTP001, approx 0.2 mi ab Machodoc Cr	POTOM	Potomac R	
DA5	Potomac R, 20 m ab DASTP001, approx 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	

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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 E 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 N confl of Woodbridge Research Fac. main X-trib	POTOM	Potomac R	
WRF06	Potomac R at NW confl of Woodbridge Research Fac. main X-trib	POTOM	Potomac R	
WRF07	Woodbridge Research Facility main compound W side stormwater	POTOM	X-trib to Occoquan R to Potomac R	
WRF08	Woodbridge Research Facility main compound S side stormwater	POTOM	X-trib to Occoquan R to Potomac R	
WRF09	Woodbridge Research Facility main compound N 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	

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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	

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Table 1 -- continued.

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
Virginia Dept. of Environmental Quality's Tidewater Region				
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	

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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	

DRAFT

Table 1 -- continued.

Station code	Station name[1]	Basin	Receiving stream	Fresh or salt[2]
Virginia Dept. of Environmental Quality's Tidewater Region -- continued				
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	

DRAFT

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	

DRAFT

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	

DRAFT

Table 1 -- continued.

<u>Notes:</u>

[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 Intensive Remediation 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.

DRAFT

Discussion

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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 compounds of concern (COC) (table 2) due to their potential to bioconcentrate and create human health and environmental risks. 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 (QSAR).

Effluent/water.

The three COC with the highest frequency of occurrence in water/effluent samples were, by decreasing frequency: 1) PCB; 2) Phthalic acid, di-(2-ethylhexyl) ester; and 3) Lindane (table 2). Remaining COC in water/effluent 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 water/effluent samples were approximately 25% of the total number of COC identified (table 2). These data indicate relatively few facilities <u>currently</u> release COC. However, data indicate current releases of COC represent an exposure pathway for human health and environmental risk. Of the ten COC identified in water/effluent samples, five were also identified in tissues samples (figure 1). The compounds, in order of frequency of occurrence in tissue samples were: 1-2) Endrin, PCB; 3-5) Heptachlor, Lindane, 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 (29) identified in the sediment matrix was almost three times the number of COC identified in effluent/water 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

DRAFT

introduced to Virginia's CZM area surface water environment through historical releases. The prevalence and persistence of the sediment COC create a potential for establishing exposure pathways through food chain mechanisms (bioaccumulation). Of the 29 COC identified in the CZM BI sediment samples, nine were identified in tissue samples of indigenous fish and shellfish (Figure 1). 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; 9) Benzo[a]pyrene (table 2).

<u>Tissue.</u>

The three COC with the highest frequency of occurrence in tissue samples were, by decreasing frequency: 1) Fluoranthene; 2) DDD; 3) Pyrene / DDT / Benzo[b]fluoranthene (table 2). Remaining COC in tissue samples had a frequency $\leq$ 2 and are comprised of both halogenated compounds and PAHs (table 2). Of the 39 COC, 12 were identified in tissue samples of indigenous fish, shellfish, and amphibians (table 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, Benzo[a]pyrene (table 2). Data indicate sediments were the dominant source of tissue COC (figure 1) and that bioaccumulation of COC was a more prevalent exposure pathway than bioconcentration. Compounds 9-11 were found in water/effluent samples only, compounds 1, 2, 4, 5, 7, 8, and 11 were found in sediment samples only, and compounds 3 and 6 were found in sediment and water samples (table 2).

<u>Soil.</u>

The frequency of occurrence of compounds 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.

DRAFT

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 (table 2).

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 water/effluent samples consisted of a mixture of halogenated compounds and PAHs (Table 2).

The percentage of COC identified in NR water/effluent 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 water/effluent samples, two were also identified in tissues samples (figure 2). 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 (27) identified in the sediment matrix was over three times the number of COC identified in effluent/water 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 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 tissue samples were identified in NR sediment samples (Figure 2). 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).

DRAFT

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. Of the eight COC identified in NR tissue samples, none were exclusively identified in NR water/effluent samples. Compound 7 was found in NR sediment samples only, and compounds 1-6, and 8 were found in both NR sediment and water samples (table 2).

DRAFT

Northern Region site specific risk assessments.

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.

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 19XX); 2) A general quality assurance problem associated with the analyses of water/effluent 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 missed 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.

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, 27 were identified in phase II and phase III samples from DA-G2 (table 3).

Effluent/water risk estimates.

Of the five COC identified in the phase II DA-G2 samples (table 3), one exceeded Virginia's Water Quality Standard for the protection of human health (VHHO, 10^{-5} risk level) (Virginia DEQ 19XX), two exceeded the Federal Water Quality Criteria for the protection of human health (FHHO, 10^{-6} risk level) (EPA 19XX), five exceeded the Virginia Water Quality Standard for the chronic protection of aquatic life (VALC) (Virginia DEQ 19XX), and four exceeded the Federal Water Quality Criteria for the continuous protection of aquatic life (FALC) (EPA 19XX) (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 - 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 water/effluent 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 22 COC identified in the phase III DA-G2 sediment samples (table 3), seven exceeded the National Status and Trends Effects Range Low (NERL) (NOAA 19XX), and five exceeded the National Status and Trends Effects Range Medium (NERM) (NOAA 19XX). The compounds, standards and/or criteria exceeded, and order of magnitude (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 3).

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 nine COC identified in the phase III DA-G2 tissue samples, one exceeded the Virginia DEQ draft Screening Value for Tissue (VTSV, 10^{-5} risk level) (Virginia DEQ 19XX), and four exceeded the EPA III Risk Based Concentration screening values (FRBT, 10^{-6} risk level) (EPA 19XX). The compounds, standards and/or criteria exceeded, and order of magnitude (OM) of the exceedences were: 1) PCB, VTSV - 1 OM, FRBT - 3 OM; 2) Chlordane, FRBT - 0 OM; 3)

DRAFT

Total DDE, FRBT - 1 OM; 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.

DRAFT

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 (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, 33 were identified in phase II and phase III samples from WRF-G1 (table 3).

Effluent/water risk estimates.

Of the two COC identified in the phase II WRF-G1 sample (table 3) 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 26 COC identified in the phase III WRF-G1 sediment samples (table 3), 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 ten of the COC in the WRF-G1 sediments were identified in DA-G2 tissue samples (figure 4).

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 10 COC identified in the phase III DA-G2 tissue samples, four exceeded the VTSV and/or the FRBT. The compounds, standards and/or criteria exceeded, and order of magnitude (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

DRAFT

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 DA-G2 soil samples, 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.

DRAFT

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 (table 3).

Effluent/water risk estimates.

The single COC identified in the phase II WRF-G2 sample, PCB, (table 3) 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 sediment samples.

Sediment risk estimates.

Of the nine COC identified in the phase III WRF-G2 sediment samples (table 3), 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.

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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, 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.

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.

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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 (table 2).

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 (Table 2).

The percentage of COC identified in TR water/effluent 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 water/effluent samples, two were also identified in tissues samples (figure 6). 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 (table 2). The number of COC (22) identified in the sediment matrix was over five times the number of COC identified in effluent/water 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 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 2). The six compounds, by decreasing frequency of occurrence were: 1) DDE; 2) PCB; 3) DDD; 4) Chlordane; 5) DDT; 6) Dieldrin (table 2).

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Tissue.

Lindane, and Phthalic acid, diethyl ester were identified in TR tissue samples in addition to the six COC reported above. 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 (table 2).

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Tidewater Region 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, 13 were identified in phase II and phase III samples from ACL-G1 (table 3).

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 13 COC identified in the phase III ACL-G1 sediment samples (table 3), four exceeded the NERL and two exceeded the NERM. 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 7).

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.

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Tissue risk estimates.

Of the four COC identified in the phase III ACL-G1 tissue (table 3) samples, 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.

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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, 10 were identified in phase II and phase III samples from BNF-G1 (table 3).

Effluent/water risk estimates.

No COC were identified in the phase II BNF-G1 samples (table 3). No quality control problems were associated with the phase II 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. Quality control problems associated with the BNF3 sediment sample included: 1) recovery of the Perinapthenone and Tribromophenol surrogates below the QCL.

Of the nine COC identified in the phase III BNF-G1 sediment samples (table 3), 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 8).

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 from below the unnamed tributary confluence with Tarrara Creek.

Of the four COC identified in the phase III DA-G2 tissue samples,

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two exceeded the FRBT. 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 WRF-G1 phase III tissue samples was 10^{-5} for DDT and PCB.

Quality Control problems associated with analyses of WRF-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.

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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, 15 were identified in phase II and phase III samples from DRI-G1 (table 3).

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 (table 3). 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 13 COC identified in the phase III DRI-G1 sediment samples (table 3), one (PCB) exceeded the NERL by 2 OM and the NERM by 1 OM. Risk from sediment contamination at BNF -G1 may be inferable from the tissue risk estimates as two of the COC in the DRI-G1 sediments were identified in BNF-G1 tissue samples (figure 9).

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.

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Tissue risk estimates.

Of the three COC identified in the phase III DRI-G1 tissue samples, 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 19XX) 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;

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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, 19 were identified in phase II and phase III samples from HN-G1 (table 3).

Effluent/water risk estimates.

Of the two COC identified in the phase II HN-G1 sample (table 3), 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 13 COC identified in the phase III HN1-G1 sediment samples (table 3), one (PCB) exceeded the NERL by 0 OM. Risk from sediment contamination at HN1-G1 may be inferable from the tissue risk estimates as PCBs were identified in HN1-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 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.

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Tissue risk estimates.

Of the five COC identified in the phase III HN1-G1 tissue samples, four exceeded tissue assessment criteria. 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 HN1-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.

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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 at the New Church Energy 001 discharge to the unnamed tributary (Appendix A). Of the 39 COC, 14 were identified in phase II and phase III samples from NCE-G1 (table 3).

Effluent/water risk estimates.

The single COC identified in the phase II NCE-G1 sample, PCB, (table 3) 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}. 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 (table 3), two exceeded the NERL. 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 DDT was identified in NCE-G1 tissue samples (figure 11).

Quality control problems associated with analyses of DRI-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. DRAFT

Of the six COC identified in the phase III NCE-G1 tissue samples, three exceeded tissue assessment criteria. The compounds, standards and/or criteria exceeded, and OM of the exceedences were: 1) Chlordane, FRBT - 0 OM; 2) DDT, 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.

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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, 19 were identified in phase II and phase III samples from NWS-G1 (table 3).

Effluent/water risk estimates.

No COC were identified in the phase II NWS-G1 samples (NWS06, NWS07) (table 3). Quality Control problems associated with analyses of NWS-G1 phase II samples included: 1) recovery of the 1,1-Binpthyl surrogate above the QCL.

Sediment risk estimates.

Of the 18 COC identified in the phase III NWS-G1 sediment samples (table 3), five exceeded sediment assessment values. 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, and PCBs were identified in NCE-G1 tissue samples (figure 12).

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.

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Tissue risk estimates.

Of the six COC identified in the phase III NWS-G1 tissue samples, three exceeded tissue assessment criteria. 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 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 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.

Summary

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Sources of bioconcentratable compounds in Virginia's CZM area.

Phase II and phase III sample data indicate that few bioconcentratable compounds are currently being released through point and non-point source discharges. However, significant exceptions were identified in the CZM BI study. Data further indicate that sediments in the Virginia CZM area represent a substantial source of bioconcentratable compounds, apparently due to historical or episodic releases of bioconcentratable compounds. Tissue data indicate sediment related compounds are concentrating in indigenous fish and shellfish to an extent which may increases 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. Only two of the twelve compounds identified in the study's tissue samples were non-halogenated compounds. The hydrophobic, lipophilic behavior of halogenated compounds is well documented. Because of this quantitative structure activity relationship it does not require a large source of halogenated compounds to produce a significant tissue contamination problem. This phenomena is reflected in the study's sediment data where only one (PCB) of the five most commonly identified sediment contaminants is a halogenated compound.

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

Site specific summaries.

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Dahlgren Naval Weapons Lab

Phase II samples from 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}.

Woodbridge Research Facility WRF-G1

Phase II samples from 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 DA-G2 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 DA-G2 tissue samples at levels exceeding one or more tissue assessment values.

Of the 33 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}.

Woodbridge Research Facility WRF-G2. DRAFT

Phase II samples from 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-G1 were estimated at 10^{-1} for the water borne concentrations of PCB. Additive risk for all COC at WRF-G1 may be higher than 10^{-1}.

Allied Colloids.

No COC were identified in the ACL-G1 phase II samples. 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}.

Boykins Narrow Fabrics.

No COC were identified in the BNF-G1 phase II samples. 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}.

Driver Naval Transmitting Facility.

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Phase II samples from 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^{-1}.

HRSD Nansemond-STP.

Phase II samples from 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 HN1-G1 sediment samples above sediment assessment values. Chlordane, Total DDT, and Dieldrin were identified in HN1-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 HN1-G1 sediment COC may be high.

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

New Church Energy Associates.

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Phase II samples from 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}.

Yorktown Naval Weapons Station.

No COC were identified in the NWS-G1 phase II samples. 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}.

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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, p=federal priority contaminant, c=federal contaminant of concern.
2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

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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
98-82-8		Benzene, (2-propyl)- (cumene)	1	0	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

1 V=Va. water quality standard, p=federal priority contaminant, c=federal contaminant of concern.
2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

DRAFT

All sites sampled

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
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
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
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
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
4362-18-9		Dioxolane, 2-methyl-2-(phenylmethyl)-1,3-	0	0	1	0

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Table 2 - continued.

DRAFT

All sites sampled

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
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
		Extractable organic compound, UID	2	21	35	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	pc	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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Table 2 - continued.

DRAFT

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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Table 2 - continued.

DRAFT

All sites sampled

CAS		Compound name[1]	Wat	Sed	Tis	Sol
			Number of observations[2]			
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.

DRAFT

All sites sampled

CAS	Compound name[1]	Wat	Sed	Tis	Sol
		Number of observations[2]			
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	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
58-95-7	Vitamin E acetate (VAN)	0	0	1	0
95-47-6	Xylene, o- (1,2-dimethylbenzene)	1	0	0	0

	Wat	Sed	Tis	Sol	All
Number compounds detected:[3]	53	158	92	59	276
Number compounds with Va. water quality standards detected:[4]	7	23	13	16	29
Number federal priority contaminants observed:[4]	10	30	14	23	40
Number EPA contaminants of concern observed:[4]	15	6	11	10	5

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2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.
3 Aroclors, DDT products, Chlordane isomers counted separately.
4 Aroclors, DDT products counted separately; Chlordane isomers grouped as one.

Table 2 - continued.

DRAFT

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
98-82-8		Benzene, (2-propyl)- (cumene)	1	0	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

[1] V=Va. water quality standard, p=federal priority contaminant, c=federal contaminant of concern.
[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

DRAFT

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Wat	Sed	Tis	Sol
			Number of observations[2]			
58-89-9	vpc	Benzenehexachloride, gamma- (gamma-BHC; gamma-hexachlorocyclohexane;	1	0	0	0
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
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
25152-84-5		Deca-2,4-dienal, (E,E)-	0	0	10	0
334-48-5		Decanoic acid	0	2	0	0

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

Table 2 - continued.

DRAFT

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Number of observations[2] Wat	Sed	Tis	Sol
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
		Extractable organic compound, UID	0	12	19	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	pc	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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Table 2 - continued.

DRAFT

Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Wat	Sed	Tis	Sol
			Number of observations[2]			
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.

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Va. Dept. of Environmental Quality's Northern Region

CAS		Compound name[1]	Wat	Sed	Tis	Sol	All
			Number of observations[2]				
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	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	
58-95-7		Vitamin E acetate (VAN)	0	0	1	0	
95-47-6		Xylene, o- (1,2-dimethylbenzene)	1	0	0	0	
		Number compounds detected:[3]	25	108	74	59	200
		Number compounds with Va. water quality standards detected:[4]	6	22	11	16	27
		Number federal priority contaminants observed:[4]	7	29	11	23	36
		Number EPA contaminants of concern observed:[4]	4	10	8	5	5

1 V=Va. water quality standard, p=federal priority contaminant, c=federal contaminant of concern.
2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.
3 Aroclors, DDT products, Chlordane isomers counted separately.
4 Aroclors, DDT products counted separately; Chlordane isomers grouped as one.

Table 2 - continued.

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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
		Number compounds with Va. water quality standards detected:[4]	1	0	0	0	1
		Number federal priority contaminants observed:[4]	2	0	0	0	2
		Number EPA contaminants of concern observed:[4]	0	0	0	0	0

1 V=Va. water quality standard, p=federal priority contaminant, c=federal contaminant of concern.
2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.
3 Aroclors, DDT products, Chlordane isomers counted separately.
4 Aroclors, DDT products counted separately; Chlordane isomers grouped as one.

Table 2 - continued.

DRAFT

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.

DRAFT

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
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
		Extractable organic compound, UID	2	9	16	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	pc	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, p=federal priority contaminant, c=federal contaminant of concern.
[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

DRAFT

Va. Dept. of Environmental Quality's Tidewater Region

CAS		Compound name[1]	Wat	Sed	Tis	Sol
			Number of observations[2]			
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, p=federal priority contaminant, c=federal contaminant of concern.
[2] Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.

Table 2 - continued.

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Va. Dept. of Environmental Quality's Tidewater Region

CAS		Compound name[1]	Wat	Sed	Tis	Sol
			Number of observations[2]			
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

	Wat	Sed	Tis	Sol	All
Number compounds detected:[3]	29	113	39	0	161
Number compounds with Va. water quality standards detected:[4]	4	20	9	0	24
Number federal priority contaminants observed:[4]	5	24	10	0	30
Number EPA contaminants of concern observed:[4]	4	10	9	0	0

1 V=Va. water quality standard, p=federal priority contaminant, c=federal contaminant of concern.
2 Wat=ambient water or effluent, Sed=sediment, Tis=tissue, Sol=soil.
3 Aroclors, DDT products, Chlordane isomers counted separately.
4 Aroclors, DDT products counted separately; Chlordane isomers grouped as one.

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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; Table 1 lists sampling stations within each group, and site maps are in Appendix A.

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 1 -- continued.

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

DAHLGREN NAVAL WEAPONS LAB -- continued

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

s	t			Extractable organic compound, UID
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-

Table 1 -- continued.

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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 1 -- 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 1 -- continued.

DRAFT

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
	t			Extractable organic compound, UID
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)-

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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			Phenylpropanedioic acid
	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
	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-

DRAFT

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 1 -- continued.

DRAFT

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 1 -- continued.

DRAFT

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)
	t		Extractable organic compound, UID
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-

Table 1 -- continued.

DRAFT

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	t	w	Extractable organic compound, UID
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-

Table 1 -- continued.

DRAFT

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			Extractable organic compound, UID
s			Limonene
s			Phenol, 3-methyl- (m-cresol)

Table 1 -- continued.

DRAFT

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	t		Extractable organic compound, UID
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-

Table 1 -- continued.

DRAFT

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
	t		Extractable organic compound, UID
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

Table 1 -- continued.

DRAFT

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	t			Phthalic acid, butyl isobutyl ester
s				Pyrene
s	t			Tridecatrienenitrile, 4,8,12-trimethyl-3,7,11-

Table 1 -- continued.

DRAFT

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

NASA GODDARD FLIGHT CENTER

NSG-G1 NASA Goddard Flight Center 001

		W		Chlorinated hydrocarbon

Table 1 -- continued.

DRAFT

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 1 -- continued.

DRAFT

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)-
	t			Extractable organic compound, UID
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-

Table 1 -- continued.

DRAFT

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	t			Phenanthrenecarboxyaldehyde, octahydro-1,4a-dimethyl-1- (dehydroabietaldehyde)
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-

NWS-G7 Seep at end of Barracks Rd

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

Table 4. Maximum concentrations in each facility group[1] compared with standards and criteria for compounds detected in water (effluent or ambient), sediment, soil, and tissue samples collected under the 1993 Virginia Department of Environmental Quality's study of bioconcentratable compounds in the Coastal Zone Management area of Virginia. Asterisk (*) beneath criteria[2] indicates exceedance.

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	

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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	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
			.23000E+3	.16000E+4		.93300E+1		.43000E+1		.31100E+0	.31000E-1				.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	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
						.59800E+1		.18000E+1			.46000E-1				.16000E+4
WRF-G1	.55000E+0														

Benzenehexachloride, delta- (delta-BHC; delta-hexachlorocyclohexane)

Facil. group	Max. conc.	Site FSSC	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
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														

DRAFT

Table 4 -- continued.

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

Benzo[a]pyrene

	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
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+3
DA-G2	.38000E+2														
WRF-G1	.25000E+3				.14000E+3	*		*						.53000E+3	*
WRF-G2	.19000E+3														

Chlordane, total

	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
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	

DRAFT

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														

DRAFT

Table 4 -- continued.

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

DDE, total

	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
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

	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
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

	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
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	

DRAFT

Table 4 -- continued.

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

Dibenz(a,h)anthracene

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
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

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
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

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
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	

DRAFT

Table 4 -- continued.

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

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

DRAFT

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														

DRAFT

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

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
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+7
DA-G2									.23000E+1			*			

Naphthalene

Facil. group	Max. conc.	Site FSSC	.34000E+3	.21000E+4	Max. conc.			.54000E+5	Max. conc.					Max. conc.	.41000E+8
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														

DRAFT

Table 4 -- continued.

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

Xylene, o- (1,2-dimethylbenzene, 1,2-dimethyl)

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

DRAFT

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

DRAFT

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	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
						.65380E+1		.19000E+0		.14000E-2	.14000E-3	.13000E+0			.17000E+3
ACL-G1	.29500E+1														

Anthracene

Facil. group	Max. conc.	Site FSSC	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
			.85000E+2	.96000E+3		.33000E+7		.41000E+6		.11000E+6	.11000E+6				.31000E+9
HN-G1	.28000E+2														
NCE-G1	.17000E+2														
NWS-G1	.22000E+2														

Benz[a]anthracene

Facil. group	Max. conc.	Site FSSC	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
			.23000E+3	.16000E+4		.93300E+1		.43000E+1		.31100E+0	.31000E-1				.39000E+4
DRI-G1	.54000E+2														
HN-G1	.13000E+3														
NWS-G1	.18000E+3														

DRAFT

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	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
						.16900E+1		.50000E+0			.13000E-1				.45000E+3
HN-G1									.18000E-1		*				

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

Facil. group	Max. conc.	Site FSSC	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
						.32500E+4		.24000E+1		.25000E+2	.63000E-1	.10000E-1			.22000E+4
HN-G1									.21000E-1			*			
NCE-G1					.77000E+0										

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

Facil. group	Max. conc.	Site FSSC	NERL	NERM	Max. conc.	VTSV	FDA	FRBT	Max. conc.	VHHO	FHHO	VALC	FALC	Max. conc.	FRBT
						.93300E+1		.43000E+1		.31100E+0	.31000E-1				.39000E+4
ACL-G1	.10500E+3														
BNF-G1	.65000E+2														
DRI-G1	.16000E+3														

DRAFT

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														

DRAFT

Table 4 -- continued.

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

Benzo[a]pyrene

	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
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+3
DRI-G1	.63000E+2														
HN-G1	.15000E+3														
NWS-G1	.28000E+3														

Caprolactam

	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
Facil. group	Max. conc.	Site FSSC			Max. conc.			.68000E+6	Max. conc.					Max. conc.	.51000E+9
ACL-G1									.80000E+1						

Chlordane, total

	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
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			*							

DRAFT

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														

DRAFT

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

DDT, total

	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
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

	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
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 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
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+3
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+7
ACL-G1	.26100E+1														

DRAFT

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										

DRAFT

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														

DRAFT

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													

DRAFT

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
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
NWS-G7									.49000E+3	*	*				
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
ACL-G1	.47000E+2														
BNF-G1	.33000E+2														
DRI-G1	.14000E+3														
HN-G1	.24000E+3														
NCE-G1	.16000E+2														
NWS-G1	.30000E+3														
Total regional exceedances:		0	17	5		4	1	14		3	4	3	2		0

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Table 4 -- continued.

Notes:

[1]A description of each facility group is provided in Table 1. A complete listing of analytical results by station is provided in Table A-1.

[2]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.

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Figure 1

FACILITY: ALL

"listed Compounds" 39

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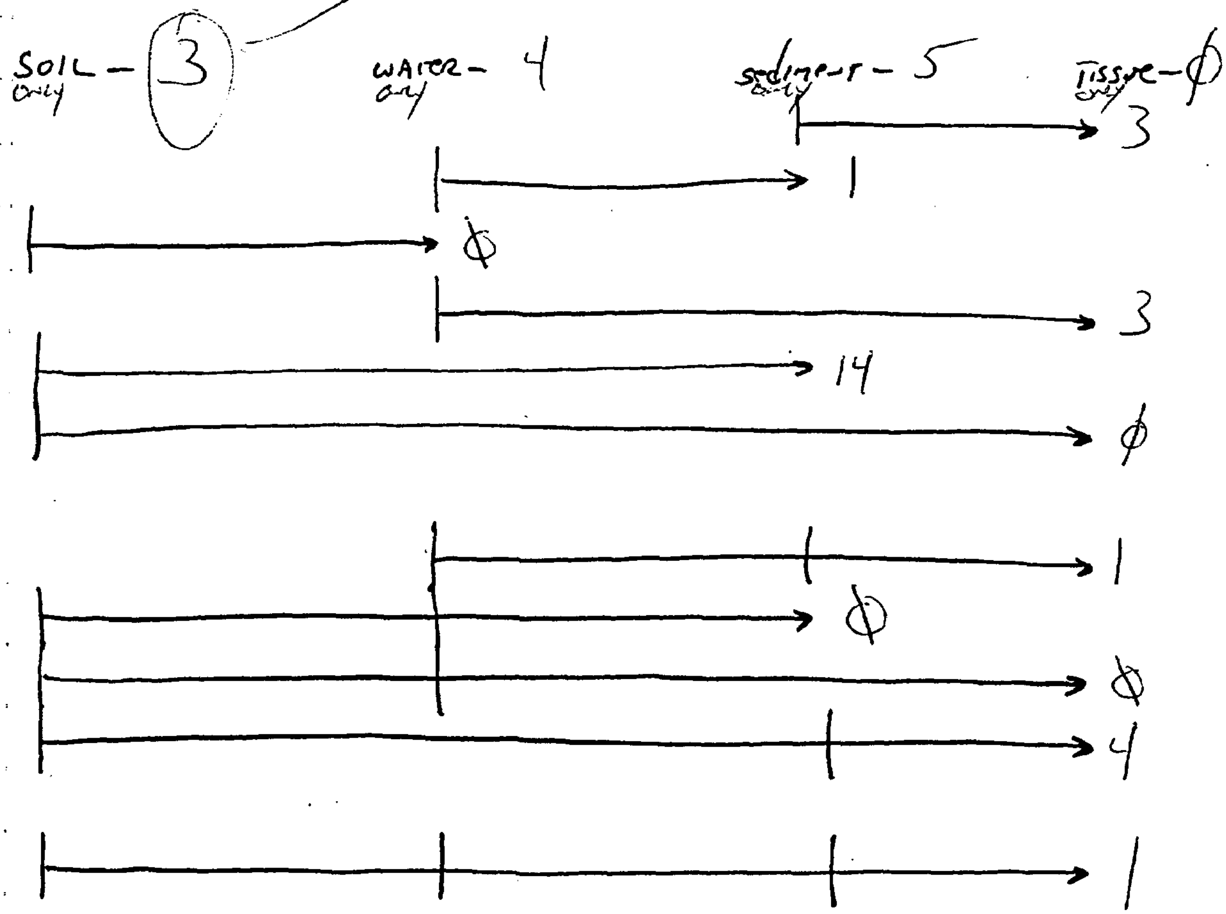
List Compounds in FINAL Figure 3



Soil – 22
WATER – 10
Sediment – 29
Tissue – 12

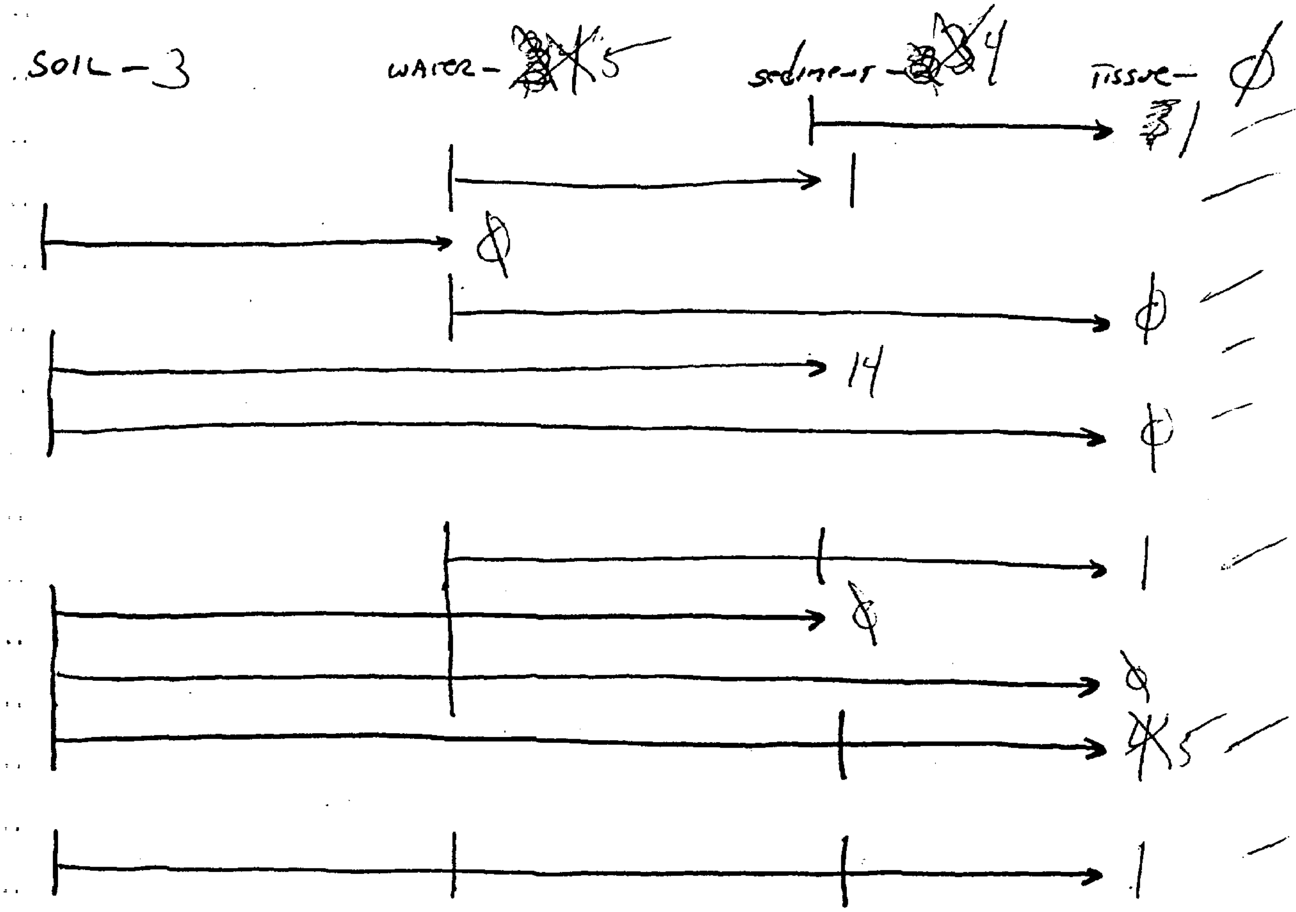
S-T – 9

Fig 2

Facility: NR

"listed Compounds" ~~34~~ 35

DRAFT



Soil – 23
Water – 8
Sediment – ~~26~~ 27
Tissue – 4

Figure 3

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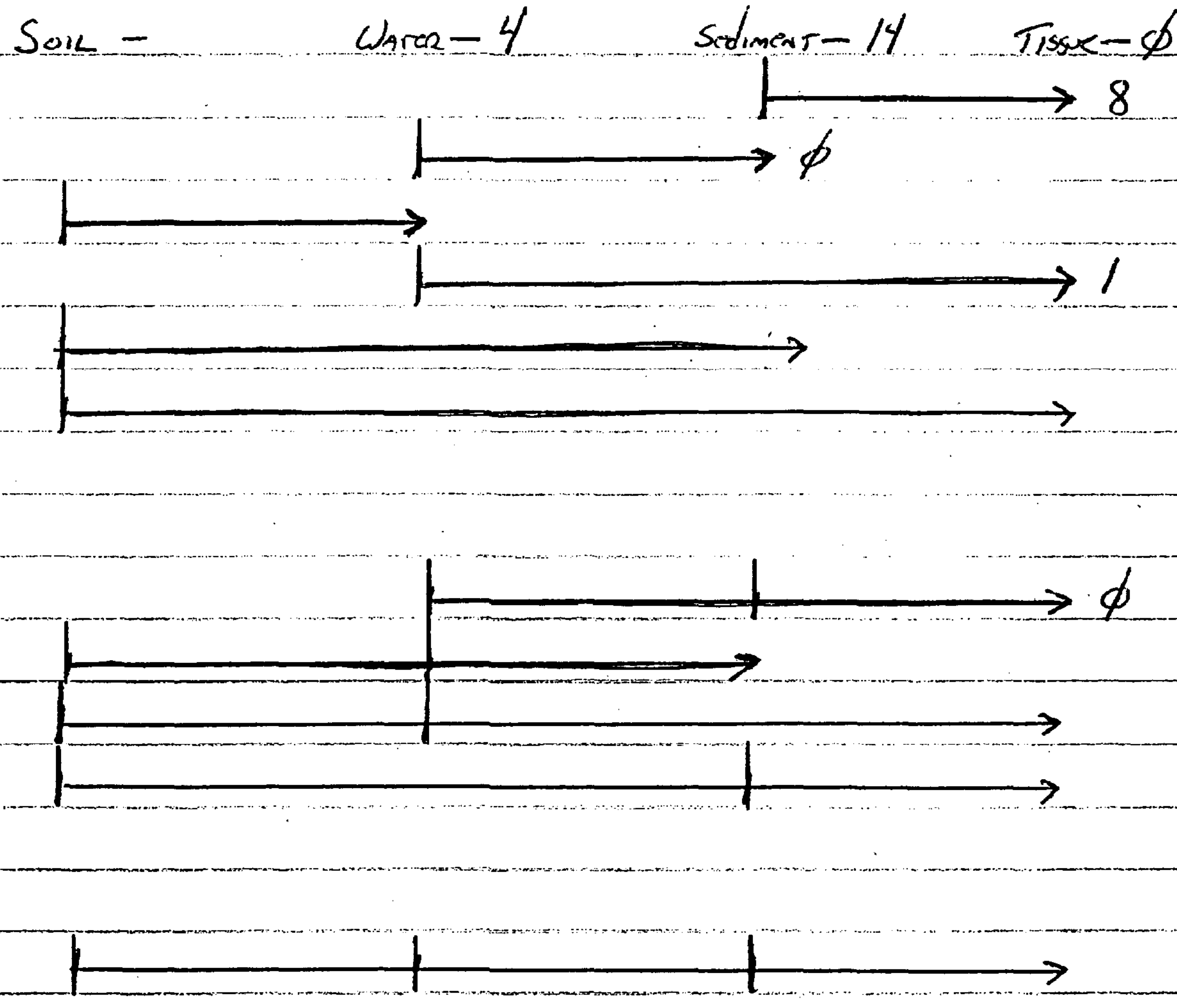
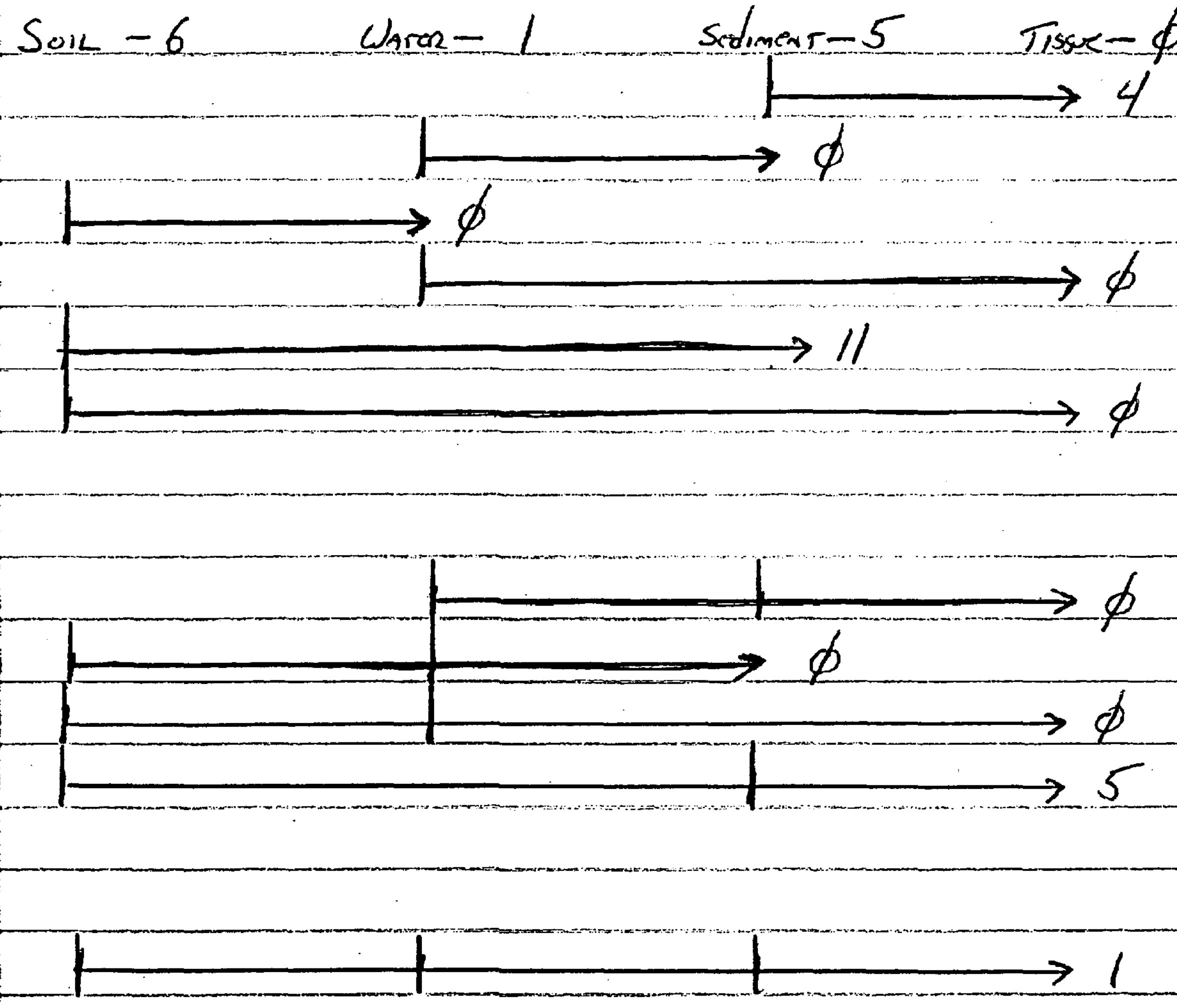
FACILITY: Dahlgren - 001 / Pesticide rinse area
27 listed Compounds



Water - 5
Sed - 22
Tis - 9

DRAFT Figure 4

Facility : Woodbridge Research Facility - Old Landfill #
333~~4~~ Listed Compounds

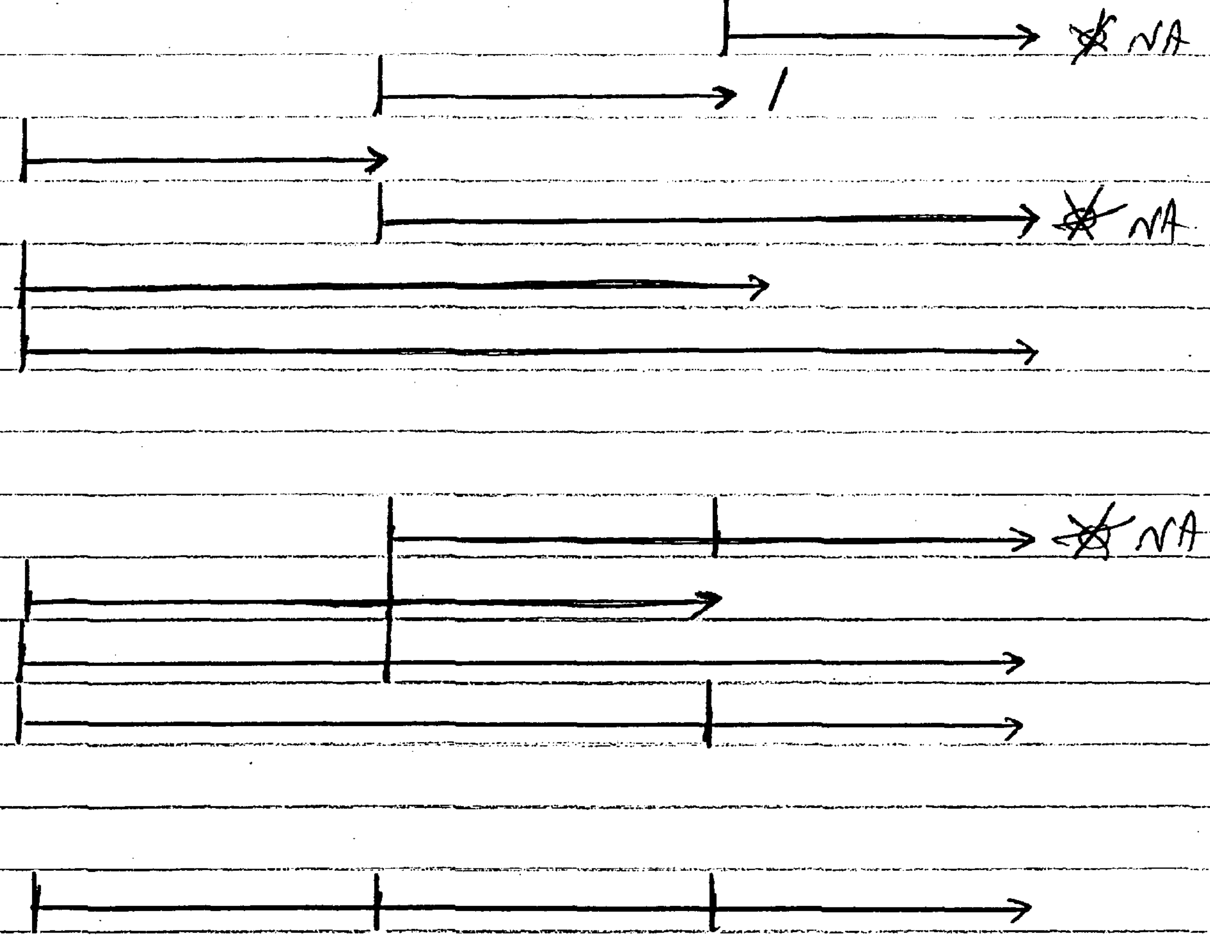


Water - 2
Sed - ~~15~~ 26
Soil - 23
Tissue - 10

DRAFT Figure 5

FACILITY: Woodbridge Research Facility – Main Compound OUTFALL
9 Listed Compounds

Soil – Water – Ø Sediment – 8 Tissue – ~~Ø~~ NS



Water – 1
Sed – 9
Tis – Ø – Not Sampled

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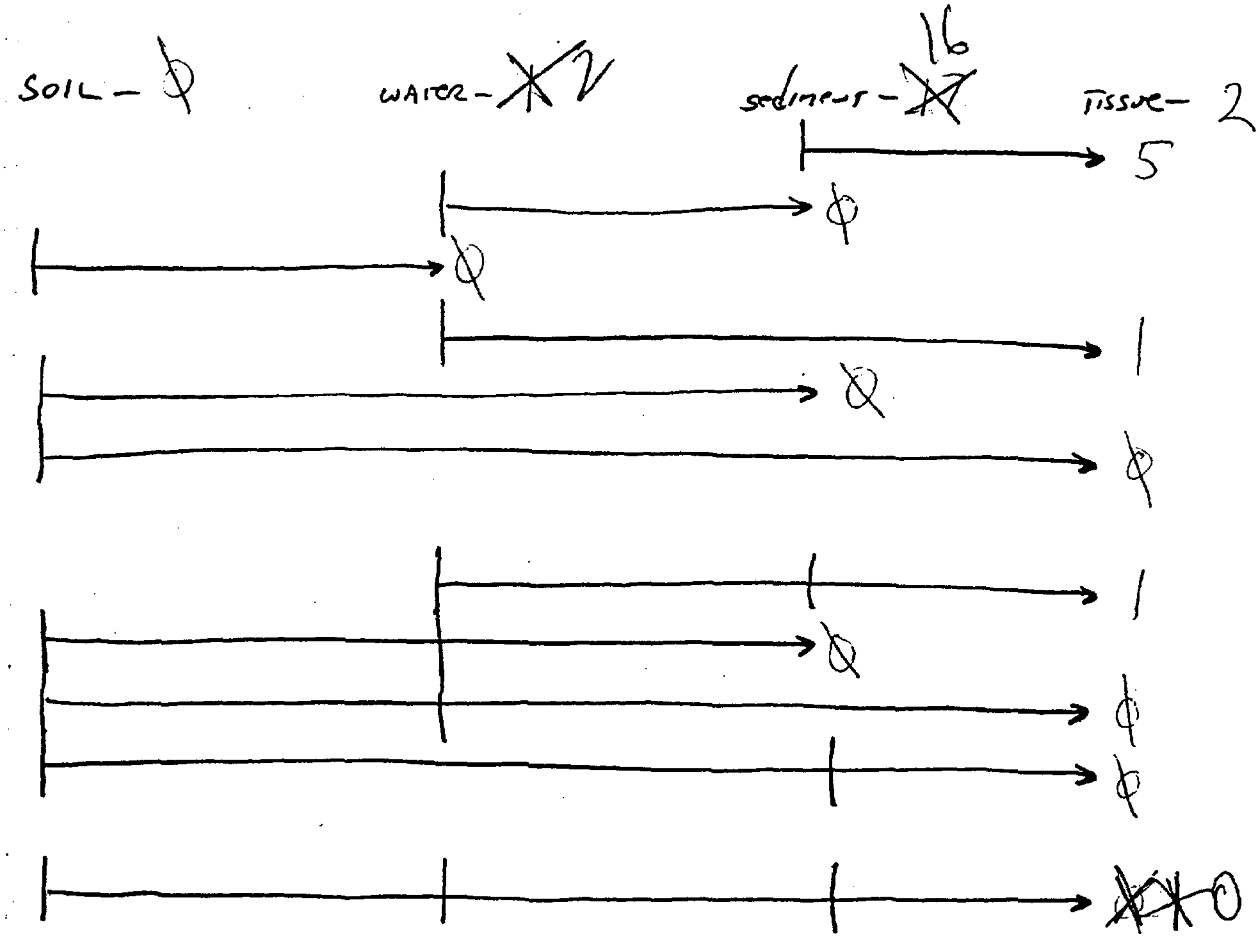
Fig 6

Facility: TR
"listed Compounds" 27



Soil – X
Water – 4
Sediments – 22
Tissue – 9

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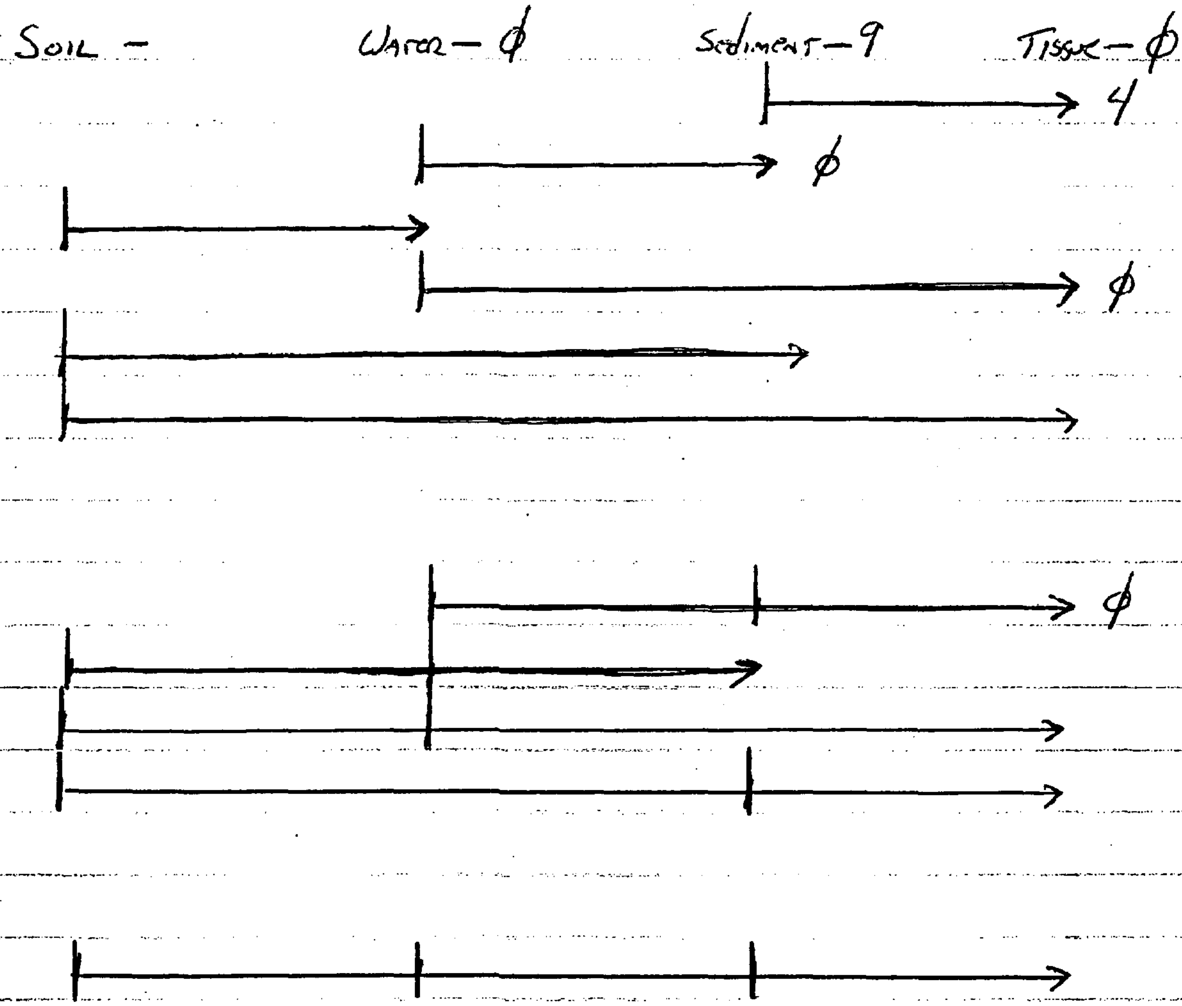
Figure 7

FACILITY: Allied Colloids

13 Listed Compounds



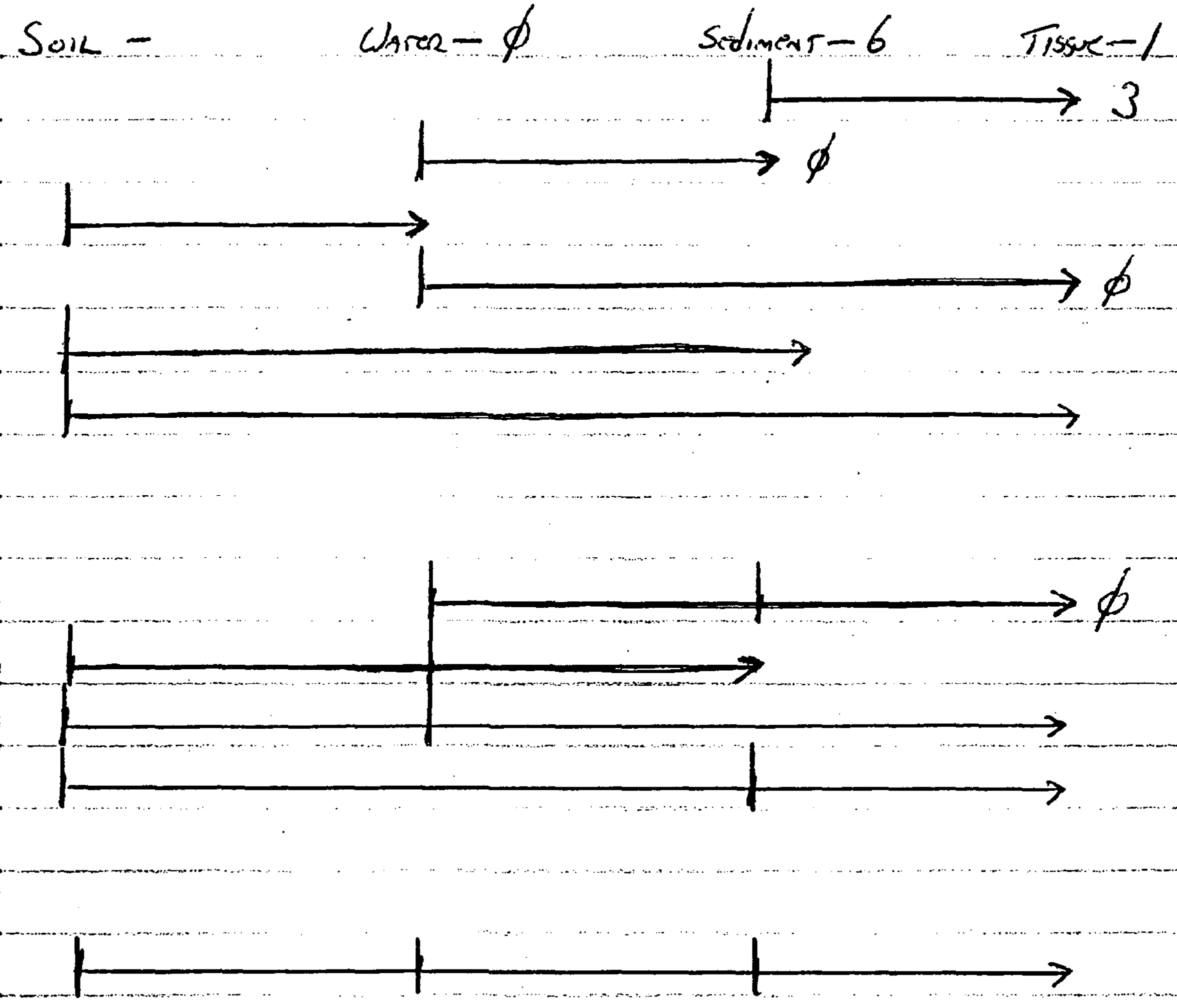
Water - ϕ

Sediment - 13

Tissue - 4

DRAFT Fig 8

FACILITY: Boykins Narrow Fabrics
10 listed Compounds



Water - ∅
Sediment - 9
Tissue - 4

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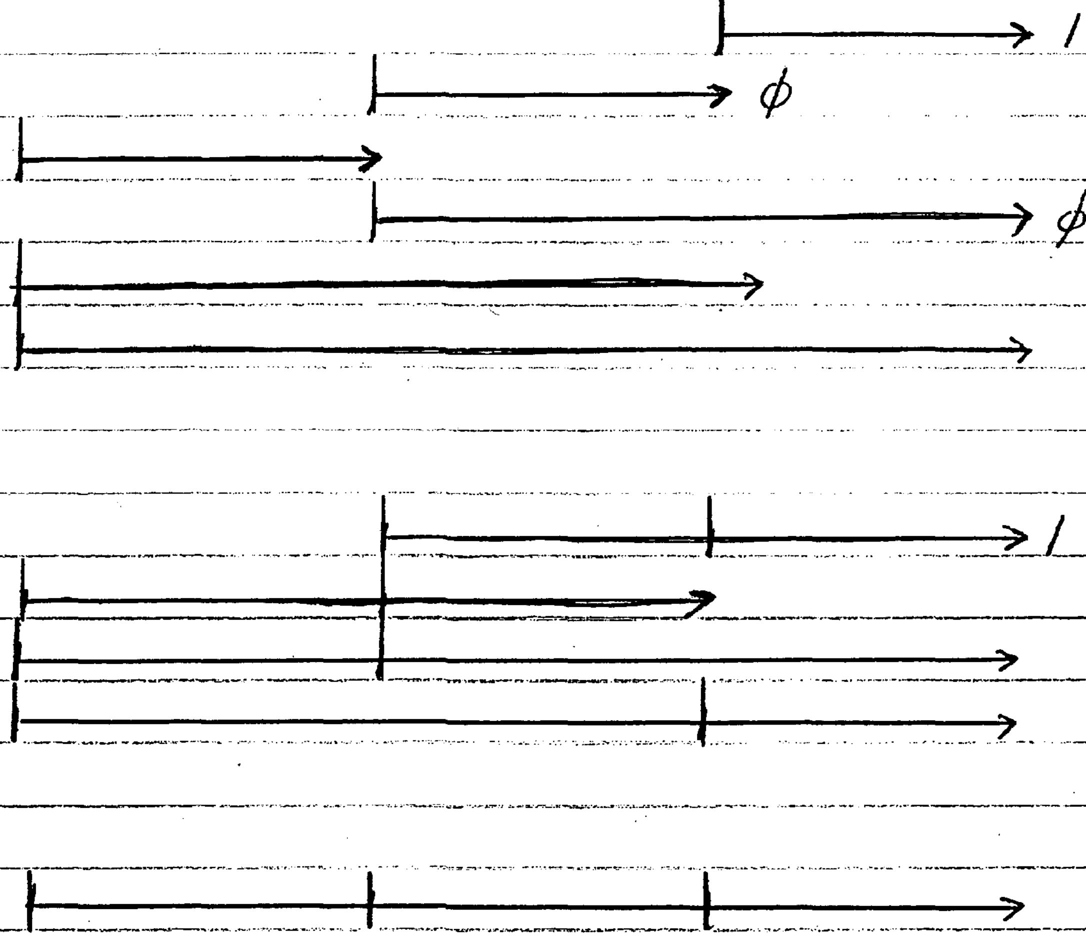
Fig 9

FACILITY: Driver

15 ~~16~~ compounds listed

Soil – Water – ~~0~~ (Δ vias total PCB to Ar1260) Sediment – ~~10~~ 11 Tissue – 1



Water – ~~0~~ 1

Sed – ~~11~~ 13

Tissue – 3

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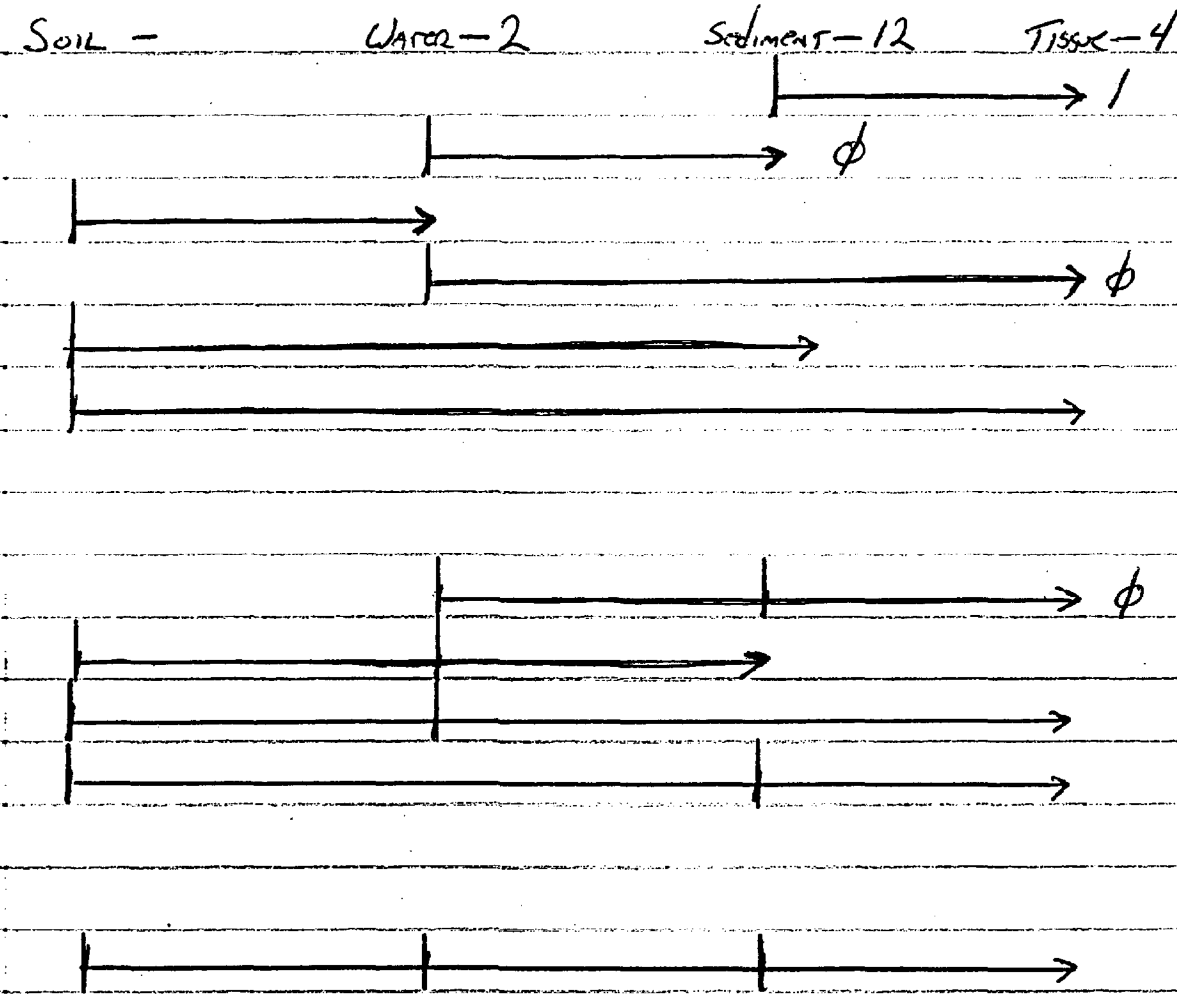
FS 10

Facility: HRSD - Nansemond STP

19 listed Compounds



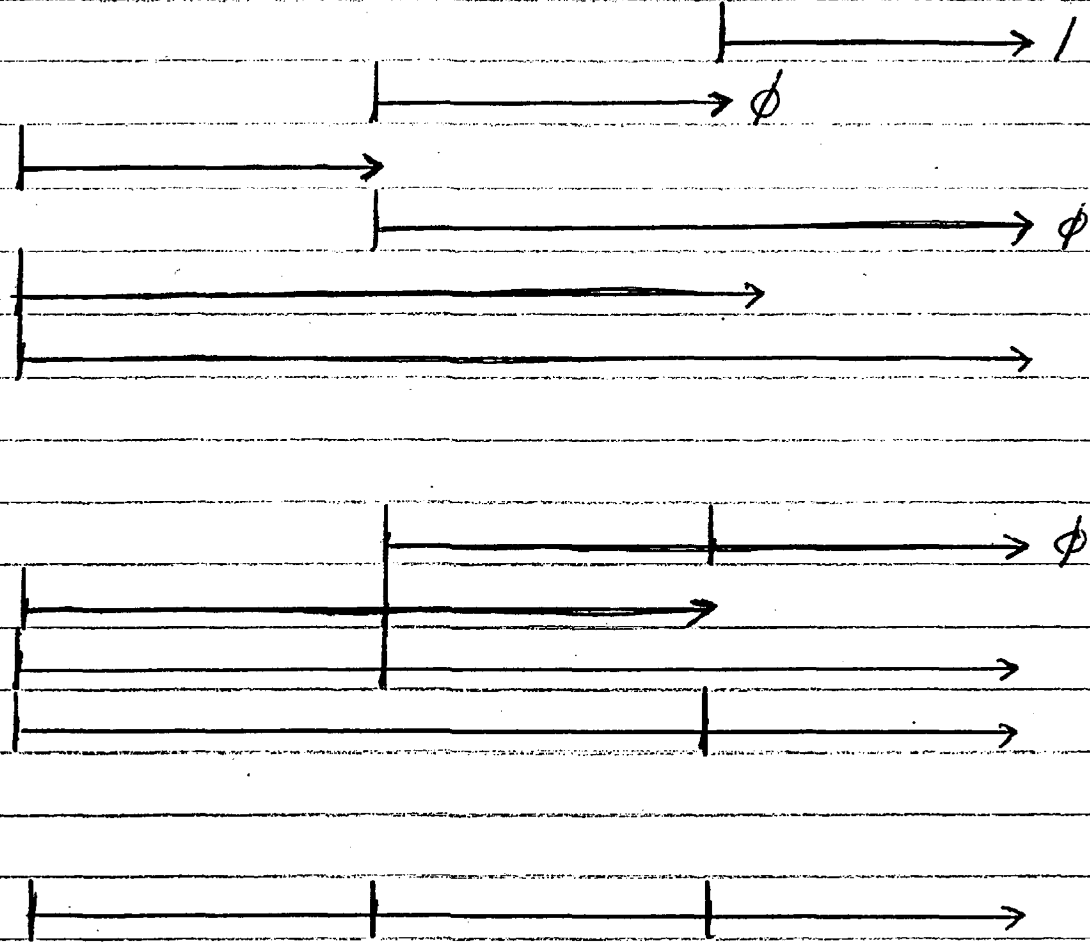
Water - 2
Sed - 13
Tissue - 5

DRAFT

Fig 11

FACILITY : New Church Energy
14 listed Compounds

SOIL - WATER - 1 SEDIMENT - 7 TISSUE - 5



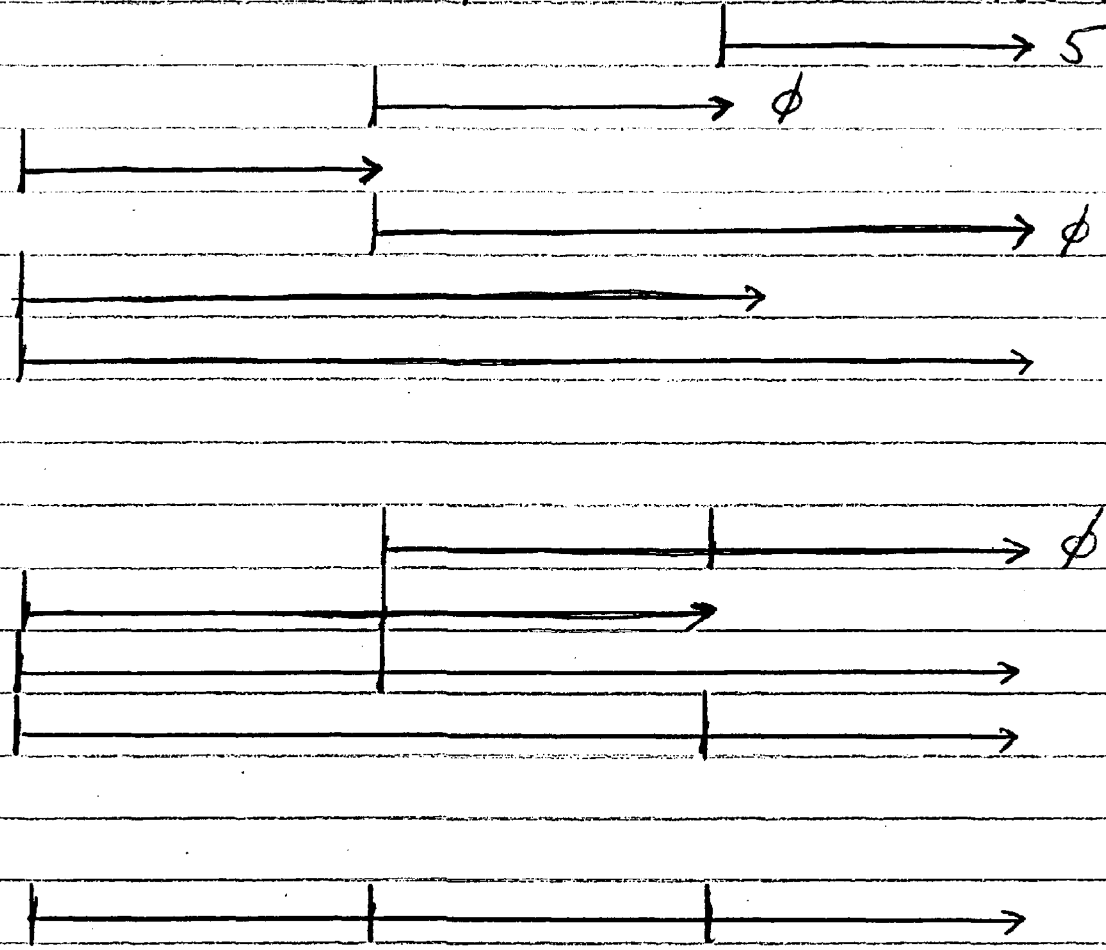
WATER - 1
Sed - 8
Tissue - 6

DRAFT

Fig 12

FACILITY: Yorktown Naval Weapons Station - Tribs to Roosevelt Pond
19 listed Compounds

Soil - Water - Ø Sediment - 13 Tissue - 1

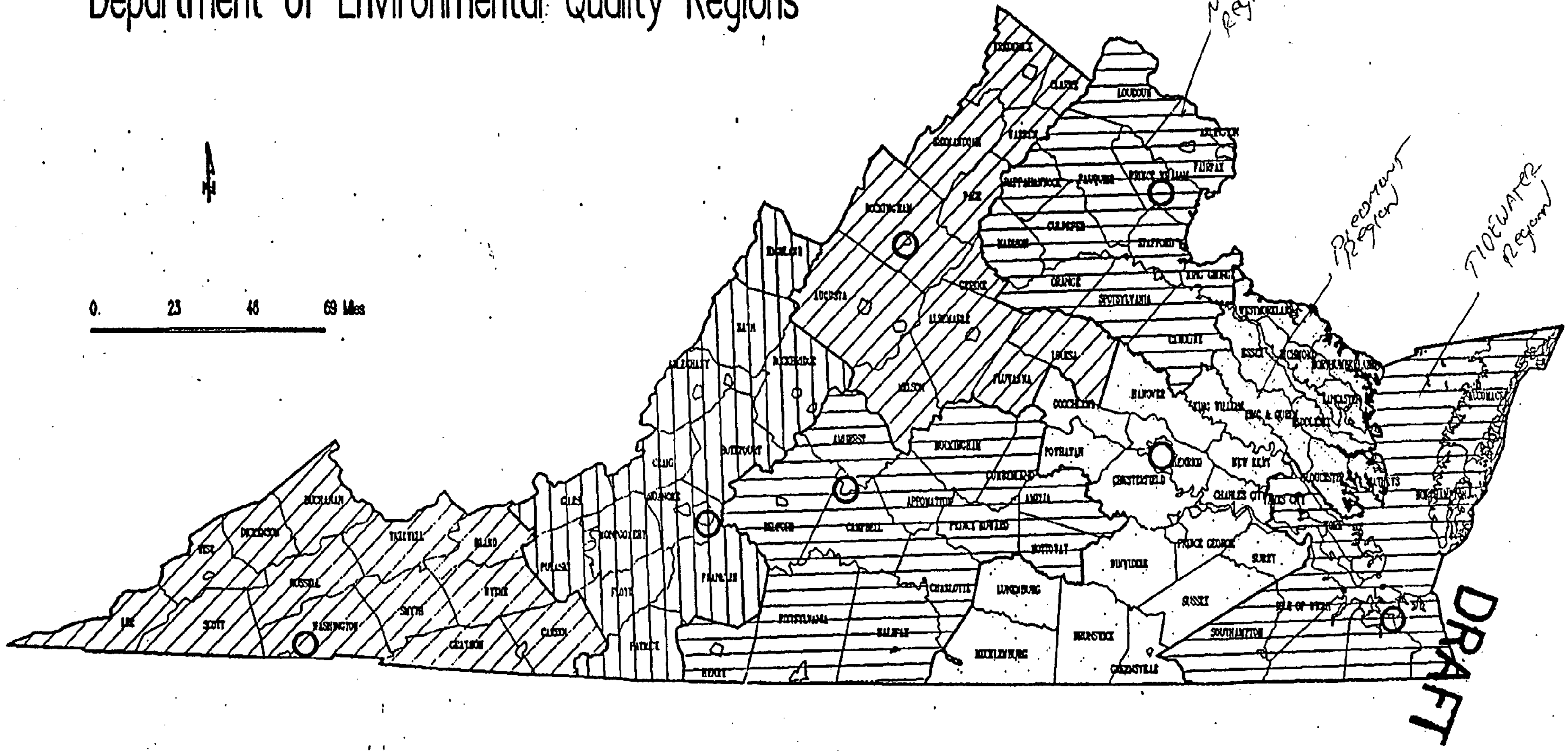


Water ~ Ø
Sed - 18
Tissue - 6

Fig

Commonwealth of Virginia

Department of Environmental Quality Regions



Conclusions

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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}.

Monitoring protocols were assessed and refinements were identified. Specific refinements are discussed below under recommendations.

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. Laboratory ability also tended to improve with time.
The laboratory assessment portion of the CZM BI study highlighted several specific areas of the analytical protocol and laboratory operating procedures in need of reevaluation for future studies.

Issues highlighted during the course of the CZM BI study included: 1) The lack of toxicology information and environmental risk information on currently unprofiled compounds. This presents a major setback when evaluating total risk from bioconcentratable compounds; 2) Control strategies for bioconcentratble 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.

An overall recommendation for future study of bioconcentratble compounds in Virginia's CZM are would be to screen additional sites, particularly those known to be, or suspected to be, releasing COC. Other recommendations for future study of bioconcentratable compounds in Virginia's CZM area are presented by site.

Dahlgren Naval Weapons Lab.

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The DA-G2 site is situated on the shore of the Potomac River, a large, tidal and open surface water environment. Consequently, fish may not be sufficiently resident in the impact are 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 are 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. Studies should be completed by August 1994 to allow time for a Virginia Health Department Fish Advisory survey if necessary.

Woodbridge Research Facility WRF-G1.

The WRF-G1 site is similar to the Dahlgren site. The site is: 1) on the shore of the Potomac River; 2) has a large, tidal and open surface water environment; and 3) has a high risk estimate (10^{0}). Future study recommendations include follow up stormwater sampling complimented by live box and/or surrogate organism system studies. Studies should be completed by August 1994 to allow time for a Virginia Health Department Fish Advisory survey if necessary.

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 included additional water sampling to identify input sources, reattempting to collect indigenous organism tissue samples, and deploying liveboxes and/or surrogate organism systems. Studies should be completed by August 1994 to allow time for a Virginia Health Department Fish Advisory survey if necessary.

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, surface 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.

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Boykins Narrow Fabrics.

Problems at BNF-G1 appear to be attributable to sediment contamination. Background sediment data indicate historical 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.

Driver Naval Transmitting Facility.

The tissue samples at the DRI-G1 site were the only tissue samples to exceed the FDA's PCB action level of 2 ppm. Maximum PCB tissue concentrations at DRI-G1 approached 20 ppm. The site is: 1) associated with the Nansemond River; 2) has a small to medium, tidal, open surface water environment; and 3) has a high risk estimate (10^{0}). Future study recommendations include follow up water sampling complimented by live box and/or surrogate organism system studies. Studies should be completed by August 1994 to allow time for a Virginia Health Department Fish Advisory survey if necessary.

HRSD Nansemond-STP

Data are generally inconclusive about bioconcentratable compound problems at the HN1-G1 site. Due to: 1) the numerous potential input sources of COC in Hampton Roads; 2) the low correlation between HN1-G1 water, sediment, and tissue data; and 3) 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.

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.

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Yorktown Naval Weapons Station.

Problems at NWS-G1 appear to be attributable to sediment contamination. Sediment data indicate historical 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 moderate high CZM BI study risk estimate (10^{-4}) is accurate.

Literature Cited

DRAFT

From Intro:
- Yosie 1993

From Methods:
- ASTM D422-63 Method for psrticle analysis of soils. 1990
- VIMS 1991
- EPA methods 8100/8270, 8080, 625, TOC, AVS, GC-MS cal,
- EPA 3620
- Va WQ Stds
- NOAA
- EPA sed crit.
- FDA action levels
- EPA RIII RBC tables
- DEQ draft screening values for fish tissue

Sediment:
- %M - XXX (19XX),
- TOC - EPA 415.1 (19XX),
- AVS - EPA (19XX),
- Grain size - XXX (19XX)

QA
- (EPA 1990),
- (EPA 19XX).

From Discussion:
- table 2:
  - VA WQS
  - EPA pri. poll
- table 4:
  - FSQC
  - NOAA
  - FHHO
  - FALC
  - VHHO
  - VALC
  - VRTC
  - FRBC

From Appendix A:

From Appendix B:
- NUMERICA:
  - Chemfate
  - Log P
  - QSAR
- IRIS

From Appendix C: