Baker

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September 22, 2004

U.S. Environmental Protection Agency
Region II
290 Broadway – 22nd Floor
New York, New York 10007-1866

Attn: Mr. Adolph Everett, P.E.
Chief, RCRA Programs Branch

Re: Contract N62470-95-D-6007
Navy CLEAN, District III
Contract Task Order (CTO) 0271
U.S. Naval Station Roosevelt Roads (NSRR), Puerto Rico
RCRA/HSWA Permit No. PR2170027203
Draft Final Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at SWMU 45

Dear Mr. Everett:

Baker Environmental, Inc. (Baker), on behalf of the Navy, is providing you with one hard copy of the replacement cover and spine, inside cover, text, tables, figures, and appendices for the Draft Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at Solid Waste Management Unit (SWMU) 45. These replacement pages make up the Draft Final Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at SWMU 45. Directions for inserting the replacement pages into the Draft Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at SWMU 45 are provided for your use. Also included with the replacement pages are two electronic copies provided on CD of the Draft Final Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at Solid Waste Management Unit (SWMU) 45.

This document has been modified in accordance with the Navy Responses to EPA comments dated July 23, 2004 to address EPA's comments of April 9, 2004 on the Draft Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at SWMU 45 which were approved by your office in a letter dated August 20, 2004. This report is being submitted in accordance with the Navy proposed schedule for ecological work provided to you as Attachment 3 to the letter dated July 23, 2004.

If you have questions regarding this submittal, please contact Mr. Kevin Cloe, P.E. at (757) 322-4736. Additional distribution has been made as indicated below.

Sincerely,

BAKER ENVIRONMENTAL, INC.

Mark E. Kimes

Mark E. Kimes, P.E.
Activity Manager

MEK/lp
Attachments

cc: Mr. Kevin R. Cloe, LANTDIV - Code EV23KC (1 hard copy and 1 CD)
Mr. Rollie Burford, LANTDIV – Code AQ112 (letter only)
Ms. Lee Anne Rapp, LANTDIV – Code EV31LR (letter only)
Ms. Madeline Rivera, NSRR (1 hard copy and 1 CD)
Mr. Tim Gordon, US EPA Region II (1 hard copy and 2 CDs)
Ms. Kathy Rogovin, Booz Allen & Hamilton (1 CD)
Mr. Carl Soderberg, US EPA Caribbean Office (1 CD)
Mr. Julio I. Rodriquez Colon, PR EQB (1 hard copy and 1 CD)
Mr. John Tomik, CH2M Hill Virginia Beach (1 CD)

Draft Final

Additional Data Collection Report and Screening Level Ecological Risk Assessment and Step 3A of Baseline Ecological Risk Assessment at SWMU 45

Naval Activity Puerto Rico
RCRA/HSWA Permit No. PR2170027203
Ceiba, Puerto Rico

Prepared For

Department of the Navy

Atlantic Division
Naval Facilities Engineering Command

Norfolk, Virginia

Contract No. N62470-95-D-6007
CTO-0271

September 22, 2004

Prepared by

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Federal Programs Corp.

DRAFT FINAL

ADDITIONAL DATA COLLECTION REPORT AND SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF BASELINE ECOLOGICAL RISK ASSESSMENT AT SWMU 45

NAVAL ACTIVITY PUERTO RICO
RCRA/HSWA PERMIT NO. PR2170027203
CEIBA, PUERTO RICO

CONTRACT TASK ORDER 0271

SEPTEMBER 22, 2004

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN Program
Contract N62470-95-D-6007

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TABLE OF CONTENTS

Page

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF TABLES
(Continued)

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

AET	Apparent Effects Threshold
AOCs	Areas of Concern
AQUIRE	Aquatic Toxicity Information Retrieval
ARARs	Applicable, Relevant, and Appropriate Regulations
AUF	Area Use Factor
AUF_j	Area Use Factor for Receptor j (unitless)
AVS	Acid Volatile Sulfide
BAFs	Bioaccumulation Factors
BAF_{sed}	Sediment-to-fish BAF
BAF_{xi}	Mean/Median sediment-to-biota BAF for chemical x and food item (dry weight basis)
BCFs	Bioconcentration Factors
BCF_{sw}	Measured surface water-to-fish BCF (L/kg)
BCF_{xi}	Mean/Median sediment-to-biota BCF for chemical x and food item (dry weight basis)
bgs	below ground surface
BTAG	Biological Technical Assistant Group
BW	Body Weight
BW_j	Mean body weight for receptor j (kg, wet weight)
BW_r	Body weight of receptor species (kg)
BW_t	Body weight of test species (kg)
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measures Study
CN-	Cyanide Ion
CNO	Chief of Naval Operations
CS	Confirmation Study
C_{sed}	Maximum sediment concentration (mg/kg)
C_{sw}	Maximum surface water concentration (mg/L)
CTO	Contract Task Order
C_{xf}	Concentration of chemical x in whole-body fish (mg/kg)
D	duplicate
DI_x	Dietary intake for chemical x (mg chemical/kg body weight/day)
DMMP	Dredged Material Management Program
DoN	Department of the Navy
DRMO	Defense Reutilization and Marketing Office
EqP	Equilibrium Partitioning
ER	Equipment Rinsate
ERA	Ecological Risk Assessment
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ESE	Environmental Science and Engineering, Inc.

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

FCVs	Final Chronic Values
FC_{xi}	Maximum concentration of chemical x in food item i (mg/kg, dry weight)
FDA	Food and Drug Administration
FIR	Food ingestion rate (kilograms per day [kg/day], dry-weight)
FIR_j	Mean food ingestion rate for receptor j (kg/day, dry-weight)
FS	Feasibility Study
GPS	Global Positioning System
HCN	Hydrogen cyanide
HQ	Hazard Quotient
IC_{50}	Median Inhibition Concentration
ICM	Interim Corrective Measure
IR	Installation Restoration
IRP	Installation Restoration Program
K_d	Adsorption Coefficient
K_{oc}	Organic Carbon Partition Coefficient
K_{ow}	Octanol-Water Partition Coefficient
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
LD_{50}	Median lethal Dose
LOAELs	Lowest Observed Adverse Effect Levels
LOELs	Lowest Observable Effect Levels
Log B_v	Log soil-to-plant BCF
Log K_{ow}	Log octanol-water partitioning coefficient
MATC	Maximum Acceptable Toxicant Concentration
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
mg/kg	milligrams per kilogram
MHW	Mean High Water
MHSPE	Ministry of Housing, Spatial Planning and Environment
MLW	Mean Low Water
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NEESA	Naval Energy and Environmental Support Activity
NOAA	National Oceanic and Atmospheric Administration
$NOAEL_{ij}$	Ingestion-based screening value for chemical i applied to receptor j (mg chemical/kg body weight/day)
NOAELs	No Observed Adverse Effect Levels
NOEC	No Observed Effect Concentration
NPL	national Priorities List
NSRR	Naval Station Roosevelt Roads

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

OP	Organophosphorus
OU	Operable Unit
PAHs	Polyaromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDF_i	Proportion of diet composed of food item i (mg/kg, dry weight)
PDF_{ij}	Proportion of receptor j diet composed of food item i (mg/kg, dry weight)
PDS	Proportion of diet composed of surface soil/sediment (dry weight basis)
PDS_j	Proportion of receptor j diet composed of surface soil (dry weight basis) (Equation 4-6)
PEC	Probable Effect Concentration
PELs	Permissible Effect Levels
ppm	part per million
ppt	part per thousand
QA/QC	Quality Assurance/Quality Control
R	Rejected
RAC	Remedial Action Contractor
RAGS	Risk Assessment Guidelines
RCRA	Resource Conservation and Recovery Act
REDOX	Reduction/Oxidation Potential
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SCVs	Secondary Chronic Values
SC_x	Mean concentration of chemical x in sediment
SQGs	Sediment Quality Guidelines
SSI	Supplemental Site Investigation
SQUIRTS	Screening Quick Reference Tables
SVOCs	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TB	Trip Blank
TEC	Threshold Effect Concentrations
TEL	Threshold Effects Level
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USTs	Underground Storage Tanks
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This report presents results from the Additional Data Collection Field Investigation performed in August 2003 in support of the Screening Level Ecological Risk Assessment (ERA) and Step 3A of the Baseline ERA for Solid Waste Management Unit (SWMU) 45 (Former Power Plant) located at Naval Station Roosevelt Roads (NSRR), Ceiba, Puerto Rico. This Report also provides the Screening Level ERA and Step 3A of the Baseline ERA utilizing the results from this Additional Data Collection Field Investigation Report and the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) reports. This report has been prepared under the Corrective Action provisions of the NSRR's RCRA Permit No. PR2170027203. This report has been prepared under contract to the Atlantic Division, Naval Facilities Engineering Command (LANTDIV), Contract Number N62470-95-D-6007, Contract Task Order (CTO) 271.

1.1 Objective of the Additional Data Collection Field Investigation Report in Support of the Ecological Risk Assessment

The objective of the Additional Data Collection Field Investigation was to perform additional sampling of surface water and sediment at SWMU 45 to address the data gaps presented in the Draft Screening Level Ecological Risk Assessment Problem Formulation (Step 1) and Exposure Estimate for SWMU 45 (Baker, 2001a). This objective was met with the performance of the field investigation conducted in August 2003.

The objectives of this report are as follows:

To present the data collected during the additional data collection field investigation, as well as to present the revised Step 3A of the ERA incorporating the new data collected.

Make a determination whether or not this site will move forward to Step 3B of the ERA or continue in the Corrective Measures Study (CMS) planning stage.

1.2 Facility and Site Description

This section contains a description of the physical layout of NSRR, as well as provides a description of the physical layout of SWMU 45.

1.2.1 Facility Description

NSRR occupies over 8,600 acres on the northern side of the east coast of Puerto Rico, along Vieques Passage with Vieques Island lying to the east about 10 miles off the harbor entrance. The north entrance to NSRR is about 35 miles east along the coast road (Route 3) from San Juan. The closest large town is Fajardo (population approximately 37,000), which is about 10 miles north of NSRR off Route 3. Ceiba (population approximately 17,000) adjoins the west boundary of NSRR (see Figure 1-1).

NSRR was commissioned in 1943 as a Naval Operations Base, and redesignated a Naval Station in 1957. The current primary mission of NSRR is limited. NSRR is currently preparing for operational closure.

1.2.2 SWMU 45 Description

SWMU 45 is comprised of the areas outside Building 38 (Former Power Plant). Building 38 is located along an access road south of Forrestal Drive opposite Camp Moscrip, and north of

SWMU 3 - Base Landfill (see Figure 1-2). The former power plant contained a 60-megawatt steam turbine facility that operated from the early 1940s through 1949 (NEESA, 1984). The facility used Bunker C fuel, which was stored in two 50,000-gallon reinforced underground concrete tanks located directly northeast of the building (NEESA, 1984). Associated with Building 38 are two underground tunnels used to transfer cooling water to and from the building. A cooling water intake tunnel extends from Building 38 over one hundred feet out into a small cove of Puerca Bay east-northeast of the building. The cooling water discharge tunnel originates from the building's east wall and parallels the access road to the landfill (SWMU 3). The discharge tunnel terminates somewhere in the Ensenada Honda (to the south), however, the exact location of the outflow has not been determined. The underground storage tanks (USTs), cooling water intake and discharge tunnel, and the Puerca Bay cove are included as part of SWMU 45.

The additional data collection field investigation was designed to address the surface water and sediment data gaps in the Open Water Marine Environment as presented in the Draft Screening Level ERA Problem Formulation (Step 1) and Exposure Estimate for SWMU 45 (Baker, 2001a).

1.3 Regulatory Framework and Site Status

In 1943, NSRR was commissioned as a Naval Operations Base. NSRR continued in this status until 1957 when it was redesignated a naval station with the mission of providing full support for Atlantic Fleet weapons training and development activities. Until 1993 all environmental operations, with the exception of USTs, were conducted under the Department of the Navy's (DoN) Installation Restoration (IR) Program, which followed a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) pattern. Under the IR Program, a Remedial Investigation (RI) was performed. PCB contamination was found in soils immediately outside Building 38. An Interim Corrective Measure (ICM) was designed for the affected soils, which included excavation of the contaminated soils, shipment off island for appropriate disposal, and sampling the surrounding area to ensure that cleanup was achieved. The soil removal took place in 1994, and a report entitled Final Closeout Report for Interim Remedial Action of PCB Contaminated Soils, Sites 15 and 16 at Naval Station Roosevelt Roads, Puerto Rico was submitted to the United States Environmental Protection Agency (USEPA) in May 1995 (OHM, 1995). [It is noted that the "Site 16" referenced in the report title is the IR Program designation for what is now SWMU 45.]

Naval Station Roosevelt Roads submitted a RCRA Part B Permit application for the storage of hazardous waste on the Base. RCRA regulations provide a procedure to investigate and remediate areas that may have been affected by a release of hazardous wastes. The first steps for investigating a site are the RCRA Facility Assessment (RFA) and the RFI. These assessments and investigations are studies on a property to determine if there has been a release of hazardous waste, and to quantify any releases that have occurred. If these studies determine that a release has occurred, a CMS is performed to identify the most appropriate corrective measure for a given site. Recognizing that corrective action would apply to unpermitted waste management units, the Navy performed a Supplemental Site Investigation (SSI) at a variety of units (including SWMU 45) to provide additional site characterization information to the USEPA to assist in their permitting decisions. Included in the investigation were the sediments of the Puerca Bay cove and the cooling water tunnel interior. The investigations were reported in the report entitled Draft Supplemental Investigation, Installation Restoration Program Activities, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker 1993).

A RFA was performed in 1988 and updated in 1993 by A.T. Kearney, Inc. for the USEPA to identify SWMUs and AOCs, and to assess the potential for the release of hazardous constituents from any areas or units. The RFA identified 52 SWMUs and 4 AOCs, and recommended additional investigation at 25 of the SWMUs and three of the AOCs.

On October 20, 1994, a Final RCRA Part B permit was issued by the USEPA Region II to the Defense Reutilization and Marketing Office (DRMO) of NSRR as RCRA/HSWA Permit No. PR2170027203. The corrective action provisions of the permit contained specific requirements for investigation, and potentially, remediation at SWMU 45, as well as required RFI activities at 25 SWMUs and 3 Areas of Concern (AOCs). Two additional SWMUs (53 and 54) were identified during May of 2000 bringing the total to 27 SWMUs and 3 AOCs.

The RCRA Part B permit required a full RFI for SWMU 45. RFI Work Plans (Baker, 1995) were developed for NSRR that included SWMU 45. The work plan provided the framework for site characterization activities; its scope was guided by the results of the SSI. The field investigation for SWMU 45 proposed in this work plan was conducted during November 1996 and September/October 1997. The Draft RCRA Facility Investigation Report for Operable Unit (OU) 3/5 (including SWMU 45) was submitted in March 1998 (Baker, 1998). The report confirmed the findings of the SSI, in that the USTs and cooling water tunnel represented a possible source of continuing release. On the basis of this finding, the Navy decided to perform an ICM to eliminate the potential for further release. The plans for the ICM, which were submitted to the EPA and approved, called for the cleaning and abandonment in place of the USTs and tunnel. Inflow of groundwater to the tunnel necessitated a field design change (approved by the EPA) that provided for the filling of the USTs and sealing the tunnel with low density concrete. This approach entombed and effectively immobilized any residual contamination (OHM, 1997).

During the ICM on the tunnel, an excavation was made at a point along the outside of the tunnel in an attempt to ascertain how groundwater was entering the tunnel. Soils contaminated with petroleum were observed. A work plan to investigate the outside of the tunnel was submitted to and subsequently approved by the EPA. The work was performed and the results were presented in the Revised Draft RCRA Facility Investigation Report for Operable Unit 3/5 (Baker 1999), which was approved by the EPA on September 28, 1999. This report (and/or its precursor the initial "draft" report) recommended a CMS for the Puerca Bay sediments and the soils immediately adjacent to the cooling water tunnel.

Based on the recommendations presented in the Revised Draft RFI Report for OU 3/5 (Baker, 1999), a Revised Final II CMS Work Plan was submitted on July 14, 2000 (Baker, 2000), and EPA approved on May 4, 2001. A Draft Screening-Level Ecological Risk Assessment Problem Formulation (Step 1) and Exposure Estimate, as well as the Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment for SWMU 45 were submitted on August 10, 2001 (Baker, 2001a). EPA approved the above documents in their letter dated October 4, 2001. The Navy submitted a letter to the EPA stating the lack of funding to perform the work associated with SWMU 45. The Navy submitted a response to EPA's comment letter dated October 4, 2001, as well as submitted an Addendum to the Draft Screening Level ERA Problem Formulation (Step 1) and Exposure Assessment for SWMU 45 on May 22, 2003. The EPA approved the above addendum on June 10, 2003. The field investigation associated with the above-mentioned EPA approved Screening Level ERA plan was initiated and completed in August 2003. This additional data collection report and Step 3a of the Baseline ERA focus on the objectives found in Section 1.1 of this report.

1.4 Previous Investigations

The 1988 Confirmation Study (CS) conducted by Environmental Science and Engineering, Inc. (ESE) included the collection of 38 soil samples from the site (9 samples in Round 1 and 29 samples in Round 2). The analytical results indicated the presence of PCB and lead contamination at the site. Lead concentrations were less than the EP toxicity standard. Based on USEPA Region II review, the quality of the data obtained during the CS is questionable due to the unknown level of laboratory data quality objectives and the apparent lack of independent, third party data validation. Therefore, no conclusions regarding conditions at the site were drawn on the basis of this information.

A Remedial Investigation/Feasibility Study (RI/FS) conducted by Versar in 1992 determined that concrete surfaces, sediments, and soil surrounding Building 38 were contaminated with PCBs at levels exceeding applicable, relevant, and appropriate regulations (ARARs). Additionally, surface water and wipe samples collected from the cooling water tunnel and underground storage tank manways were contaminated and required further investigation as separate operable units (designated IR Site 16). Contamination was reported to a depth of at least one foot; however, the presence of coral prevented deeper sampling. The RI/FS focused on the soil/sediment operable unit.

Three alternatives were proposed in the Feasibility Study (FS): soil excavation, shipment, and off-site incineration; soil excavation, shipment, and off-site landfill; and, soil excavation and on-site incineration. Of these three, soil excavation, shipment, and off-site landfill were accepted as the most feasible. Soils outside Building 38 have been remediated and a project close-out report has been submitted (OHM, 1995).

During the Supplemental Investigation (Baker, 1993), seven surface water and six sediment samples were collected. Organic contaminants including toxaphene, endosulfan II, and Aroclor 1260 were detected in both media.

An Interim Corrective Measure (ICM) was performed for SWMU 45 to address the reported discharges of product from the cooling water tunnels. These actions included the breaching and sealing of the intake and discharge cooling water tunnels with cast-in-place concrete, removal of liquids and sludge from the underground storage tanks and tunnels, backfilling the storage tanks with concrete, and the sealing of manway entrances to the storage tanks and cooling water tunnels. Remediation at the site was performed by the Remedial Action Contractor (RAC) OHM, Inc. Work began in May 1996 and was completed in November 1996.

In 1996 and again in 1997, a RFI field investigation was conducted at SWMU 45 as mentioned in the Draft Screening Level ERA Problem Formulation (Step 1) and Exposure Estimate (Baker, 2001a). Environmental media collected during the various field investigations at SWMU 45 included surface soil, subsurface soil, groundwater, and sediment as presented in Table 1-1. The field investigations and associated analytical data for SWMU 45 were presented and discussed in the EPA-approved Revised Draft RFI for OU 3/5 (Baker, 1999). The reader is referred to these documents for a detailed description of sampling activities and analytical data.

1.5 Current Site Conditions

The following is a description of the site conditions identified during the August 2003 field investigation. The area of SWMU 45 sampled during the additional data collection investigation consisted of the small cove within Puerca Bay. A small pier was observed running from the shore within the small cove of SWMU 45 to a length of approximately 100 feet out into the water. Sea grass was encountered at many sampling locations within the small cove at SWMU 45.

1.6 Report Organization

This Additional Data Collection Report in Support of the ERA at SWMU 45 is organized into six sections. Section 1.0, the Introduction, is designed to introduce the reader to the objective of the additional data collection investigation, a description of the base and SWMU 45, a regulatory framework established at the base and at this site, a discussion of the previous investigations, as well as current site conditions at SWMU 45. Section 2.0 provides the methodologies utilized during the field investigation, while Section 3.0 describes the investigation results from the samples collected during the field investigation. The refined Screening Level ERA and Step 3a of the Baseline ERA is described in Section 4.0. Section 5.0 provides the conclusions and recommendations based on the results obtained from the additional data collection investigation, and findings presented in the refined ERA. Section 6.0 provides the references cited in this report.

SECTION 1.0
TABLES

TABLE 1-1

SUMMARY OF HISTORICAL SAMPLING AND ANALYTICAL PROGRAM
SWMU 45 - FORMER POWER PLANT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample Media	RFI Phase	Sample Designation	Sample Depth (ft bgs)	Sample Date	Analytical Parameters	Comments
Surface Soil	I	45MW01-00	0.0-1.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW02-00	0.0-1.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW03-00	0.0-1.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW04-00	0.0-1.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW04-00D	0.0-1.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	Duplicate
Subsurface Soil	I	45MW01-02	4.0-6.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW01-03	6.0-8.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW02-01	2.0-4.0	11/21/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW02-02	4.0-6.0	11/21/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW03-03	6.0-8.0	11/21/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW03-03D	6.0-8.0	11/21/1996	VOC, SVOC, PCB, RCRA Metals	Duplicate
		45MW03-04	8.0-10.0	11/21/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW04-01	2.0-4.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW04-02	4.0-6.0	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
	II	11SB01-02	2.0-8.0	9/17/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB04-01	2.0-4.0	9/24/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB04-01D	2.0-4.0	9/24/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	Duplicate
		11SB05-02	2.0-8.0	9/17/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB06-02	2.0-8.0	9/18/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB07-02	2.0-8.0	9/18/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB08-02	2.0-8.0	9/18/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB09-02	2.0-8.0	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB11-02	2.0-8.0	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB11-02D	2.0-8.0	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	Duplicate
		11SB14-01	2.0-4.0	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB15-02	2.0-4.0	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB16-04	4.0-8.0	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB18-02	2.0-6.0	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB19-04	6.0-10.0	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB22-04	7.5-9.5	9/21/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB22-06	11.5-13.5	9/21/1997	PCB	
		11SB23-03	4.0-6.0	9/21/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB26-01	0.0-2.0	9/21/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SB27-04	6.0-10.0	9/21/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	

TABLE 1-1

SUMMARY OF HISTORICAL SAMPLING AND ANALYTICAL PROGRAM
SWMU 45 - FORMER POWER PLANT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample Media	RFI Phase	Sample Designation	Sample Depth (ft bgs)	Sample Date	Analytical Parameters	Comments
Groundwater	I	45MW01	NA	11/25/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW01D	NA	11/25/1996	VOC, SVOC, PCB, RCRA Metals	Duplicate
		45MW02	NA	11/25/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW03	NA	11/25/1996	VOC, SVOC, PCB, RCRA Metals	
		45MW04	NA	11/25/1996	VOC, SVOC, PCB, RCRA Metals	
		45HP01	NA	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45HP02	NA	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45HP03	NA	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
		45HP04	NA	11/22/1996	VOC, SVOC, PCB, RCRA Metals	
	II	11GW01	NA	9/18/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW02	NA	9/22/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW05	NA	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW07	NA	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW08	NA	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW10	NA	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW11	NA	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW12	NA	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW13	NA	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW16	NA	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW16D	NA	9/20/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	Duplicate
		11GW18	NA	9/21/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW19	NA	9/21/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW24	NA	9/22/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	
		11GW24D	NA	9/22/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	Duplicate
		11GW25	NA	9/22/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO, TOC	

TABLE 1-1

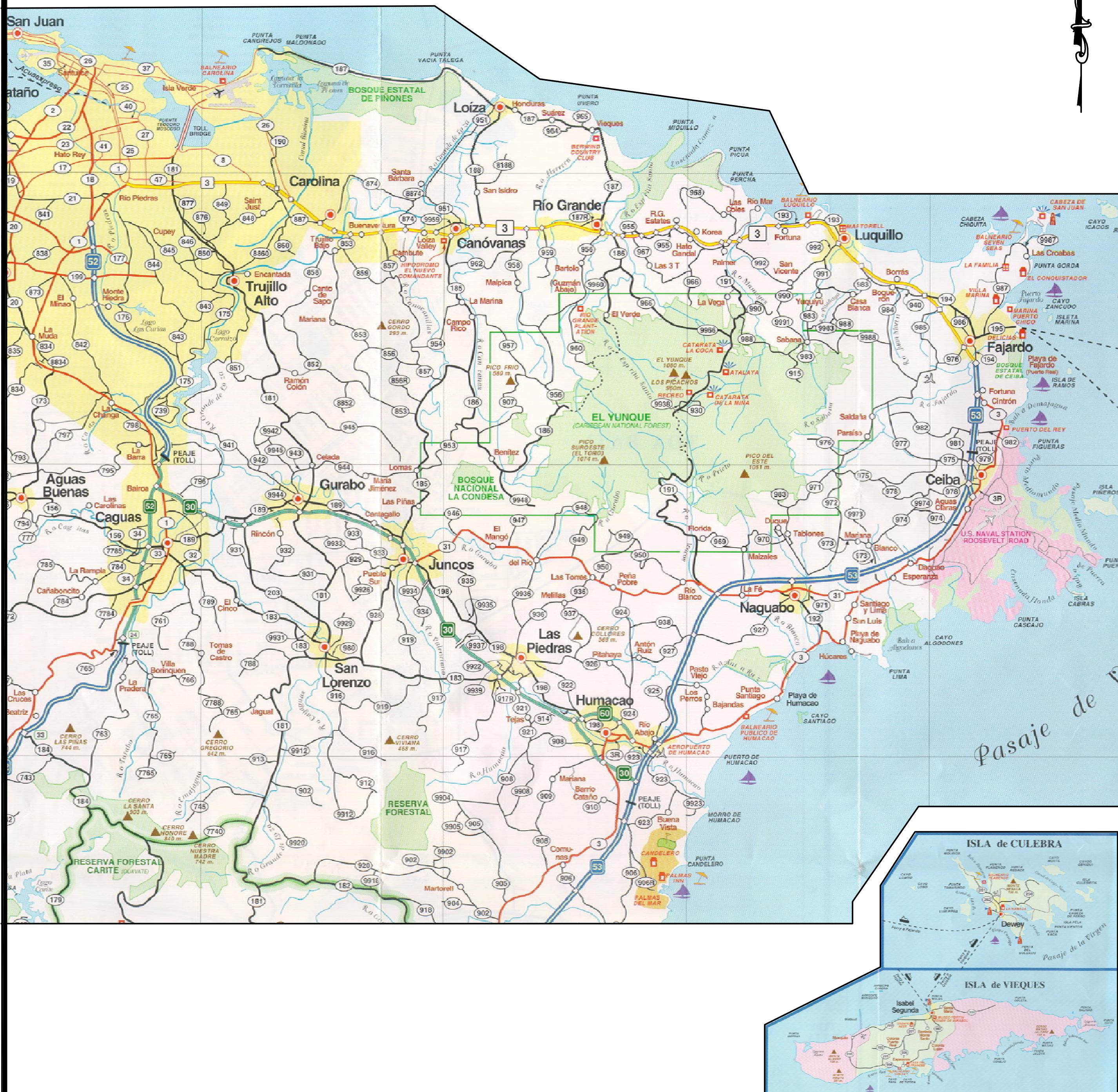
SUMMARY OF HISTORICAL SAMPLING AND ANALYTICAL PROGRAM
SWMU 45 - FORMER POWER PLANT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample Media	RFI Phase	Sample Designation	Sample Depth (ft bgs)	Sample Date	Analytical Parameters	Comments
Sediment	II	11SD01	0.0-0.25	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD01D	0.0-0.25	9/19/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	Duplicate
		11SD02	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD03	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD03D	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	Duplicate
		11SD04	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD05	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD06	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD07	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD08	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	
		11SD09	0.0-0.25	10/2/1997	VOC, SVOC, PCB, App IX Metals, GRO, DRO	

Notes:
ft bgs - feet below ground surface.
VOCs - Volatile Organic Compounds.
SVOCs - Semivolatile Organic Compounds.
PCB - Polychlorinated Biphenyls.
DRO - Diesel Range Organics.
GRO - Gasoline Range Organics.
TOC - Total Organic Carbon.
NA - Not Applicable.

SECTION 1.0
FIGURES

K\CH2M HILL CLEAN II\CTO271 (100309)\CAD\SWMU 45\CH2271801



4 0 2 4 8

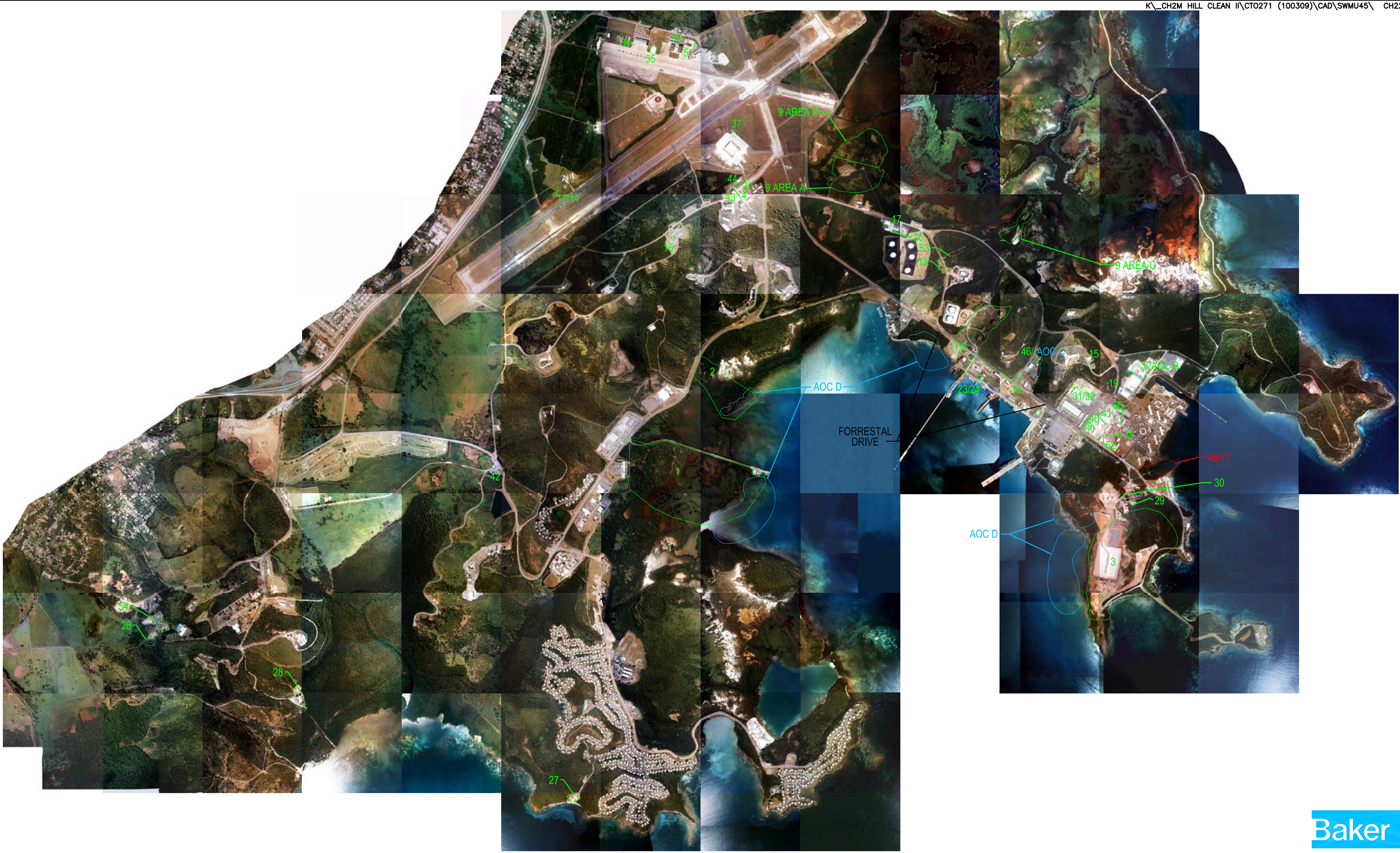
1 inch = 4 miles

FIGURE 1-1
REGIONAL LOCATION MAP

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

SOURCE: METRODATA, INC., 1999.

K_CH2M HILL CLEAN II\CTO271 (100309)\CAD\SWMU45\ CH2271802



LEGEND

1 – SWMUs

45/11 – AREA OF WHICH THIS INVESTIGATION PERTAINS TO

AOC D – AOCs

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

2500 0 1250 2500

1 inch = 2500 ft.

FIGURE 1-2
SWMU/AOC LOCATION MAP

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

2.0 INVESTIGATION METHODOLOGIES

The additional data collection field investigation at SWMU 45, consisted of the collection of surface water and sediment for the purpose of addressing data gaps presented in the Draft Screening Level ERA Problem Formulation (Step) 1 and Exposure Estimate for SWMU 45 (Baker, 2001a). The methods and procedures utilized during the field investigation are presented in the following subsections.

Although not collected during the above mentioned investigation, base background open water surface water and sediment samples were collected at NSRR during the additional data collection investigation for the Tow Way Fuel farm (TWFF) in January 2002 in accordance with the Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment at SWMU 45 (Baker, 2001b). These samples were collected during this earlier sampling event due to the need of the base background data for other sites undergoing ecological risk assessments.

A total of nine base background open water surface water and sediment samples were collected during this investigation with their locations presented on Figure 4-13 of this report. Each base background surface water sample was analyzed for VOCs, SVOCs, low level PAHs, pesticides/polychlorinated biphenyls (PCBs), chlorinated herbicides, dioxins/furans, and the Appendix IX total and dissolved metals list along with cyanide. The base background sediment samples were analyzed for Appendix IX VOCs, SVOCs, low level PAHs, pesticides/PCBs, chlorinated herbicides, dioxins/furans, total organic carbon (TOC), and the Appendix IX total metals including cyanide.

The base background open water surface water and sediment samples are discussed in Section 4.0 of this report. A detailed description and corresponding results of the open water background surface water and sediment samples were previously presented in the document entitled Final Additional Data Collection Investigation Report for the Tow Way Fuel Farm (Baker, 2003a).

2.1 Sampling Procedures

All the investigation tasks described in subsequent sections of this report were performed in accordance with the techniques and methodologies provided in the original USEPA approved work plan (Baker, 1995). Therefore, only the work elements themselves are discussed in the sections that follow.

Due to the depth of water within the investigation area of Puerca Bay, a boat was used to access the sample locations collected during the investigation.

2.1.1 Surface Water

The surface water samples were collected using the direct dip method where possible with a sample container. Because the surface water samples were to be collected one to two feet above the sediment, a Wildco Beta Plus horizontal water bottle was used in the collection of surface water in areas were the depth of water was too deep for the direct dip method. A dedicated non pre-preserved sample container was utilized to collect and pour the surface water into the laboratory prepared sample containers where the direct dip method was used. At the locations where the Wildco Beta Plus horizontal water bottle was used, the surface water was poured directly out of the sampling device into the laboratory prepared sample containers. The sample containers were labeled and kept in coolers on ice and under strict chain-of-custody until delivered to the laboratory. Chain-of-custody forms for the samples collected are provided as Appendix A. The following surface water field parameters: pH, dissolved oxygen, temperature, specific conductance, conductivity, reduction/oxidation potential (REDOX), and salinity as presented in Table 2-1.The surface water field parameters were collected by lowering the multimeter over the side of the boat to a depth of approximately five feet below the surface of the water. The field notes taken during this investigation are provided in Appendix B.

Surface water samples were shipped to a fixed based laboratory for analysis of Appendix IX volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), low level polyaromatic hydrocarbons (PAHs), total and dissolved metals, and cyanide as presented in Table 2-2.

2.1.2 Sediment

Sediment samples were obtained using an Eckman Ponar dredge which collects a sample from approximately the top six inches of sediment. The sediment sample was then removed from the dredge using a stainless steel spoon and placed on an aluminum pie pan. Once ample quantity of sediment was collected using the ponar dredge, the sediment was then transferred out of the aluminum pie pan into the laboratory supplied sample container using a stainless steel spoon. Care was taken to remove any rocks or twigs, if present, prior to the placement of the sample into the laboratory supplied container. Samples were labeled and kept in coolers on ice and under strict chain-of-custody until delivered to the laboratory. Chain-of-custody forms for the samples collected are provided as Appendix A, and the field notes taken during this investigation are provided in Appendix B.

Sediment samples were shipped to a fixed based laboratory for analysis of Appendix IX VOCs, SVOCs, total organic carbon (TOC), low level PAHs, grain size, total metals, cyanide, and/or PCBs as presented in Tables 2-2. All of the sediment samples proposed in the EPA approved Additional Data Collection Investigation Work Plan (Baker, 2001b) were also analyzed in the field for PCBs using a PCB Ensys® 12T Soil Test System Kit. If the field screening samples indicated the presence of PCBs, then additional samples were to be collected further into the Puerca Bay, and analyzed by the fixed base laboratory for PCBs only. This process was to occur until adequate delineation of PCBs had occurred.

2.1.3 Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) samples were collected during the additional data collection investigation. These samples were obtained to:

(1) ensure that the new stainless steel spoons were free of contamination (i.e., equipment rinsate blank);
(2) Establish field background conditions (i.e., field blanks);
(3) evaluate field methodology (i.e., duplicate samples); and,
(4) Evaluate whether cross-contamination occurred during sampling and/or shipping (i.e., trip blanks).

Several types of field QA/QC samples were collected and analyzed including duplicate samples, equipment rinsate samples, field blank, trip blanks, and matrix spike/matrix spike duplicate (MS/MSD).

These QA/QC samples are defined below:

- <u>Duplicate Sample (D)</u>: Two samples collected simultaneously into separate containers from the same source under identical conditions. One duplicate sample was collected for every 10 environmental samples collected for each media type.

- Equipment Rinsate Sample (ER): Sample obtained by running laboratory supplied deionized water over/through sample collection equipment after it was decontaminated and/or new disposable equipment. Two equipment rinsate samples (45ER01 and 45ER02) were taken by running deionized water over a new disposable stainless steel spoon and through the Eckman Dredge, respectively. These samples were collected to determine if the sampling equipment was free of contamination.

- Field Blank (FB): Sample obtained from each water source utilized during the field program. The water source used during the field program included laboratory supplied deionized water utilized to collect equipment rinsate blanks.

- Trip Blank (TB): Trip blanks were prepared at the laboratory and shipped with the sample containers. Trip blanks were packaged for shipment with the other VOC samples and sent for analysis. At no time after preparation were the trip blank sample containers opened before they reached the laboratory. At least one trip blank per shipping cooler containing samples requiring VOC analysis was sent to the laboratory for VOC analysis.

- Matrix Spike/Matrix Spike Duplicate: MS/MSDs are not field samples but are laboratory derived, and are collected to evaluate the matrix effect of the sample upon the analytical methodology. An MS and MSD must be performed for each group of samples of a similar matrix. MS/MSD samples were collected at a frequency of five percent.

2.2 Surface Water Investigation

The surface water investigation conducted during the Additional Data Collection Investigation consisted of the collection of surface water from the Open Water Marine environment of SWMU 45. All surface water samples collected during this investigation were identified in the field using a global positioning system (GPS) unit. All surface water samples were collected prior to sediment sample collection from the same site location.

A total of nine surface water samples (11OWSW10 through 11OWSW18) and one duplicate sample (11OWSW11D), were collected from nine sample locations (11SD10 through 11SD18) during the August 2003 field investigation as presented on Figure 2-1. A set of field parameters, as mentioned in Section 2.1.1, were measured in-situ at each surface water location in this area as presented in Table 2-1.

2.3 Sediment Investigation

The sediment investigation conducted during the Additional Data Collection Investigation consisted of the collection of sediment from the Open Water Marine Environment of SWMU 45. All sediment samples collected during this investigation were identified in the field using a GPS unit.

Although the EPA approved Additional Data Collection Work Plan (Baker, 2001b) proposed the collection of nine sediment samples, a total of fourteen sediment samples (11OWSD10 through 11OWSD18, and 11OWSD20 through 11OWSD24), and one duplicate sample (11OWSD11D), were collected from fourteen sample locations (11SD10 through 11SD18, and 11SD20 through 11SD24), during the August 2003 field investigation as presented on Figure 2-1. The rationale for the collection of additional sediment samples is discussed in the paragraph that follows. All fourteen sediment samples were collected using an Eckman Dredge along with a stainless steel spoon.

After collection of the proposed nine sediment samples as presented in the EPA approved Additional Data Collection Work Plan (Baker, 2001b), these samples were field analyzed for PCBs as mentioned in Section 2.1.2, and as presented in Table 2-3. The work plan, developed after consultation with the manufacture, indicated that the EnSys PCB kits would be used to field screen the sediment samples at levels consisting of 0.1 parts per million (ppm), 1 ppm, and 10 ppm. However, after ordering and upon receipt of the PCB kits, the Baker field crew was told by the manufacturer that the kits cannot detect a PCB concentration at a level of 0.1 ppm. Therefore, the sediment samples were field analyzed for PCBs at levels of 1 and 10 ppm. The results of the field analysis indicated that PCB concentrations in all the sediment samples analyzed were less than 1 ppm. Since the lowest detection level was 1 ppm instead of 0.1 ppm it was determined in the field that all of the sediment samples needed to be submitted to the fixed base laboratory for analysis of PCBs to obtain data that is useable for the ERA. Therefore, to be proactive in the delineation of PCBs in Puerca Bay, the Baker field crew collected five additional sediment samples at five new sediment sample locations (11SD20 through 11SD24) further out into Puerca Bay from sample locations 11SD11, 11SD12, and 11SD14, as presented on Figure 2-1 to ensure that the delineation of PCBs in the sediment was accomplished. These samples were sent to the fixed base laboratory with instructions to extract and hold for analysis.

2.4 Quality Assurance/Quality Control Samples

Two equipment rinsate samples (45ER01 and 45ER02) were collected during this investigation by running lab grade deionized water over a stainless steel spoon, as well as an Eckman Dredge. These samples were analyzed for Appendix IX VOCs, SVOCs, PCBs, low level PAHs, total metals, and cyanide as presented in Table 2-4.

Two trip blank samples (45TB01 and 45TB02) were sent to the laboratory and analyzed for Appendix IX VOCs as presented in Table 2-4.

One field blank sample (2003FB01) was obtained during this investigation and analyzed for Appendix IX VOCs, SVOCs, PCBs, low level PAHs, total metals, and cyanide as presented in Table 2-4. The field blank sample consisted of lab grade deionized water supplied by the analytical laboratory and used in the collection of 45ER01 and 45ER02.

2.5 Laboratory Analyses

Surface water and sediment samples were submitted to the mainland laboratory for the analysis mentioned in the above sections. The same firm (STL Savannah Laboratories) was retained for this investigation that performed the laboratory analysis for the majority of the field investigations that have taken place at NSRR. This ensured a consistency of techniques for analysis of the samples. Specific analytical methods utilized in the analysis process are presented in Table 2-5.

2.6 Data Validation

All mainland laboratory data generated by the investigation was subjected to independent, third party, validation. The USEPA Region II Data Validation Standard Operating Procedures were followed. The same firm (Heartland Environmental Services, Inc.) was retained for this investigation that performed data validation for many of the previous investigations that have taken place at NSRR. This ensured a consistency of techniques and that an equivalent review of the data were performed.

SECTION 2.0
TABLES

TABLE 2-1

FIELD PARAMETER RESULTS OF SURFACE WATER
OPEN WATER MARINE - SWMU 45
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample ID	Date	Time	Temperature (^{O}C)	Specfic Conductance (mS/cm^{c})	Conductivity (mS/cm)	pH (S.U.)	Salinity (ppt)	D.O. (mg/L)	ORP (mV)
Open Water Marine									
11SD17	08/05/03	0957	30.2	41.22	45.18	7.92	26.36	7.10	-30.7
11SD18	08/05/03	1020	29.4	42.23	45.82	7.94	27.04	5.25	-27.6
11SD15	08/05/03	1100	29.8	42.33	46.24	8.09	27.06	6.45	-20.4
11SD16	08/05/03	1145	29.9	42.35	46.31	8.09	27.07	6.42	-18.9
11SD10	08/05/03	1235	29.9	42.40	46.37	8.13	27.12	6.97	-21.1
11SD11	08/06/03	0730	29.1	42.40	45.75	8.07	27.13	6.02	10.0
11SD12	08/06/03	0932	29.1	42.36	45.76	8.05	27.09	6.38	-3.8
11SD13	08/06/03	0950	29.2	42.30	45.76	8.00	27.00	6.24	-6.6
11SD14	08/06/03	1023	29.2	42.30	45.67	8.06	27.05	6.53	-5.4

Notes:
^{o}C - Degrees Celsius.
S.U. - Standard Unit.
mS/cm - milli semens per centimeter.
ppt - parts per thousand.
mg/L - milligrams per liter.
mV - millivolts.

TABLE 2-2

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample Media	Environment	Sample ID	Sample Depth (ft bgs)	Fixed Base Laboratory									Comments
				Appendix IX Parameters					Non App IX Param				
				App IX VOCs - (8260)	APP IX SVOCs - (8270)	App IX PCBs - (8082)	App IX Metals (total) (6020A/7000)	App IX Metals (diss.) - (6020A/7000)	Low Level PAHs (8270)	Cyanides - (9012)	Grain Size - sieve only (ASTM D422)	Total Organic Carbon - (9060)	
Sediment	Open Water Marine	11OWSD10	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD11	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD11D	0.0 - 0.5	X	X	X	X		X	X		X	Duplicate
		11OWSD11MS/MSD	0.0 - 0.5	X	X	X	X		X	X			Matrix SpikeMatrix Spike Duplicate
		11OWSD12	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD13	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD14	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD15	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD16	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD17	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD18	0.0 - 0.5	X	X	X	X		X	X	X	X	
		11OWSD20	0.0 - 0.5			X							
		11OWSD21	0.0 - 0.5			X							
		11OWSD22	0.0 - 0.5			X							
		11OWSD23	0.0 - 0.5			X							
		11OWSD24	0.0 - 0.5			X							
Surface Water	Open Water Marine	11OWSW10	NA	X	X	X	X	X	X	X			
		11OWSW11	NA	X	X	X	X	X	X	X			
		11OWSW11D	NA	X	X	X	X	X	X	X			Duplicate
		11OWSW11MS	NA	X	X	X	X	X	X	X			Matrix Spike
		11OWSW11MSD	NA	X	X	X	X	X	X	X			Matrix Spike Duplicate
		11OWSW12	NA	X	X	X	X	X	X	X			
		11OWSW13	NA	X	X	X	X	X	X	X			
		11OWSW14	NA	X	X	X	X	X	X	X			
		11OWSW15	NA	X	X	X	X	X	X	X			
		11OWSW16	NA	X	X	X	X	X	X	X			
		11OWSW17	NA	X	X	X	X	X	X	X			
		11OWSW18	NA	X	X	X	X	X	X	X			

Notes:
ft bgs - feet below ground surface.
NA - Not Applicable.

TABLE 2-3

ENSYS PCB RisC IN SOIL TEST KIT RESULTS
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

			Optical Density			Interpretation			
Sample ID	**Date**	**Time**	**Standard**	**1 ppm**	**10 ppm**	**1 ppm**	**10 ppm**	**Conc. Range in ppm**	**Laboratory Confirmation Result (ppm)**
11OWSD11	08/06/03	0730	-0.00	0.35	0.37	-	-	< 1	0.150
11OWSD12	08/06/03	0932	-0.00	0.42	0.41	-	-	< 1	0.035J
11OWSD14	08/06/03	1023	-0.00	0.39	0.43	-	-	< 1	0.077U
11OWSD10	08/05/03	1235	-0.08	0.31	0.32	-	-	< 1	0.018J
11OWSD13	08/06/03	0950	-0.08	0.33	0.41	-	-	< 1	0.022J
11OWSD17	08/05/03	0957	-0.08	0.39	0.40	-	-	< 1	0.026J
11OWSD15	08/05/03	1100	-0.25	0.36	0.34	-	-	< 1	0.035J
11OWSD16	08/05/03	1145	-0.25	0.38	0.39	-	-	< 1	0.025J
11OWSD18	08/05/03	1020	-0.25	0.39	0.41	-	-	< 1	0.038J

Note:
ppm - parts per million.

TABLE 2-4

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

QA/QC Sample Type	Sample ID	Fixed Base Laboratory						Comments
		App IX Param				Non App IX Param		
		App IX VOCs - (8260)	APP IX SVOCs - (8270)	App IX PCBs - (8082)	App IX Metals (total) - (6020A/7000)	Low Level PAHs (8270)	Cyanides - (9012)	
Trip Blanks	45TB01	X						Lab Prepared
	45TB02	X						Lab Prepared
Equipment Rinsates	45ER01	X	X	X	X	X	X	Stainless Steel Spoon
	45ER02	X	X	X	X	X	X	Eckman Dredge
Field Blank	2003FB01	X	X	X	X	X	X	Lab Grade DI

TABLE 2-5

**METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)**

Volatiles	Quantitation Limits*		Method Number
	Water (mg/L)	Low Soil (mg/kg)	
Acetone	50	50	8260
Acetonitrile	200	200	8260
Acrolein	100	100	8260
Acrylonitrile	100	100	8260
Benzene	5.0	5.0	8260
Bromodichloromethane	5.0	5.0	8260
Bromoform	5.0	5.0	8260
Bromomethane	10	10	8260
Carbon Disulfide	5.0	5.0	8260
Carbon Tetrachloride	5.0	5.0	8260
Chlorobenzene	5.0	5.0	8260
Chloroethane	10	10	8260
Chloroform	5.0	5.0	8260
Chloromethane	10	10	8260
Chloroprene	5.0	3.0	8260
3-Chloro-1-propene	5.0	5.0	8260
1,2-Dibromo-3-chloropropane	5.0	10	8260
Dibromochloromethane	5.0	5.0	8260
1,2-Dibromoethane	5.0	5.0	8260
Dibromomethane	5.0	5.0	8260
trans-1,4-Dichloro-2-butene	10	10	8260
Dichlorodifluoromethane	10	5.0	8260
Dibromomethane	5.0	5.0	8260
1,1-Dichloroethane	5.0	5.0	8260
1,2-Dichloroethane	5.0	5.0	8260
trans-1,2-dichloroethene	5.0	5.0	8260
1,1-Dichloroethene	5.0	5.0	8260
Methylene Chloride	5.0	5.0	8260
1,2-Dichloropropane	5.0	5.0	8260
cis-1,3-Dichloropropene	5.0	5.0	8260
trans-1,3-Dichloropropene	5.0	5.0	8260
Ethyl benzene	5.0	5.0	8260
Ethyl methacrylate	5.0	5.0	8260
2-Hexanone	25	25	8260
Iodomethane	5.0	5.0	8260
Isobutanol	200	200	8260
Methacrylonitrile	100	100	8260

TABLE 2-5

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

Volatiles	Quantitation Limits*		Method Number
	Water (μg/L)	Low Soil (μg/kg)	
2-Butanone	25	25	8260
Methyl methacrylate	5.0	5.0	8260
4-Methyl-2-pentanone	25	25	8260
Pentachloroethane	25	25	8260
Propionitrile	100	100	8260
Stryene	5.0	5.0	8260
1,1,1,2-Tetrachloroethane	5.0	5.0	8260
1,1,2,2-Tetrachloroethane	5.0	5.0	8260
Tetrachloroethene	5.0	5.0	8260
Toluene	5.0	5.0	8260
1,1,1-Trichloroethane	5.0	5.0	8260
1,1,2-Trichloroethane	5.0	5.0	8260
Trichloroethene	5.0	5.0	8260
Trichlorofluoromethane	5.0	5.0	8260
1,2,3-Trichloropropane	5.0	5.0	8260
Vinyl Acetate	10	10	8260
Vinyl Chloride	10	10	8260
Xylene	10	10	8260

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 2-5

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

Semivolatiles	Quantitation Limits* Water (mg/L)	Low Soil (mg/kg)	Method Number
Acenaphthene	10	330	8270
Acenaphthylene	10	330	8270
Acetophenone	10	330	8270
2-Acetylaminofluorene	10	330	8270
4-Aminobiphenyl	20	330	8270
Aniline	20	330	8270
Anthracene	10	330	8270
Aramite	10	330	8270
Benzo(a)anthracene	10	330	8270
Benzo(b)fluoranthene	10	330	8270
Benzo(k)fluoranthene	10	330	8270
Benzo(g,h,i)perylene	10	330	8270
Benzo(a)pyrene	10	330	8270
Benzyl alcohol	10	330	8270
Bis(2-chloroethoxyl)methane	10	330	8270
Bis(2-chloroethyl)ether	10	330	8270
Bis(2-ethylhexyl)phthalate	10	330	8270
4-Bromophenyl phenyl ether	10	330	8270
Butylbenzylphthalate	10	330	8270
4-Chloroaniline	20	660	8270
4-Chloro-3-methylphenol	10	330	8270
2-Chloronaphthalene	10	330	8270
2-Chlorophenol	10	330	8270
4-Chlorophenyl phenyl ether	10	330	8270
Chrysene	10	330	8270
3&4 Methylphenol	10	330	8270
2-Methylphenol	10	330	8270
Diallate	10	330	8270
Dibenzofuran	10	330	8270
Di-n-butyl phthalate	10	330	8270
Dibenzo(a,h)anthracene	10	330	8270
o-Dichlorobenzene	10	330	8270
m-Dichlorobenzene	10	330	8270
p-Dichlorobenzene	10	330	8270
3,3'-Dichlorobenzidine	20	660	8270
2,4-Dichlorophenol	10	330	8270
2,6-Dichlorophenol	10	330	8270
Diethylphthalate	10	330	8270
p-(Dimethylamino)azobenzene	10	330	8270
7,12-Dimethyl benz(a)anthracene	10	330	8270

TABLE 2-5

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

Semivolatiles	Quantitation Limits* Water (μg/L)	Quantitation Limits* Low Soil (μg/kg)	Method Number
3,3-Dimethyl benzidine	20	1,700	8270
2,4-Dimethylphenol	10	330	8270
alpha, alpha-Dimethylphenethylamine	2,000	67,000	8270
Dimethyl phthalate	10	330	8270
m-Dinitrobenzene	10	330	8270
4,6-Dinitro-2-methylphenol	50	1,700	8270
2,4-Dinitrophenol	50	1,700	8270
2,4-Dinitrotoluene	10	330	8270
2,6-Dinitrotoluene	10	330	8270
Di-n-octylphthalate	10	330	8270
1,4-Dioxane	10	330	8270
Dinoseb	10	330	8270
Ethylmethanesulfonate	10	330	8270
Fluoranthene	10	330	8270
Fluorene	10	330	8270
Hexachlorobenzene	10	330	8270
Hexachlorobutadiene	10	330	8270
Hexachlorocyclopentadiene	10	330	8270
Hexachloroethane	10	330	8270
Hexachlorophene	5,000	170,000	8270
Hexachloropropene	10	330	8270
Indeno(1,2,3-cd)pyrene	10	330	8270
Isophorone	10	330	8270
Isosafrole	10	330	8270
Methapyrilene	2,000	67,000	8270
3-Methylcholanthrene	10	330	8270
Methyl methanesulfonate	10	330	8270
2-Methylnaphthalene	10	330	8270
Naphthalene	10	330	8270
1,4-Naphthoquinone	10	330	8270
1-Naphthylamine	10	330	8270
2-Naphthylamine	10	330	8270
2-Nitroaniline	50	1,700	8270
3-Nitroaniline	50	1,700	8270
4-Nitroaniline	50	1,700	8270
Nitrobenzene	10	330	8270
2-Nitrophenol	10	330	8270
4-Nitrophenol	50	1,700	8270
4-Nitroquinoline-1-oxide	20	3,300	8270
n-Nitrosodi-n-butylamine	10	330	8270

TABLE 2-5

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

Semivolatiles	Quantitation Limits*		Method Number
	Water (mg/L)	Low Soil (mg/kg)	
n-Nitrosodiethylamine	10	330	8270
n-Nitrosodimethylamine	10	330	8270
n-Nitrosodiphenylamine	NA	330	8270
n-Nitrosodi-n-propylamine	10	330	8270
n-Nitrosomethylethylamine	10	330	8270
n-Nitrosomorpholine	10	330	8270
n-Nitrosopiperidine	10	330	8270
n-Nitrosopyrrolidine	10	330	8270
5-Nitro-o-toluidine	10	330	8270
bis-(2-chloroisopropyl)ether	10	330	8270
Pentachlorobenzene	10	330	8270
Pentachloronitrobenzene	10	330	8270
Pentachlorophenol	50	1,700	8270
Phenacetin	10	330	8270
Phenanthrene	10	330	8270
Phenol	10	330	8270
1,4-Phenylenediamine	2,000	1,700	8270
2-Picolin	10	330	8270
Pronamide	10	330	8270
Pyrene	10	330	8270
Pyridine	50	330	8270
Safrole	10	330	8270
1,2,4,5-Tetrachlorobenzene	10	330	8270
2,3,4,6-Tetrachlorophenol	10	330	8270
o-Toluidine	10	330	8270
1,2,4-Trichlorobenzene	10	330	8270
2,4,5-Trichlorophenol	10	330	8270
2,4,6-Trichlorophenol	10	330	8270
1,3,5-Trinitrobenzene	10	330	8270

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

NA = Not Available

TABLE 2-5

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

PCBs	Quantitation Limits*		Method Number
	Water (μg/L)	Low Soil (μg/kg)	
Aroclor-1016	1.0	33	8082
Aroclor-1221	2.0	67	8082
Aroclor-1232	1.0	33	8082
Aroclor-1242	1.0	33	8082
Aroclor-1248	1.0	33	8082
Aroclor-1254	1.0	33	8082
Aroclor-1260	1.0	33	8082

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

Field Reading Parameters	Quantitation Limits	Method Number
	Water (μg/L)	
Dissolved Oxygen (DO)	50	DO Meter (Field)
Salinity	parts per trillion	Salinity Meter (Field)
pH	unitless	pH Meter (Field)
Temperature	degrees C	Conductivity Meter (Field)

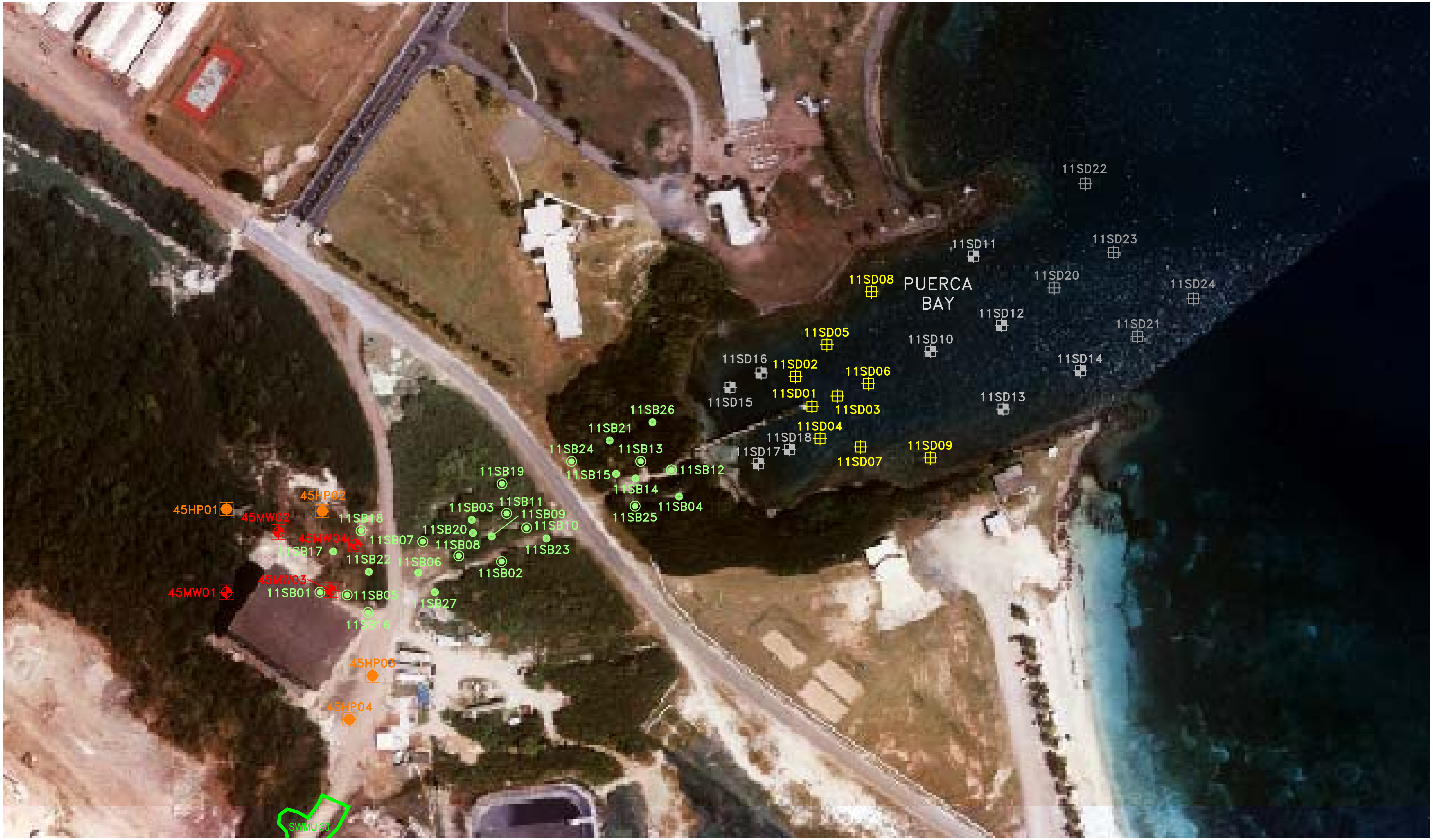
TABLE 2-5

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

Inorganics	Method Number	Quantitation Limits*		Method Description
		Water (mg/L)	Low Soil (mg/kg)	
Antimony	6010	20	2.0	Inductively Coupled Plasma
Arsenic	6010	10	1.0	Inductively Coupled Plasma
Barium	6010	10	1.0	Inductively Coupled Plasma
Beryllium	6010	4.0	0.4	Inductively Coupled Plasma
Cadmium	6010	5.0	0.5	Inductively Coupled Plasma
Chromium	6010	10	1.0	Inductively Coupled Plasma
Cobalt	6010	10	1.0	Inductively Coupled Plasma
Copper	6010	20	2.0	Inductively Coupled Plasma
Lead	6010	5.0	0.5	Inductively Coupled Plasma
Mercury	7470/7471	0.2	0.02	Cold Vapor AA
Nickel	6010	40	4.0	Inductively Coupled Plasma
Selenium	6010	10	1.0	Inductively Coupled Plasma
Silver	6010	10	1.0	Inductively Coupled Plasma
Thallium	6010	10	1.0	Inductively Coupled Plasma
Tin	6010	10	5.0	Inductively Coupled Plasma
Vanadium	6010	10	1.0	Inductively Coupled Plasma
Cyanide	9012	0.010	1.0	Colorimetric
Sulfide	9030	1.0	25	Titrimetric, Iodine
Zinc	6010	20	2.0	Inductively Coupled Plasma

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

SECTION 2.0
FIGURES



LEGEND

- 30 – SWMU
- – HYDROPUNCH LOCATION (1996 RFI)
- – MONITOR WELL LOCATION (1996 RFI)
- – DIRECT PUSH SOIL SAMPLE LOCATION (1997 RFI)
- – DIRECT PUSH SOIL AND GROUNDWATER SAMPLE LOCATION (1997 RFI)

OPEN WATER MARINE

- – SEDIMENT SAMPLE LOCATION (1997 RFI)
- – SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)
- – SURFACE WATER/SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

150 0 75 150
1 inch = 150 ft.

Baker

FIGURE 2-1
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS-SWMU 45
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

3.0 INVESTIGATION RESULTS

This section presents an overview of chemical analytical results obtained from samples taken during the Additional Data Collection Field Investigation at SWMU 45. The data presented below was obtained through sample collection and analysis of surface water and sediment samples. The analytical results for environmental and QA/QC samples also are included in this section. Appendix C contains the complete set of analytical results obtained from this investigation, including sediment and surface water, as well as the QA/QC results. Appendix D provides the data validation report narratives for the analytical results provided in this section.

The PAHs reported in the SVOC analysis were not presented in this report in favor of the low level PAH analysis. The detection levels for the low level PAHs were lower than the detection levels for the same constituents under the SVOC analysis.

The data reported for SWMU 45 was not screened against any criteria in this section of the report. However, this data was screened against criteria in the Refined Screening Level Ecological Risk Assessment and Step 3A of the Baseline Ecological Risk Assessment section of this report (Section 4.0). Please refer to Section 4.0 for any risks associated with the detections that will be mentioned in the subsections that follow.

Although the base background open water surface water and sediment samples were not collected during the additional data collection investigation at SWMU 45 as mentioned in Section 2.0, these results are utilized in Section 4.0 of this report. A detailed description and corresponding results for the open water background surface water and sediment samples can be found in the Final Additional Data Collection Investigation Report for the Tow Way Fuel Farm (Baker, 2003a).

3.1 Surface Water

A total of nine surface water samples along with one duplicate sample were collected from the Open Water Marine Environment of SWMU 45 during the Additional Data Collection Investigation as presented in Table 2-2. Of the analysis requested, only positive detections of VOCs and metals (total and dissolved fractions) were present.

A total of five volatiles: 2-Butanone (Methyl ethyl ketone), toluene, ethylbenzene, styrene, and xylenes (Total) were positively detected at low levels below the reporting limits in the surface water samples collected as shown in Table 3-1. Of the ten samples collected, only four samples (11OWSW12, 11OWSW13, 11OWSW14, and 11OWSW17) contained detections of at least one of the listed volatiles above. 2-Butanone was detected in two of the three locations (11SD13 and 11SD14) containing detections of the samples ranging in concentrations of 0.75J to 0.79J micrograms per liter (µg/L), respectively. Toluene was present in only one of the four locations (11SD17) containing positive detections, with a result of 0.17J µg/L in sample 11OWSW17. Ethylbenzene was present in only one of the four samples, with a result of 0.13J µg/L in sample 11OWSW12. Styene was detected in two of the four locations (11SD12 and 11SD13) containing detections of the samples ranging in concentrations of 0.45J to 0.57J µg/L, respectively. Xylenes (Total) was present in only one of the three locations (11SD12) containing positive detections, with a result of 0.44J µg/L in sample 11OWSW12, as presented in Table 3-1. The locations of these detections can be found on Figure 2-1.

There were no detections listed for the remaining analysis requested including: semivolatiles, low level PAHs, and PCBs.

A total of fourteen different metals were detected in the total fraction of the surface water samples as shown in Table 3-2, including antimony, arsenic, barium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, tin, vanadium, and zinc. A majority of the maximum detections in the total metals fraction were from sample 11OWSW13. This sample was collected at sample location 11SD13, located northeast of sediment location 11SD09, and due north of the enlisted personnel beach along Forrestal Drive, as presented on Figure 2-1. The remaining maximum detections were found in samples 11OWSW10 (antimony and silver), 11OWSW11 (selenium - Also located at 11OWSW13), and 11OWSW15 (thallium and tin).

A total of twelve different metals were detected in the dissolved fraction of the surface water samples as shown in Table 3-3, including antimony, arsenic, barium, chromium, cobalt, copper, nickel, selenium, thallium, tin, vanadium, and zinc. All of the metals detected in the total fraction were detected in the dissolved fraction except for lead and silver. The maximum detections of the metals in the dissolved fraction were found in samples 11OWSW15 (antimony), 11OWSW13 (arsenic, barium, vanadium, and zinc), 11OWSW11D (chromium, cobalt, thallium, and tin), 11OWSW16 (copper), 11OWSW18 (nickel), 11OWSW17 (selenium), 11OWSW12 (zinc), and 11OWSW14 (zinc). The maximum detections of all the dissolved fraction of metals, with the exception of thallium and tin, were less than the maximum detections for the same metals within the total fraction of metals. The dissolved detections of thallium and tin were slightly above the corresponding levels for the total fraction.

3.2 Sediment

A total of fourteen sediment samples along with one duplicate sample were collected from the Open Water Marine Environment of SWMU 45 during the Additional Data Collection Investigation as presented in Table 2-2. As mentioned in Section 2.3 of this report, five additional sediment samples were collected at SWMU 45 during this investigation for delineation purposes of PCBs. These sediment samples were sent to the laboratory with instructions to extract and hold for analysis. After a thorough review of the initial PCB sample results from the originally proposed sample locations, along with the high detection levels with the EnSys PCB Kit as mentioned in Section 2.3, it was decided that these additional samples (11OWSD20 through 11OWSD24) should be analyzed for PCBs only to aide in the delineation of PCBs in the sediment and the Refined Screening Level Ecological Risk Assessment and Step 3A of the Baseline Ecological Risk Assessment. Of the analysis requested for the ten samples originally proposed in the EPA approved work plan (Baker, 2001b), positive detections of VOCs, SVOCs, low level PAHs, PCB, and metals were present. The TOC and grain size values for these samples are also provided in this section. Five of the fifteen sediment samples collected during this investigation were only analyzed for PCBs. Figure 2-1 presents the locations of the sediment samples obtained from SWMU 45 during the Additional Data Collection Investigation.

A total of five volatiles: acetone, 2-butanone (methyl ethyl ketone), toluene, 2-hexanone, and ethylbenzene were detected in all ten of the originally proposed sediment samples collected at this site as presented in Table 3-4. Acetone was detected in every sample, and is most likely attributed to the analytical laboratory. 2-butanone was also present in all ten sediment samples, with concentrations ranging from 14J micrograms per kilogram (μg/kg) (11OWSD10) to 85J μg/kg (11OWSD15). Toluene was only detected in two of the ten samples collected, with concentrations of 2.1J μg/kg in sample 11OWSD17, and 2.5J μg/kg in sample 11OWSD18. 2-hexanone was detected in one sample at a concentration of 230J μg/kg in sample 11OWSD15 and ethylbenzene was also detected in one sample at a concentration of 0.78J μg/kg in sample 11OWSD14.

Two SVOCs: di-n-butylphthalate, and bis(2-ethylhexyl)phthalate were detected in one of the nine sediment sample locations originally proposed in the work plan, as presented in Table 3-4. The location of the detection for both of the above listed SVOCs was found in sample 11OWSD11, with concentrations of 170J µg/kg, and 300J µg/kg, respectively. Sample location 11OWSD11 was positioned just south of the land point north of the cove in Puerca Bay.

Seventeen low level PAHs were detected in the originally proposed sediment samples collected during this investigation as presented in Table 3-4. The maximum detections of the low level PAH constituents detected, were found at sample location 11SD11, with the exception of benzo(k)fluoranthene located at 11SD18. Sample location 11SD11 was located just south of the land point north of the cove in Puerca Bay, while sample location 11SD18 was located just south of the water cooling tunnel which runs into the cove in Puerca Bay, as presented on Figure 2-1. Eight of the seventeen low level PAHs detected were found in all nine sediment samples, including phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)pyrene, chrysene, indeno(1,2,3-cd)pyrene, and benzo(g,h,I)perylene.

One PCB (Aroclor-1260) was detected in ten of the fourteen sediment sample location as shown in Table 3-4. The detections of Aroclor-1260 ranged from 12J µg/kg in sample 11OWSD21, to 150 µg/kg in sample 11OWSD11. This sample was collected from location 11SD11, positioned just south of the land point north of the cove in Puerca Bay. As mentioned in the above paragraph of this section, five additional sediment samples (11SD20 through 11SD24) were collected and analyzed for PCBs only to assist in the delineation of PCBs within the embayment of Puerca Bay . Table 3-4 contains the PCB results for those sediment samples along with the ten original sediment samples collected. The five additional samples were obtained to assist in delineating the contamination out from the cooling water intake tunnel. The five samples made up two additional lines of samples at the mouth of the embayment. 11SD20 and 11SD21 were at the first line while 11SD22, 11SD23, and 11SD24 were the final line of samples collected from the embayment. As shown on Table 3-4 only two of the five samples (11SD20 and 11SD21) positively detected PCBs. These samples were collected from the first line. The remaining other three samples provide the delineation of Aroclor 1260 away from the cooling water intake tunnel.

The TOC in the nine sediment sample locations collected from the Open Water Marine Environment of SWMU 45 ranged from 17,000 milligrams per kilogram (mg/kg) in sample 11OWSD11, to 34,000 mg/kg in sample 11OWSD18.

A total of seventeen different inorganics were detected in the sediment samples as shown in Table 3-5, including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, and zinc. All of the inorganics detected, except for mercury in sample 11OWSD15, were detected in all of the sediment samples collected. The inorganics detected in the sediment samples from SWMU 45 were consistently detected across the site. More than half of all the location of maximum detections for the inorganics were found in sample 11OWSD18. This sample was collected from sample location 11SD18, positioned just south of the water cooling tunnel which runs into the cove in Puerca Bay, as presented on Figure 2-1.

One sample was obtained from the nine original sample locations to determine the grain size from the SWMU 45 Open Water Marine Environment. The makeup of the sediments in this environment consists of 54.5% fines, 45.2% sands, and 0.3% gravel on average for the nine samples collected. The results from each sample, along with the ranges of the soil classification by percent of total sample are presented in Table 3-6. As presented on this table, it appears that the nine sediment samples can be grouped into two distinct soil classification categories. The first category consists of four sediment samples (11OWSD10, 11OWSD12, 11OWSD13, and

11OWSD18) with a soil make up of predominantly fines (60.3% to 80.2%). The second category consists of five sediment samples (11OWSD11, 11OWSD14, 11OWSD15, 11OWSD16, and 11OWSD17) with a soil make up of predominantly sands (51.8% to 67.4%). Appendix C presents the entire grain size data package.

3.3 QA/QC Samples

A total of five QA/QC samples including two trip blanks (45TB01 and 45TB02), two equipment rinsate samples (45ER01 and 45ER02), and one field blank sample (2003FB01) were collected during the Additional Data Collection Investigation for SWMU 45 as presented in Table 2-4.

A total of two VOCs were detected in one of the two trip blank samples collected, including ethylbenzene and styrene. The concentrations ranged from 0.11J µg/L and 0.93J µg/L, respectively from sample 45TB01, as presented in Table 3-7. It should be noted that the corresponding samples (11OWSW10, 11OWSW15, 11OWSW16, 11OWSW17, 11OWSW18, 11OWSD10, 11OWSD15, 11OWSD16, 11OWSD17, 11OWSD18, 45ER01, and 45ER02) shipped in the same cooler as 45TB01, did not contain any detections of the above mentioned two VOCs. No detections of VOCs were identified in either of the two equipment rinsate samples, or the field blank sample (2003FB01).

There were no detections in the remaining organic analysis requested for the equipment rinsate samples and the field blank sample (SVOCs, low level PAHs, and PCBs).

Of the inorganic (total) analysis requested, a total of seven constituents were positively detected, including antimony, barium, copper, lead, nickel, tin, and zinc as presented in Table 3-7. The constituents mentioned above are most likely related to the lab grade deionized water that was used to collect the equipment rinsate samples. All but one of the metals from the equipment rinsate samples were detected in the field blank sample) as presented in Table 3-7.

SECTION 3.0
TABLES

TABLE 3-1

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SURFACE WATER
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD11	11SD12	11SD13	11SD14	11SD15
Sample ID	11OWSW10	11OWSW11	11OWSW11D	11OWSW12	11OWSW13	11OWSW14	11OWSW15
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03
Volatiles (ug/L)							
2-Butanone (Methyl ethyl ketone)	10 U	10 U	10 U	10 U	0.79 J	0.75 J	10 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	0.13 J	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	0.57 J	0.45 J	1 U	1 UJ
Xylenes, Total	2 U	2 U	2 U	0.44 J	2 U	2 U	2 U

Semivolatiles (ug/L)
Not Detected

Low Level PAHs (ug/L)
Not Detected

PCBs (ug/L)
Not Detected

Notes:
U - Not Detected.
J - Estimated Value.
UJ - Reported quantitation limit is qualified as estimated.
ug/L - micrograms per liter.

TABLE 3-1

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SURFACE WATER
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date	11SD16 11OWSW16 08/05/03	11SD17 11OWSW17 08/05/03	11SD18 11OWSW18 08/05/03	Number of Positive Detections	Range of Positive Detections	Location of Maximum Detection
Volatiles (ug/L)						
2-Butanone (Methyl ethyl ketone)	10 U	10 U	10 U	2/10	0.75J - 0.79J	11OWSW13
Toluene	1 U	0.17 J	1 U	1/10	0.17J - 0.17J	11OWSW17
Ethylbenzene	1 U	1 U	1 U	1/10	0.13J - 0.13J	11OWSW12
Styrene	1 U	1.2 U	1 U	2/10	0.45J - 0.57J	11OWSW12
Xylenes, Total	2 U	2 U	2 U	1/10	0.44J - 0.44J	11OWSW12
Semivolatiles (ug/L)						
Not Detected						
Low Level PAHs (ug/L)						
Not Detected						
PCBs (ug/L)						
Not Detected						

Notes:
U - Not Detected.
J - Estimated Value.
UJ - Reported quantitation limit is qualified as estimated.
ug/L - micrograms per liter.

TABLE 3-2

SUMMARY OF INORGANIC (TOTAL) DETECTIONS IN OPEN WATER MARINE SURFACE WATER
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD11	11SD12	11SD13	11SD14	11SD15	11SD16
Sample ID	11OWSW10	11OWSW11	11OWSW11D	11OWSW12	11OWSW13	11OWSW14	11OWSW15	11OWSW16
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03	08/05/03
Inorganics (Total) mg/L								
Antimony	0.0018 J	0.00049 J	0.00048 J	0.00049 J	0.00044 J	0.00041 J	0.0013 J	0.0012 J
Arsenic	0.002 J	0.0017 J	0.0018 J	0.0016 J	0.0022 J	0.0018 J	0.0017 J	0.0019 J
Barium	0.0086	0.0084	0.0076	0.0078	0.0093	0.0084	0.0082	0.0083
Chromium	0.0009 J	0.00077 J	0.00094 J	0.00081 J	0.0024 J	0.00085 J	0.00098 J	0.005 U
Cobalt	0.00072 J	0.00089 J	0.00085 J	0.00087 J	0.0012 J	0.0009 J	0.00075 J	0.00075 J
Copper	0.0039 J	0.00077 J	0.00076 J	0.00098 J	0.005 J	0.0007 J	0.0013 J	0.0022 J
Lead	0.00038 J	0.00027 J	0.00015 J	0.00009 J	0.0012 J	0.000097 J	0.00014 J	0.00024 J
Nickel	0.00036 J	0.00023 J	0.00027 J	0.00015 J	0.00083 J	0.00036 J	0.00029 J	0.00034 J
Selenium	0.00019 J	0.0003 J	0.00029 J	0.00019 J	0.0003 J	0.00024 J	0.00019 J	0.00023 J
Silver	0.000076 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Thallium	0.00032 J	0.00028 J	0.0004 J	0.001 U	0.001 U	0.001 U	0.00045 J	0.001 U
Tin	0.00024 J	0.00019 J	0.00062 J	0.00047 J	0.00056 J	0.00026 J	0.00072 J	0.00043 J
Vanadium	0.0031 J	0.0028 J	0.0034 J	0.0027 J	0.0069	0.0029 J	0.0027 J	0.0026 J
Zinc	0.0091 J	0.0096 J	0.01	0.01	0.014	0.011	0.008 J	0.0092 J

Notes:
U - Not Detected.
J - Estimated Value.
mg/L - milligrams per liter.

TABLE 3-2

SUMMARY OF INORGANIC (TOTAL) DETECTIONS IN OPEN WATER MARINE SURFACE WATER
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date	11SD17 11OWSW17 08/05/03	11SD18 11OWSW18 08/05/03	Number of Positive Detections	Range of Positive Detections	Location of Maximum Detection
Inorganics (Total) mg/L					
Antimony	0.0011 J	0.0011 J	10/10	0.0004J - 0.0018J	11OWSW10
Arsenic	0.0018 J	0.0018 J	10/10	0.0016J - 0.0022J	11OWSW13
Barium	0.0087	0.0086	10/10	0.0076 - 0.0093	11OWSW13
Chromium	0.005 U	0.00089 J	8/10	0.00077J - 0.0024J	11OWSW13
Cobalt	0.00075 J	0.00082 J	10/10	0.00072J - 0.0012J	11OWSW13
Copper	0.0028 J	0.0024 J	10/10	0.0007J - 0.005J	11OWSW13
Lead	0.00037 J	0.00051 J	10/10	0.00009J - 0.0012J	11OWSW13
Nickel	0.00021 J	0.00053 J	10/10	0.00015J - 0.00083J	11OWSW13
Selenium	0.00026 J	0.0002 J	10/10	0.00019J - 0.0003J	11OWSW11,11OWSW13
Silver	0.005 U	0.005 U	1/10	0.000076J - 0.000076J	11OWSW10
Thallium	0.001 U	0.001 U	4/10	0.00028J - 0.00045J	11OWSW15
Tin	0.00038 J	0.00037 J	10/10	0.00019J - 0.00072J	11OWSW15
Vanadium	0.0028 J	0.003 J	10/10	0.0026J - 0.0069	11OWSW13
Zinc	0.0093 J	0.013	10/10	0.008J - 0.014	11OWSW13

Notes:
U - Not Detected.
J - Estimated Value.
mg/L - milligrams per liter.

TABLE 3-3

SUMMARY OF INORGANIC (DISSOLVED) DETECTIONS IN OPEN WATER MARINE SURFACE WATER
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD11	11SD12	11SD13	11SD14	11SD15	11SD16
Sample ID	11OWSW10	11OWSW11	11OWSW11D	11OWSW12	11OWSW13	11OWSW14	11OWSW15	11OWSW16
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03	08/05/03
Inorganics (Dissolved) mg/L								
Antimony	0.00081 J	0.00044 J	0.00039 J	0.00042 J	0.00041 J	0.0004 J	0.00094 J	0.00087 J
Arsenic	0.0015 J	0.0016 J	0.0018 J	0.0018 J	0.0019 J	0.0016 J	0.0016 J	0.0017 J
Barium	0.0075	0.0081	0.0081	0.0081	0.0085	0.0082	0.0079	0.0076
Chromium	0.005 U	0.00073 J	0.00082 J	0.00079 J	0.00072 J	0.00077 J	0.005 U	0.005 U
Cobalt	0.00069 J	0.00083 J	0.00087 J	0.00085 J	0.00084 J	0.00085 J	0.00071 J	0.00068 J
Copper	0.00052 J	0.0005 J	0.00045 J	0.0004 J	0.00041 J	0.00061 J	0.0004 J	0.00088 J
Nickel	0.00023 J	0.00016 J	0.00019 J	0.00014 J	0.00018 J	0.00016 J	0.00021 J	0.00017 J
Selenium	0.00018 J	0.0002 J	0.00021 J	0.00021 J	0.00014 J	0.0025 U	0.00023 J	0.00018 J
Thallium	0.001 U	0.001 U	0.00046 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tin	0.00027 J	0.00019 J	0.00078 J	0.00046 J	0.0004 J	0.00028 J	0.00038 J	0.00023 J
Vanadium	0.0021 J	0.0025 J	0.0024 J	0.0025 J	0.0026 J	0.0023 J	0.0022 J	0.0022 J
Zinc	0.0081 J	0.01	0.01	0.011	0.011	0.011	0.0083 J	0.0091 J

Notes:
U - Not Detected.
J - Estimated Value.
mg/L - milligrams per liter.

TABLE 3-3

SUMMARY OF INORGANIC (DISSOLVED) DETECTIONS IN OPEN WATER MARINE SURFACE WATER
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date	11SD17 11OWSW17 08/05/03	11SD18 11OWSW18 08/05/03	Number of Positive Detections	Range of Positive Detections	Location of Maximum Detection
Inorganics (Dissolved) mg/L					
Antimony	0.00085 J	0.00067 J	10/10	0.00039J - 0.00094J	11OWSW15
Arsenic	0.0018 J	0.0018 J	10/10	0.0015J - 0.0019J	11OWSW13
Barium	0.0083	0.0079	10/10	0.0075 - 0.0085	11OWSW13
Chromium	0.005 U	0.005 U	5/10	0.00072J - 0.00082J	11OWSW11D
Cobalt	0.00075 J	0.00072 J	10/10	0.00068J - 0.00087J	11OWSW11D
Copper	0.00081 J	0.00071 J	10/10	0.0004J - 0.00088J	11OWSW16
Nickel	0.00021 J	0.00024 J	10/10	0.00014J - 0.00024J	11OWSW18
Selenium	0.00028 J	0.00022 J	9/10	0.00014J - 0.00028J	11OWSW17
Thallium	0.001 U	0.001 U	1/10	0.00046J - 0.00046J	11OWSW11D
Tin	0.00026 J	0.005 U	9/10	0.00019J - 0.00078J	11OWSW11D
Vanadium	0.0024 J	0.0023 J	10/10	0.0021J - 0.0026J	11OWSW13
Zinc	0.0099 J	0.0091 J	10/10	0.0081J - 0.011	11OWSW12,11OWSW13,11OWSW14

Notes:
U - Not Detected.
J - Estimated Value.
mg/L - milligrams per liter.

TABLE 3-4

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD11	11SD12	11SD13	11SD14	11SD15	11SD16
Sample ID	11OWSD10	11OWSD11	11OWSD11D	11OWSD12	11OWSD13	11OWSD14	11OWSD15	11OWSD16
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03	08/05/03
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Volatiles (ug/kg)								
Acetone	30 J	40 J	80 J	40 J	57 J	67 J	320 J	68 J
2-Butanone (Methyl ethyl ketone)	14 J	18 J	19 J	19 J	19 J	22 J	85 J	22 J
Toluene	10 U	12 U	12 U	11 U	11 U	12 U	19 U	11 U
2-Hexanone	50 UJ	62 UJ	60 UJ	56 UJ	54 UJ	59 UJ	230 J	55 UJ
Ethylbenzene	10 U	12 U	12 U	11 U	11 U	0.78 J	19 U	11 U
Semivolatiles (ug/kg)								
Di-n-butylphthalate	3,200 U	170 J	110 J	7,500 U	7,500 U	770 U	5,900 U	8,200 U
bis(2-Ethylhexyl)phthalate	3,200 U	300 J	120 J	7,500 U	7,500 U	770 U	5,900 U	8,200 U
Low Level PAHs (ug/kg)								
Naphthalene	13 U	64 UJ	16 J	15 U	15 U	16 U	24 U	17 U
2-Methylnaphthalene	13 U	32 J	10 J	15 U	15 U	16 U	2.5 J	1.5 J
1-Methylnaphthalene	13 U	24 J	8.2 J	15 U	15 U	16 U	24 U	1.4 J
Acenaphthylene	13 U	64 U	3.5 J	15 U	15 U	16 U	24 U	17 U
Acenaphthene	4.1 J	220 J	70 J	15 U	15 U	16 U	13 J	11 J
Fluorene	2.8 J	220 J	62 J	15 U	15 U	16 U	14 J	11 J
Phenanthrene	46	2,400 J	720 J	25	23	16 U	190	150
Anthracene	9.6 J	540 J	140 J	6.3 J	5.3 J	16 U	41	33
Fluoranthene	87	2,600 J	920 J	56	51	6.5 J	230	210
Pyrene	76	2,100 J	760 J	50	46	6.1 J	200	190
Benzo(a)anthracene	50	1,200 J	480 J	32	30	4.7 J	120	110
Chrysene	52	1,000 J	430 J	35	32	5 J	110	100
Benzo(b)fluoranthene	120	1,200 J	720 J	65	62	13 J	160	160
Benzo(k)fluoranthene	13 U	64 U	14 U	15 U	15 U	16 U	24 U	17 U
Benzo(a)pyrene	60	790 J	420 J	39	35	7.3 J	93	95
Indeno(1,2,3-cd)pyrene	17	370 J	73 J	16	14 J	3.2 J	19 J	14 J
Benzo(g,h,i)perylene	23	340 J	100 J	22	17	4.8 J	27	31

TABLE 3-4

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD11	11SD12	11SD13	11SD14	11SD15	11SD16
Sample ID	11OWSD10	11OWSD11	11OWSD11D	11OWSD12	11OWSD13	11OWSD14	11OWSD15	11OWSD16
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03	08/05/03
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
PCBs (ug/kg)								
Aroclor-1260	18 J	150	48 J	35 J	22 J	77 U	35 J	25 J
Miscellaneous Parameters								
Total Organic Carbon (mg/kg)	22,000	17,000	27,000	29,000	24,000	22,000	31,000	27,000

Notes:
U - Not Detected.
J - Estimated Value.
UJ - Reported quantitation limit is qualified as estimated.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
NA - Not Applicable.

TABLE 3-4

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD17		11SD18		11SD20	11SD21	11SD22	11SD23	11SD24
Sample ID	11OWSD17		11OWSD18		11OWSD20	11OWSD21	11OWSD22	11OWSD23	11OWSD24
Sample Date	08/05/03		08/05/03		08/06/03	08/06/03	08/06/03	08/06/03	08/06/03
Sample Depth (ft bgs)	0.0 - 0.5		0.0 - 0.5		0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Volatiles (ug/kg)									
Acetone	42	J	93	J	NA	NA	NA	NA	NA
2-Butanone (Methyl ethyl ketone)	19	J	27	J	NA	NA	NA	NA	NA
Toluene	2.1	J	2.5	J	NA	NA	NA	NA	NA
2-Hexanone	60	UJ	66	UJ	NA	NA	NA	NA	NA
Ethylbenzene	12	U	13	U	NA	NA	NA	NA	NA
Semivolatiles (ug/kg)									
Di-n-butylphthalate	7,500	U	8,700	U	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	7,500	U	8,700	U	NA	NA	NA	NA	NA
Low Level PAHs (ug/kg)									
Naphthalene	4.8	J	18	U	NA	NA	NA	NA	NA
2-Methylnaphthalene	2.6	J	18	U	NA	NA	NA	NA	NA
1-Methylnaphthalene	1.8	J	18	U	NA	NA	NA	NA	NA
Acenaphthylene	15	U	18	U	NA	NA	NA	NA	NA
Acenaphthene	11	J	18	U	NA	NA	NA	NA	NA
Fluorene	9.1	J	18	U	NA	NA	NA	NA	NA
Phenanthrene	140		20		NA	NA	NA	NA	NA
Anthracene	33		8.2	J	NA	NA	NA	NA	NA
Fluoranthene	190		150		NA	NA	NA	NA	NA
Pyrene	180		180		NA	NA	NA	NA	NA
Benzo(a)anthracene	110		52		NA	NA	NA	NA	NA
Chrysene	99		71		NA	NA	NA	NA	NA
Benzo(b)fluoranthene	180		18	U	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	15	U	110		NA	NA	NA	NA	NA
Benzo(a)pyrene	93		18	U	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	9.2	J	7.5	J	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	25		22		NA	NA	NA	NA	NA

TABLE 3-4

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD17	11SD18	11SD20	11SD21	11SD22	11SD23	11SD24
Sample ID	11OWSD17	11OWSD18	11OWSD20	11OWSD21	11OWSD22	11OWSD23	11OWSD24
Sample Date	08/05/03	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
PCBs (ug/kg)							
Aroclor-1260	26 J	38 J	24 J	12 J	63 U	60 U	58 U
Miscellaneous Parameters							
Total Organic Carbon (mg/kg)	19,000	34,000	NA	NA	NA	NA	NA

Notes:
U - Not Detected.
J - Estimated Value.
UJ - Reported quantitation limit is qualified as estimated.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
NA - Not Applicable.

TABLE 3-4

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	Number of Positive Detections	Range of Positive Detections	Location of Maximum Detection
Volatiles (ug/kg)			
Acetone	10/10	30J - 320J	11OWSD15
2-Butanone (Methyl ethyl ketone)	10/10	14J - 85J	11OWSD15
Toluene	2/10	2.1J - 2.5J	11OWSD18
2-Hexanone	1/10	230J - 230J	11OWSD15
Ethylbenzene	1/10	0.78J - 0.78J	11OWSD14
Semivolatiles (ug/kg)			
Di-n-butylphthalate	2/10	110J - 170J	11OWSD11
bis(2-Ethylhexyl)phthalate	2/10	120J - 300J	11OWSD11
Low Level PAHs (ug/kg)			
Naphthalene	2/10	4.8J - 16J	11OWSD11D
2-Methylnaphthalene	5/10	1.5J - 32J	11OWSD11
1-Methylnaphthalene	4/10	1.4J - 24J	11OWSD11
Acenaphthylene	1/10	3.5J - 3.5J	11OWSD11D
Acenaphthene	6/10	4.1J - 220J	11OWSD11
Fluorene	6/10	2.8J - 220J	11OWSD11
Phenanthrene	9/10	20 - 2,400J	11OWSD11
Anthracene	9/10	5.3J - 540J	11OWSD11
Fluoranthene	10/10	6.5J - 2,600J	11OWSD11
Pyrene	10/10	6.1J - 2,100J	11OWSD11
Benzo(a)anthracene	10/10	4.7J - 1,200J	11OWSD11
Chrysene	10/10	5J - 1,000J	11OWSD11
Benzo(b)fluoranthene	9/10	13J - 1,200J	11OWSD11
Benzo(k)fluoranthene	1/10	110 - 110	11OWSD18
Benzo(a)pyrene	9/10	7.3J - 790J	11OWSD11
Indeno(1,2,3-cd)pyrene	10/10	3.2J - 370J	11OWSD11
Benzo(g,h,i)perylene	10/10	4.8J - 340J	11OWSD11

TABLE 3-4

SUMMARY OF ORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	Number of Positive Detections	Range of Positive Detections	Location of Maximum Detection
PCBs (ug/kg)			
Aroclor-1260	11/15	12J - 150	11OWSD11
Miscellaneous Parameters			
Total Organic Carbon (mg/kg)	10/10	17,000 - 34,000	11OWSD18

Notes:
U - Not Detected.
J - Estimated Value.
UJ - Reported quantitation limit is qualified as estimated.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
NA - Not Applicable.

TABLE 3-5

SUMMARY OF INORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD11	11SD12	11SD13	11SD14	11SD15
Sample ID	11OWSD10	11OWSD11	11OWSD11D	11OWSD12	11OWSD13	11OWSD14	11OWSD15
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Inorganics (mg/kg)							
Antimony	0.24 J	0.65 J	0.27 J	0.21 J	0.21 J	0.27 J	0.49 J
Arsenic	5.9	7.1	7.3	6.6	6.8	5.3	4.1
Barium	17	27	25	21	18	17	22
Beryllium	0.064 J	0.097 J	0.11 J	0.08 J	0.074 J	0.1 J	0.064 J
Cadmium	0.13 J	0.2 J	0.21 J	0.13 J	0.14 J	0.11 J	0.25 J
Chromium	10	16 J	19 J	13 J	14 J	11 J	9.5
Cobalt	3.5	5	4.8	3.8	3.7	2.9	3.6
Copper	27	59 J	50 J	35 J	35 J	24 J	31
Lead	10	25 J	19 J	12 J	10 J	6.4 J	13
Mercury	0.031 J	0.034 J	0.032 J	0.034 J	0.036 J	0.015 J	0.07 U
Nickel	3.6	5.6	6.6	4.8	4.7	3.9	4.2
Selenium	0.25 J	0.31 J	0.4 J	0.38 J	0.36 J	0.39 J	0.26 J
Silver	0.05 J	0.079 J	0.074 J	0.05 J	0.058 J	0.084 J	0.088 J
Thallium	0.14 J	0.094 J	0.07 J	0.14 J	0.083 J	0.046 J	0.23 J
Tin	3.4 J	4.3 J	4.8 J	4.2 J	4.4 J	4.1 J	6.4 J
Vanadium	24	40	42	30	30	27	27
Zinc	39	66 J	67 J	47 J	44 J	26 J	52

Notes:
U - Not Detected.
J - Estimated Value.
mg/kg - milligrams per kilogram.

TABLE 3-5

SUMMARY OF INORGANIC DETECTIONS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	11SD16 11OWSD16 08/05/03 0.0 - 0.5	11SD17 11OWSD17 08/05/03 0.0 - 0.5	11SD18 11OWSD18 08/05/03 0.0 - 0.5	Number of Positive Detections	Range of Positive Detections	Location of Maximum Detection
Inorganics (mg/kg)						
Antimony	0.32 J	0.47 J	0.71 J	10/10	0.21J - 0.71J	11OWSD18
Arsenic	3.6	3.2	4.7	10/10	3.2 - 7.3	11OWSD11D
Barium	15	22	33	10/10	15 - 33	11OWSD18
Beryllium	0.054 J	0.058 J	0.12 J	10/10	0.054J - 0.12J	11OWSD18
Cadmium	0.17 J	0.38 J	1.3	10/10	0.11J - 1.3	11OWSD18
Chromium	6.8	11	17	10/10	6.8 - 19J	11OWSD11D
Cobalt	3.7	3.6	6.1	10/10	2.9 - 6.1	11OWSD18
Copper	25	25	48	10/10	24J - 59J	11OWSD11
Lead	7.2	13	18	10/10	6.4J - 25J	11OWSD11
Mercury	0.016 J	0.017 J	0.038 J	9/10	0.015J - 0.038J	11OWSD18
Nickel	3.8	4	7.1	10/10	3.6 - 7.1	11OWSD18
Selenium	0.25 J	0.21 J	0.37 J	10/10	0.21J - 0.4J	11OWSD11D
Silver	0.062 J	0.062 J	0.1 J	10/10	0.05J - 0.1J	11OWSD18
Thallium	0.14 J	0.11 J	0.2 J	10/10	0.046J - 0.23J	11OWSD15
Tin	4.1 J	3.8 J	5.1 J	10/10	3.4J - 6.4J	11OWSD15
Vanadium	21	25	43	10/10	21 - 43	11OWSD18
Zinc	36	41	80	10/10	26J - 80	11OWSD18

Notes:
U - Not Detected.
J - Estimated Value.
mg/kg - milligrams per kilogram.

TABLE 3-6

GRAIN SIZE SOIL CLASSIFICATION RESULTS IN OPEN WATER MARINE SEDIMENT
SWMU 45 - FORMER POWER PLANT
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Site ID	11SD10	11SD11	11SD12	11SD13	11SD14	11SD15	11SD16	11SD17	11SD18		
Sample ID	11OWSD10	11OWSD11	11OWSD12	11OWSD13	11OWSD14	11OWSD15	11OWSD16	11OWSD17	11OWSD18	Range of % of	Average % of
Sample Date	08/05/03	08/06/03	08/06/03	08/06/03	08/06/03	08/05/03	08/05/03	08/05/03	08/05/03	Total Sample	Total Sample
Sample Depth (ft bgs)	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5		
Soil Clasification (% of total sample)											
Gravel	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0 - 2.7	0.3
Sand	39.7	61.2	19.8	26.3	51.8	67.4	66.7	52.6	21.5	19.8 - 67.4	45.2
Coarse Sand	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0 - 4.3	0.5
Medium Sand	2.6	20.9	1.0	0.8	15.6	19.1	27.7	6.3	2.1	0.8 - 27.7	10.7
Fine Sand	37.1	40.3	18.8	25.5	36.2	48.3	34.7	46.3	19.4	18.8 - 48.3	34.1
Fines	60.3	38.8	80.2	73.7	48.2	32.6	30.6	47.4	78.5	30.6 - 80.2	54.5

Notes:
ft bgs - feet below ground surface.

TABLE 3-7

SUMMARY OF DETECTIONS IN QA/QC SAMPLES
ADDITIONAL DATA COLLECTION INVESTIGATION
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Sample ID	2003FB01	45TB01	45TB02	45ER01	45ER02
Sample Date	07/28/03	08/05/03	08/07/03	08/05/03	08/05/03
Volatiles (ug/L)					
Ethylbenzene	1 U	0.11 J	1 U	1 U	1 U
Styrene	1 U	0.93 J	1 U	1 U	1 U
Semivolatiles (ug/L)					
Not Detected					
Low Level PAHs (ug/L)					
Not Detected					
PCBs (ug/L)					
Not Detected					
Inorganics (Total) mg/L					
Antimony	0.0025 U	NA	NA	0.00059 J	0.00055 J
Barium	0.0093	NA	NA	0.0011 J	0.001 J
Copper	0.0034 J	NA	NA	0.00086 J	0.0018 J
Lead	0.00016 J	NA	NA	0.0015 U	0.00015 J
Nickel	0.00012 J	NA	NA	0.000069 J	0.005 U
Tin	0.00021 J	NA	NA	0.00024 J	0.00032 J
Zinc	0.0049 J	NA	NA	0.01 U	0.01 U

Notes:
U - Not Detected.
J - Estimated Value.
NA - Not Applicable.
ug/L - micrograms per liter.
mg/L - milligrams per liter.

4.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT

This section presents a screening-level ecological risk assessment (ERA) and Step 3a of the baseline ERA for SWMU 45 (Areas Outside of Building 38), located at NSRR, Ceiba, Puerto Rico. The ERA was conducted in accordance with the Chief of Naval Operations (CNO) document entitled Navy Policy for Conducting Ecological Risk Assessments (CNO, 1999).

The Navy ERA process (see Figure 4-1) consists of eight steps organized into three tiers and represents a clarification and interpretation of the eight-step ERA process outlined in the USEPA ERA guidance for the Superfund program (USEPA, 1997). Tier 1 of the Navy ERA process represents the screening-level ERA:

- Screening-level problem formulation and ecological effects evaluation (Step 1).
- Screening-level exposure estimate and risk calculation (Step 2).

Under Navy policy, if the results of Steps 1 and 2 (Tier 1 screening-level ERA) indicate that, based on a set of conservative exposure assumptions, there are chemicals present in environmental media that may pose a risk to receptor species/communities, the ERA process proceeds to the baseline ERA. According to Superfund guidance (USEPA, 1997), Step 3 represents the problem formulation phase of the baseline ERA. Under Navy policy, the baseline ERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a. In Step 3a, the conservative exposure assumptions applied in Tier 1 are refined and risk estimates are recalculated using the same conceptual site model. The evaluation of risks in Step 3a may also include consideration of background data, chemical bioavailability, and the frequency of detection. If the re-evaluation of conservative exposure assumptions does not support an acceptable risk determination, the site continues through the baseline ERA process, starting with Step 3b (baseline ERA problem formulation).

4.1 Environmental Setting

The sections that follow provide a brief description of the site. The habitats occurring within and contiguous to SWMU 45 are also described, as well as the biota that may be present. The description of habitats and biota relies primarily on literature-based information for Puerto Rico and NSRR. This information is supplemented by observations recorded during a habitat characterization conducted at SWMU 45 in May 2000 (upland habitats) and June 2000 (marine habitats). The habitat characterization report, prepared by Geo-Marine, Inc (Plano, Texas), is included as Appendix E.

4.1.1 Site History

NSRR occupies over 8,600 acres on the East Coast of Puerto Rico, along Vieques Passage (see Figure 1-1), with Vieques Island lying approximately ten miles to the east. NSRR was commissioned in 1943 as a Naval Operations Base and re-designated a Naval Station in 1957. The current primary mission of NSRR is limited (NSRR is currently preparing for operational closure).

SWMU 45 is comprised of the area outside Building 38 (Former power plant). Building 38 is located along an access road south of Forrestal Drive opposite Camp Moscrip and north of SWMU 3 (Base Landfill [see Figure 1-2]). The former power plant contained a 60-megawatt steam turbine facility that operated from the early 1940s through 1949 (NEESA, 1984). The facility used Bunker C fuel, which was stored in two 50,000-gallon reinforced underground concrete tanks located directly northeast of the building (NEESA, 1984). From 1956 to 1964, transformer maintenance was performed at building 38. As part of the maintenance, transformer oil was reportedly drained on the ground, in the immediate vicinity of the building.

Associated with Building 38 are two underground tunnels that were used to transfer cooling water to and from the building. A cooling water intake tunnel extends from Building 38 out into a small cove of Puerca Bay, east-northeast of the building. The cooling tower discharge tunnel originates from the building's east wall and parallels the access road to the landfill (SWMU 3). Apparently, the discharge tunnel terminates somewhere in the Ensenada Honda (to the south); however, the exact location of the outfall has not been determined. The underground storage tanks (USTs), cooling water intake and discharge tunnel, and the Puerca Bay cove (embayment) are included as part of SWMU 45.

SWMU 45 was initially addressed under the Navy's Installation Restoration Program (IRP), which followed a CERCLA pattern. Under the IRP, a Remedial Investigation (RI) was performed. PCB contamination was found in soil immediately outside Building 38. An Interim Corrective Measure (ICM) was designed for the affected soils, which included excavation of the contaminated soils, shipment off island for appropriate disposal, and sampling of the surrounding area to ensure that cleanup was achieved. The soil removal took place in 1994. A report entitled Final Closeout Report for Interim Remedial Action of PCB Contaminated Soils, Sites 15 and 16 at Naval Station Roosevelt Roads, Puerto Rico was submitted to the USEPA in May 1995 (OHM, 1995). It is noted that the "Site 16" referenced in the report title is the IRP designation for what is now SWMU 45.

NSRR submitted a RCRA Part B Permit application for the storage of hazardous waste on the base. Recognizing that Corrective Action would apply to unpermitted waste management units, the Navy performed a Supplemental Site Investigation (SSI) at a variety of units (including SWMU 45) to provide additional site characterization information to the EPA to assist in their permitting decisions. Included in the investigation were the sediments of the Puerca Bay cove and the cooling water tunnel interior. The investigations were reported in the report entitled Draft Supplemental Investigation, Installation Restoration Program Activities, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker 1993).

The Resource Conservation and Recovery Act (RCRA) corrective action portion of the facility's permit (issued in October 1994) contained specific requirements for investigation and, potentially, remediation at the site. To accomplish the goals of the permit, a RCRA Facility Investigation (RFI) work plan was submitted to, and subsequently approved by the EPA. The work plan provided the framework for site characterization activities; its scope was guided by the results of the SSI.

An RFI at SWMU 45 was performed in 1996 in accordance with the work plan. The findings of the RFI confirmed those of the SSI and indicated that USTs and cooling water tunnel represented a possible source of continuing release. On the basis of this finding, the Navy decided to perform an ICM to eliminate the potential for further release. The plans for the ICM, which were submitted to the EPA and approved, called for the cleaning and abandonment in place of the USTs and tunnel. Inflow of groundwater to the tunnel necessitated a field design change (approved by the EPA), which provided for the filling of the USTs and sealing the tunnel with low density concrete. This approach entombed and effectively immobilized any residual contamination.

During the ICM on the tunnel, an excavation was made at a point along the outside of the tunnel in an attempt to ascertain how groundwater was entering the tunnel. Soils contaminated with petroleum were observed. A work plan to investigate the outside of the tunnel was submitted to and subsequently approved by the EPA. The work was performed and the results were presented in the EPA-approved Revised Draft RCRA Facility Investigation Report for Operable Unit 3/5 (Baker 1999). This report (and/or its precursor the initial "draft" report) recommended a CMS for the Puerca Bay sediments and the soils immediately adjacent to the cooling water tunnel.

4.1.2 Terrestrial and Marine Habitats

A description of terrestrial habitats within and contiguous to SWMU 45, as well as a description of the marine habitats occurring within the small cove of Puerca Bay is provided in the sections that follow. As discussed in Section 4.1, the description of habitats relies primarily on literature-based information for Puerto Rico and NSRR, and is supplemented by site-specific observations recorded during the habitat characterization conducted at SWMU 45 in May 2000 (upland habitats) and June 2000 (marine habitats).

4.1.2.1 Terrestrial Habitats

The upland habitat bounded by NSRR is classified as subtropical dry forest (Ewel and Witmore, 1973). Similar to other forested areas of Puerto Rico, this region was previously clear-cut in the early part of the century, primarily for pastureland (Geo-Marine, Inc., 1998). After acquisition by the Navy, a secondary growth of thick scrub, dominated by lead tree (*Leucaena spp.*), Christmas tree (*Randia aculeate*), sweet acacia (*Acacia famesiana*), and Australian corkwood (*Sesbania grandiflora*) grew in the previously grazed sections (Geo-Marine, Inc., 1998). Secondary growth communities (upland coastal forest communities and coastal scrub forest communities) exist today throughout the station's undeveloped upland. The upland vegetative community within and contiguous to SWMU 45 is classified as a coastal scrub forest community (see Figure 4-2). Shrubs, including wild tamarind (*Leucaena leucocephala*), dwarf poinciana (*Caesalpinia pulcherrima*), bottle wiss (*Capparis flexusa*), and prickly mampoo (*Pisonia aculeate*) dominate the community. Maintained grasses, including *Bothriochloa ischaemum*, *Chloris barbata*, and *Digitaria sp.*, dominate areas immediately adjacent to road corridors. The fringe of the cove has near 100 percent shrub cover with little herbaceous vegetation. The community is dominated by seaside mahoe (*Thespesia populnea*), with sparse coverage by black mangroves (*Stachytarpeta jamaicensis*) and sea pusley (*Hellotropium curassavicum*).

Cobana negra (*Stahlia monosperma*), a federally threatened tree species, is known to occur between the boundary of black mangrove communities and coastal upland forest communities. This species is also known to occur in coastal forests of southeastern Puerto Rico (Little and Wadsworth, 1964). However, this species has not been found to occur on NSRR by previous surveys and was not observed at SWMU 45 during the May 2000 habitat characterization.

4.1.2.2 Marine Habitats

The marine environment surrounding NSRR includes mudflats, mangroves (black mangrove [*Avicenia germinans*] and red mangrove [*Rhizophora mangle*] communities), and seagrass beds (turtle grass [*Thalassia testudium*] and manatee grass [*Syringodium filliforme*]). The total area of mudflats, mangroves, and sea grass beds in the offshore environment is approximately 161 acres, 2,700 acres, and 1,900 acres, respectively (Geo-Marine, Inc., 1998). Coral reefs are also located in the offshore marine environment. Seagrass beds represent grazing areas for the green sea turtle (*Chelonia mydas*) and the West Indian manatee (*Trichechas manatus*). The green sea turtle is a federally threatened species, and the West Indian manatee is a federally endangered species. Both species have been reported from the marine environment surrounding NSRR.

The nearest open water habitat downgradient from SWMU 45 is the Puerca Bay cove. As described in Section 4.1.1, a cooling water intake tunnel extends from Building 38 out into this cove. A reconnaissance survey of the cove, conducted on June 19, 2000 as part of the habitat characterization at SWMU 45, identified the following distinct habitats: (1) rocky subtidal zone comprised of riprap extending from above Mean High Water (MHW) to approximately 3 feet below Mean Low Water (MLW); (2) shallow subtidal shelf (3 to 10 feet below Mean Sea Level [MSL]) characterized as a seagrass/algae bed dominated by turtle grass; (3) shelf slope (10 to 15 feet below MSL) devoid of seagrass and dominated by marine algae; and (4) unvegetated sand to silty-sand bottom (15 to 20 feet below MSL) located within the interior of the cove from its mouth with Puerca Bay to and around the cooling water intake structure. The concrete sidewalls of the cooling tunnel intake structure also serves as habitat, supporting a hardbottom community dominated by soft corals, marine algae, and sponges.

A map showing the spatial relationship of SWMU 45 to the embayment is provided as Figure 4-3. Included on this figure are wetland units identified by the Cowardian Wetland Classification System (Cowardian et al., 1979 [see Figure 4-4]). The wetlands depicted on Figure 4-3 were delineated by Geo-Marine, Inc. in December 1999 from 1993 color infrared and 1998 true color aerial photography. Twenty percent of the wetlands delineated by aerial photography were field checked to verify the accuracy of the delineations. Field verification was based on the 1987 Corps of Engineers wetland delineation manual (United States Army Corps of Engineers [USACE], 1987). As evidenced by Figures 4-2 and 4-3, there are no freshwater or marine wetland units within or contiguous to SWMU 45.

4.1.3 Biota

A description of the biota occurring within Puerto Rico and the landmass encompassed by NSRR is provided in the sections that follow. This description is supplemented by information contained within the habitat characterization report included as Appendix E.

4.1.3.1 *Mammals*

A total of 22 terrestrial mammal species are known historically from Puerto Rico; however, all mammals except bats (13 species) have been extirpated (United States Geological Society [USGS], 1999). None of the bats found on Puerto Rico are exclusive to the island. The West Indian manatee is known to occur in the marine environment surrounding NSRR. As depicted on Figure 4-2 and discussed in Section 4.1.2.2, seagrass (i.e., turtle grass) occurs within the small cove of Puerca Bay. The location of the seagrass (shallow subtital shelf 3 to 10 feet below MSL) represents potential feeding habitat for this marine mammal.

Several terrestrial mammals have been introduced into Puerto Rico, including the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), and mongoose (*Herpestes javanicus*). These nonindigenous mammals have been implicated in the decline of native bird and reptile populations (USGS, 1999 and United States Fish and Wildlife Service [USFWS], 1996a).

4.1.3.2 Birds

A total of 239 bird species are native to Puerto Rico (Raffaele, 1989). This total includes breeding permanent residents and non-breeding migrants. In addition, many nonindigenous bird species have been introduced to Puerto Rico, including the shiny cowbird (*Molothrus* *bonariensis*) and several parrot species, such as the budgerigar (*Melopsittacus undulates*), orange-fronted parrot (*Aratinga canicularis*), and monk parrot (*Myiopsitta monaqchus*). Of the 239 species native to Puerto Rico, 12 are endemic to the island (Raffaele, 1989).

Numerous native and migratory bird species have been reported at NSRR (Geo-Marine, Inc., 1998). A list of bird species reported at NSRR or having the potential to occur is provided in Table 4-1. The list, compiled from literature-based information pre-dating 1990, includes the great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), little blue heron (*Florida caerulea*), black-crowned night heron (*Nycticorax nycticorax*), belted kingfisher (*Ceryle alcyon*), spotted sandpiper (*Actitis macularia*), greater yellowlegs (*Tringa melanoleauca*), black-bellied plover (*Squatarola squatarola*), clapper rail (*Rallus longirostris*), Royal tern (*Thalasseus maximus*), sandwich tern (*Thalasseus sandvicensis*), least tern (*Stema albifrons*), yellow warbler (*Dendroica petechia*), palm warbler (*Dendroica palmarum*), prairie warbler (*Dendroica discolar*), magnolia warbler (*Dendrocia magnolia*), mourning dove (*Zenaida macroura*), red-legged thrush (*Mimocichla plumbea*), common nighthawk (*Chordeiles minor*), and red-tailed hawk (*Buteo jamaicensis*). Endemic species reported from NSRR include the Puerto Rican lizard cuckoo (*Saurothera vieilloti*), Puerto Rican flycatcher (*Myiarchus antillarum*), Puerto Rican woodpecker (*Malanerpes portoricensis*), Puerto Rican emerald (*Chlorostilbon maugaeus*), and yellow-shouldered blackbird (*Agelaius xanthomus*).

The yellow-shouldered blackbird is a federally endangered species. One of the principal reasons for the status of this species is attributed to parasitism by the nonindigenous shiny cowbird, which lays its eggs in blackbird nests and sometimes punctures the host's eggs (USFWS, 1983). Other factors contributing to the status of this species include nest predation by the introduced black rat, Norway rat, and mongoose, as well as habitat modification and destruction (USFWS 1996a). The entire land area of NSRR was declared critical habitat for the yellow-shouldered blackbird in 1976; however, a 1980 agreement with the USFWS exempted certain areas from this categorization (Geo-Marine, Inc., 1998). A study conducted by the Naval Facilities Engineering Command (NFEC, 1996) reported that the mangrove forests surrounding NSRR should be considered the most important nesting habitats for the yellow-shouldered blackbird. SWMU 45 is outside the critical habitat designation for the yellow-shouldered blackbird; however, potential feeding habitat (shrubland) is present at the site (Geo-Marine, inc., 2000). It is noted that only seven sightings in all have been reported at NSRR from 1986 to 1996. The last reported nesting pair of yellow-shouldered blackbirds at NSRR was in 1986 (USFWS, 1996a). Other federally listed bird species that have been reported at NSRR or have the potential to occur are the brown pelican (*Pelecanus occidentalis occidentalis*), roseate tern (*Sterna dougallii dougallii*), and the piping plover (*Charadrius melodus*) (Geo-Marine, Inc., 1998). Given their habitat preferences for feeding (open water), the brown pelican and roseate tern have the potential to use the small cove as a food source.

Several bird species typically associated with coastal forests were observed at SWMU 45 during the habitat characterization (see Appendix E). Specific species observed were the killdeer (*Charadrius vociferous*), common ground dove (*Columbina passerina*), frigatebird (*Fregata magnificens*), pearly-eyed thrasher (*Margarops fascatus*), northern mockingbird (*Mimus polygottos*), greater antillen grackle (*Quiscalus niger*), cave swallow (*Pterochelidon fulva*), gray kingbird (*Tyrannus dominicensis*), white-winged dove (*Zenaida asiatica*), zenaida dove (*Zenaida aurita*), and yellow warbler

4.1.3.3 Reptiles and Amphibians

A total of 23 amphibians and 47 reptiles are known from Puerto Rico and the adjacent waters (USGS, 1999). Fifteen of the amphibians and 29 of the reptiles are endemic, while four amphibian species and three reptilian species have been introduced (USGS, 1999). Puerto Rico's native amphibian species include 16 species of tiny frogs commonly called coquis. On the coastal lowlands, almost all coqui species are arboreal. The only amphibians listed under provisions of the Endangered Species Act of 1973 are the Puerto Rican ridge-headed toad (*Peltophryene lemur*) and the golden coqui (*Eleutherodactylus jasperi*). Both species are listed as threatened. Distribution of the golden coqui is restricted to areas of dense bromeliad growth. All specimens to date have been collected from a small semicircular area of a 6-mile radius south of Cayeye (approximately 30 miles southwest of NSRR), generally at elevations above 700 meters (USFWS, 1984). The Puerto Rican ridge-headed toad occurs at low elevations (below 200 meters) where there is exposed limestone or porous, well drained soil offering an abundance of fissures and cavities (USFWS, 1987). A single large population is known to exist from the southwest coast in Guanica Commonwealth Forest, and a small population is believed to survive on the north coast near Quebradillas, Arecibo, Barceloneta, Viga Baja, and Bayamon (USFWS, 1987). It has also been collected on the southeastern coastal plain near Coamo (USFWS, 1987). Given the habitat preferences and locations of known occurrences, these two species are not expected to occur at NSRR.

Puerto Rico's native reptilian species include 31 lizards, 8 snakes, 1 freshwater turtle, and 5 sea turtles (USGS, 1999). Of the five sea turtles, only the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), and loggerhead sea turtle (*Dermochelys coriacea*) nest within Puerto Rico. These three sea turtles, as well as the leatherback sea turtle (*Caretta caretta*) and the Puerto Rican boa (*Epicrates inornatus*) represent the reptilian species listed under the provisions of the Endangered Species Act of 1973 (USGS, 1999). Given the presence of seagrass within the small cove of Puerca Bay, this surface water body represents potential feeding habitat for the listed sea turtles.

The Puerto Rican boa uses a variety of habitats but is most commonly found in karst forest habitats. Given the absence of karst forest habitat and the absence of any known occurrence of this species at or contiguous to Building 38 (Geo-marine, Inc. 1998 and 2000), there is a low probability of occurrence for this species at SWMU 45. The only reptile species observed with the upland habitat at SWMU 45 during the May 2000 habitat characterization (Geo-marine, Inc. 2000) was a lizard (crested anole [*Anolis cristatellus*]).

4.1.3.4 Fish and Aquatic Invertebrates

A diverse fish and invertebrate community can be found in the marine environment surrounding NSRR. This can be attributed to the varied habitats that include marine and estuarine open water habitat, mud flats, sea grass beds, and mangrove forests. The fish community is represented by stingrays, herrings, groupers, needlefish, mullets, barracudas, jacks, snappers, grunts, snooks, lizardfishes, parrotfishes, gobies, filefishes, wrasses, damselfishes, and butterflyfish (Geo-Marine, Inc., 1998). The benthic invertebrate community includes sponges, corals, anemones, sea cucumbers, sea stars, urchins, and crabs.

Marine invertebrates observed within the small cove of Puerca Bay during the marine reconnaissance survey included sea urchins (*Echinometra lucunter* and *Echinometra viridis*), encrusting fire coral (*Millipora alcicormus*), common sea fan (*Gorgonia venalina*), starlet coral (*Siderastrea ammulatta*), pincushin starfish (*Oreaster reticulates*), and corkscrew anemone (*Bartholomea annulatta*), as well as two species of sea cucumbers (*Actinopyga agassizii* and *Holothuria mexicana*). In addition to invertebrates, sixteen fish species were observed with in the cove. The specific species encountered included the sergeant major (*Abudefduf saxatillis*), dusky damselfish (*Stegates fuscus*), tomtate (*Haemulon aurolineatum*), gray snapper (*Lutjanus griseus*), squirrelfish (*Holocentrus sp.*), yellow fin mojarra (*Gerres cinereus*), and silver jenny

(*Eucinostomus gula*). A complete list of the benthic invertebrate and fish species encountered within each of the cove's habitats is included within the habitat characterization report included as Appendix E.

4.2 Sources of Available Analytical Data

Since completion of the ICM in 1994 (removal of PCB-contaminated surface soil), sampling activities at SWMU 45 have been conducted under two separate investigations:

- RFI investigation in 1996 (Phase 1) and 1997 (Phase 2): groundwater (Phase 1 and 2), surface soil (Phase 1), subsurface soil (Phase 1 and 2), and sediment (Phase 2)

- Additional data collection field investigation in August 2003: embayment surface water and sediment.

The 1996 RFI investigation was limited to the general area of the USTs associated with Building 38, while the 1997 investigation focused on the cooling water intake tunnel leading to the embayment. The RFI investigations (Phase 1 and 2) and associated analytical data were previously presented and discussed in the USEPA-approved Revised Draft RFI for OU 3/5 (Baker, 1999).

The objective of the additional data collection investigation was to address various data deficiencies and gaps associated the analytical data generated during the RFI investigation. Specific data deficiencies addressed by this investigation included the following:

- The collection and analysis of surface water samples from the embayment (surface water samples were not collected during the RFI field investigations).

- The collection and analysis of additional sediment samples from locations within the embayment to characterize the extent of PCB (Aroclor-1260) contamination. These locations included the mouth of the embayment, as well as locations on either side of the cooling water intake tunnel).

A description of the additional data collection investigation and associated analytical data is presented in Sections 2.0, and 3.0, respectively. The location that surface soil, subsurface soil, groundwater, surface water, and sediment were collected from during the RFI and additional data collection investigations are depicted on Figure 2-1. A listing of the samples utilized in this screening-level ERA is provided in Table 4-2.

Analytical data for groundwater samples collected during the RFI investigation (Phase 1 and 2) were excluded from evaluation in the screening-level ERA for the following reasons:

- Groundwater does not represent an exposure point for ecological receptors.

- Although migration with groundwater to embayment surface water and sediment represents a potential transport pathway at SWMU 45, a sufficient number of surface water and sediment samples have been collected from the embayment to adequately address this transport pathway.

- The majority of groundwater samples at SWMU 45 were collected from hydropunch or temporary wells. Because they were installed without a sand pack or bentonite seal, samples may be impacted by high turbidity and thus elevated metal concentrations.

The groundwater data were discussed with regard to the potential for groundwater to serve as a potential migration pathway for contaminants to relevant downgradient media (i.e., embayment surface water and sediment).

Analytical data for soil samples collected from the surface to a maximum depth of one-foot below ground surface (bgs) were quantitatively evaluated in the screening-level ERA. This depth range is the most active biological zone (most soil heterotrophic activity occurs within the surface soil and soil invertebrates occur on the surface or within the oxidized root zone [Suter II, 1995]) and thus represents the most realistic potential for exposure for most of the ecological receptors evaluated in terrestrial habitats. Analytical data for the RFI (Phase 1 and 2) subsurface soil samples collected from deeper depth intervals (e.g., 2 to 4 feet, 2 to 6 feet, 4 to 8 feet, and 6 to 10 feet bgs), were not evaluated since these depths are not likely to represent a significant exposure point for ecological receptors. However, identical to groundwater, these data were discussed with regard to the potential for subsurface soil to serve as a potential source area for subsequent migration of contaminants to relevant downgradient media (i.e., embayment surface water and sediment) in the refined screening-level risk calculation.

The analytical data for sediment collected during Phase 2 of the RFI investigation and the additional data collection investigation were combined into a unified data set for evaluation in the screening-level ERA. Although the age of the RFI data are not indicative of current levels of exposure, their exclusion from quantitative evaluation would result in data deficiencies since locations sampled were not re-characterized during the additional data collection field investigation. It is noted that many of the chemicals associated with the RFI sediment data (Aroclor-1260 and metals) do not readily degrade. Finally, analytical data for surface water samples collected during the additional data collection investigation were evaluated in the screening-level ERA. Surface water samples were not collected from the embayment during the RFI investigation (Phase 1 or 2). The analytical data used in the screening-level ERA is presented as Appendix F.

4.3 Screening-Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the ERA. The products of the screening-level problem formulation are (1) the preliminary conceptual model and (2) the assessment and measurement endpoints. The purpose of the preliminary conceptual model is to describe how ecological receptors may be exposed to chemicals originating from the site. The preliminary conceptual model is developed using information regarding major habitats and ecological receptors, media of concern, and potential contaminant sources in conjunction with an understanding of potential transport pathways, exposure pathways, and exposure routes. The fate, transport, and toxicological properties of the chemicals present at the site are also considered during this process. Assessment and measurement endpoints define the ecological attributes to be protected. They are selected to evaluate those receptors for which complete and potentially significant exposure pathways are likely to exist.

4.3.1 Preliminary Conceptual Model

Exposure, and thus potential for risk, can only occur if each of the following conditions are present (USEPA, 1998):

- A source of contamination must be present.

- Release and transport mechanisms must be available to move the contaminants from the source to an exposure point.

- An exposure point must exist where ecological receptors could contact affected media.

- An exposure route must exist whereby the contaminant can be taken up by ecological receptors.

Figure 4-5 presents a preliminary conceptual model for SWMU 45. The conceptual model outlines potential sources of contamination, transport pathways, exposure media, potential exposure pathways and routes, and receptor groups. Specific components of the preliminary conceptual model (i.e., source areas, transport pathways, and exposure pathways and routes) are discussed in the sections that follow.

4.3.1.1 Source Areas

The USTs and associated piping have historically represented source areas for the release of Bunker C fuel to subsurface soil and groundwater. Chemicals associated with Bunker C fuel include PAHs [i.e., 1-methylnaphthalene, 2-methylnaphthalene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene] and oil soluble metals (i.e., nickel and vanadium). The PCB-contaminated soil also represented a potential source area for the release of PCBs to subsurface soil, groundwater, and downgradient surface soil. Finally, transformer storage and maintenance areas within Building 38, as well as contaminated sediment within the cooling water intake tunnel have represented historical source areas for the release of chemicals (i.e., PCBs and Bunker C fuel) to surface water and sediment within the embayment. The source areas at SWMU 45 have been eliminated by the ICMs conducted in 1994 and 1996 (see Section 4.1.1)

4.3.1.2 Transport Pathways

A transport pathway describes the mechanisms whereby chemicals may be transported from a source of contamination to ecologically relevant media. As depicted on Figure 4-5, the primary mechanisms for contaminant transport from potential source areas at SWMU 45 are believed to include the following:

- Overland transport of chemicals with surface soil via surface runoff to downgradient surface soil. Given the nearly level upland terrain at SWMU 45, as well as the soil removal completed in 1996, this transport pathway is considered insignificant

- Leaching of chemicals from surface soil and/or subsurface soil by infiltrating precipitation and transport to embayment surface water and sediment with groundwater.

- Uptake by biota from surface soil, surface water, and/or sediment and trophic transfer to upper trophic level receptors.

The discharge of chemicals through the cooling water intake tunnel represents a historical transport pathway. This transport pathway was eliminated during the 1996 ICM by sealing of the cooling water intake tunnel with cast-in-place concrete.

As evidenced by Figure 4-6, there are no storm water conveyances (e.g., ditches and storm sewers) present at Building 38 or the surrounding area that can serve as pathways for the transport of chemicals with surface soil (via surface runoff) to surface water and sediment. Furthermore, sheet flow conveyances to off-site surface soil is hindered by the nearly level upland terrain at SWMU 45 (Geo-Marine Inc., 2000), the secondary growth vegetation that surrounds much of building 38, and the access roadway located immediately east of Building 38. There are two storm water outfalls discharging to the embayment (Outfall 015 and NR-020). Drainage areas for both outfalls include roadways, parking lots, and administrative, industrial, and storage areas. The presence of these two storm water outfalls is a significant source of uncertainty in the screening-level ERA since any chemicals detected in surface water and sediment collected from the embayment may not be associated with a release from SWMU 45. This uncertainty is further complicated by the lack of background surface water and sediment data for a surface water body that receives similar storm water discharges. Differentiating the source(s) of contamination (if any) in embayment surface water and sediment under these conditions will be difficult, if not impossible.

4.3.1.3 Exposure Pathways and Routes

An exposure pathway links a source of contamination with one or more receptors via exposure to one or more media. Requirements for a complete exposure pathway were presented in Section 4.3.1. As depicted on Figure 4-5, potentially complete and significant exposure pathways exist at SWMU 45.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. The most common exposure routes are dermal contact, direct uptake, ingestion, and inhalation. Terrestrial plants may be exposed to chemicals present in surface soil directly through their root surfaces during water and nutrient uptake. Unrooted, floating aquatic plants, rooted submerged aquatic plants, and algae may be exposed to chemicals directly from the water or (for rooted plants) from sediments. Terrestrial and aquatic invertebrates may be exposed to chemicals in surface soil, surface water, and/or sediment, through dermal adsorption and ingestion. Much of the toxicological data available for terrestrial and aquatic invertebrates are based upon *in situ* studies that represent both pathways. Therefore, both pathways were considered together in this screening-level ERA. Invertebrates also represent a link between surface soil, surface water, and/or sediment and upper trophic level receptors through food web transfer. As such, they were included as prey items, where appropriate, for upper trophic level dietary exposures.

Birds and mammals may be exposed to chemicals through: (1) the inhalation of gaseous chemicals or chemicals adhered to particulate matter; (2) the incidental ingestion of contaminated abiotic media (e.g., soil or sediment) during feeding or cleaning activities; (3) the ingestion of contaminated water; (4) the ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. These exposure routes, where applicable, are depicted on Figure 4-5. Their relative importance depends in part on the chemical being evaluated. For chemicals having the potential to bioaccumulate (e.g., PCBs), the greatest exposure to wildlife is likely to be from the ingestion of prey. For chemicals having a limited potential to bioaccumulate (e.g., aluminum), the exposure of wildlife to chemicals is likely to be greatest through the direct ingestion of abiotic media, such as surface soil.

Direct ingestion of drinking water is only considered if the salinity of a drinking water source is less than 15 parts per thousand (ppt), the approximate toxic threshold for wildlife receptors (Humphreys, 1988). As evidenced by Figures 4-2 and 4-3, there are no fresh surface water bodies within or contiguous to SWMU 45. The only potential drinking water source contiguous to SWMU 45 is the small cove of Puerca Bay. Salinity measurements were taken at each surface water sampling location within the embayment during the additional data collection field investigation conducted in August 2003. The salinity of surface water ranged from 26.4 ppt to 27.1 ppt. Given that all salinity values exceeded the approximate toxic threshold for wildlife, the downgradient surface water body does not represent a potential drinking water source. Thus, ingestion of surface water is not a potential complete exposure pathway and was not considered in risk calculations for upper trophic level receptors.

Certain potential exposure pathways and/or routes identified on or excluded from Figure 4-5 were not evaluated by the screening-level ERA. Though potentially complete, these pathways were considered insignificant relative to other pathways due to low potential for exposure and low levels of relevant contaminants. For example, dermal exposures were not identified as significant relative to ingestion exposures for upper trophic level receptors and were not evaluated in the screening-level ERA. This approach is supported by evidence outlined in Suter II et al. (2000) and the USEPA (2000a), including the general fate properties of the majority of compounds detected in surface soil and sediment (e.g., low affinity for dermal uptake), the low potential exposure frequency and duration, and the protection offered by feathers, fur, and scales to avian, mammalian, and reptilian receptors. In addition, literature reviews indicate that dermal exposures to wildlife from classes of chemicals known or suspected to be of concern via dermal adsorption (e.g., VOCs, organophosphorous pesticides, and petroleum compounds) are often overestimated in laboratory studies (where feathers/fur are removed) and do not represent realistic exposure scenarios (USEPA, 2000a). Furthermore, though burrowing reptiles (which would be expected to experience the most significant exposure) inhabit the upland habitat at SWMU 45 (see Section 4.1.3.3 and Appendix E), chemicals known or suspected to be of concern via dermal adsorption are not known to be associated with historical activities at the site (e.g., organophsophorous pesticides) or were not detected (e.g., VOCs). Moreover, in developing surface soil screening levels for twenty-four important compounds identified from National Priorities List (NPL) sites and Biological Technical Assistant Group (BTAG) recommendations, USEPA calculated that the contribution of dermal exposures to the total dose received by terrestrial receptors to be 0.5% or less and therefore omitted the dermal pathway from their exposure estimates (USEPA, 2000a). Incidental ingestion of surface soil or sediment during feeding and preening activities was considered in risk estimates for upper trophic level receptors. Direct contact exposures were also considered for lower trophic level receptors (i.e., terrestrial and aquatic invertebrates).

Inhalation of gaseous chemicals and chemicals adhered to particulate matter (e.g., soil) were also excluded from evaluation in this screening-level ERA as the inhalation pathway is considered insignificant relative to ingestion pathways. As described above for dermal exposures, this approach is consistent with Suter II et al. (2000) and USEPA (1997 and 2000a), which recognize the relatively small contribution the inhalation pathway contributes to exposure estimates. For example, USEPA (2000a) estimates the expected contribution of exposure to dust particles and VOCs via inhalation to be 0.01% and 0.5% or less, respectively relative to ingestion. Site conditions further reduce the importance of this exposure route relative to ingestion. The vegetative groundcover at SWMU 45 minimizes the suspension of dust and the potential for exposure via inhalation of chemicals adhered to soil particles. Furthermore, inhalation of gaseous chemicals that have volatilized from surface soil is not a potential exposure route since VOCs were not detected in surface soil samples (see Appendix F).

Potentially complete and significant exposure pathways for terrestrial mammals (i.e., incidental ingestion of surface soil and ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs) were not selected for evaluation. The exclusion of mammals is appropriate because the potentially exposed mammalian receptors are limited to nonindigenous, nuisance species (see Section 4.1.3.1). However, because they represent a potential link between surface soil chemicals and terrestrial carnivores, they were included as food items in this screening-level ERA.

Though potentially complete exposure pathways have been identified for terrestrial reptiles (e.g., various lizard species), terrestrial amphibians (e.g., coquis), and aquatic reptiles (e.g., sea turtles) at SWMU 45 (see Figure 4-5), there is a paucity of data concerning the toxicological effects of chemicals for reptiles and amphibians, rendering a quantitative evaluation problematic (USEPA, 2000a and 2003a). However, it can be qualitatively stated that reptiles and amphibians are not at risk if no risks are identified to other upper trophic level receptors utilizing the site that occupy a similar trophic level. This approach is consistent with USEPA Region III BTAG policy (USEPA, 2004). Although this represents an uncertainty in the assessment, it is assumed that reptiles and amphibians are not likely to be more sensitive to chemical exposures than the other receptor groups that are included in the screening-level ERA.

4.3.2 Endpoints and Risk Hypotheses

The conclusion of the screening-level problem formulation includes the selection of ecological endpoints, which are based on the preliminary conceptual model. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ERA process as are risk hypotheses or risk questions (USEPA, 1997 and 1998). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1992, and 1997) and discussed in detail in Suter II (1989, 1990, and 1993). Risk hypotheses are testable hypotheses about the relationship among the assessment endpoints and their predicted responses when exposed to contaminants.

Endpoints in the screening-level ERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur. Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to the site (USEPA, 1997). Assessment endpoints contain an entity (e.g., belted kingfisher) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself (USEPA, 1992). Effects on individuals are important for some receptors, such as rare and endangered species; however, population- and community-level effects are typically more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level. In addition, use of criteria values designed to protect the vast majority (e.g., 95 percent) of the components of a community (e.g., National Ambient Water Quality Criteria [NAWQC] for the Protection of Aquatic Life) can be useful in evaluating potential community- and/or population-level effects.

Table 4-3 summarizes the assessment endpoints, risk hypotheses, and measurement endpoints selected for the screening-level ERA. The assessment endpoints selected were based on the survival, growth, and reproduction of terrestrial receptor groups (terrestrial plants and invertebrates), aquatic receptor groups (aquatic plants, benthic invertebrates, and fish), amphibians, reptiles, upper trophic level birds (herbivores, omnivores, and carnivores), and marine mammals (i.e., West Indian manatee). The population traits of interest for each of the assessment endpoints represent components of a healthy population. Failure or impairment of survival, growth, or reproduction will adversely affect the ability of the population to be healthy and viable and fill its appropriate role in an ecosystem.

4.3.2.1 Selection of Receptors

Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. Therefore, specific receptor species (e.g., spotted sandpiper) or species groups (e.g., aquatic invertebrates) are often selected as surrogates to evaluate potential risks to larger components of the ecological community (e.g., aquatic invertebrate consumers) that are used to represent the assessment endpoints (e.g., survival, growth, and reproduction of aquatic invertebrate consumers). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, at the site;
- Have a particular ecological, economic, or aesthetic value;
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present at the site for which complete exposure pathways are likely to exist;
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations at the site; and
- Have sufficient ecotoxicological information available on which to base an evaluation.

Lower trophic level receptor species were evaluated based on those taxonomic groupings (e.g., terrestrial and aquatic plants and invertebrates) for which screening values have been developed. These groupings and screening values are used in most ERAs. As such, specific receptor species of lower trophic level terrestrial biota were not chosen because of the limited species-specific information available. These receptors were instead dealt with on a community level via a comparison to media-specific screening values.

The upper trophic level receptor species listed below were chosen for dietary exposure modeling based on the criteria listed above, the general guidelines presented in USEPA (1991a), the description of habitats and biota presented in Sections 4.1.2 and 4.1.3, respectively, and the assessment endpoints (see Table 4-3).

Terrestrial habitat:

- Mourning dove (*Zenaida macroura*) (avian herbivore)
- American robin (*Turdus migratorius*) (avian omnivore)
- Red-tailed hawk (*Buteo jamaicensis*) (avian carnivore)

Aquatic habitat:

- Belted kingfisher (*Ceryle alcyon*) (avian piscivore)
- Double-crested cormorant (*Phalacrocorax auritus*) (avian piscivore)
- West Indian manatee (*Trichechus manatus*) (mammalian herbivore)

With the exception of the American robin and double-crested cormorant, the upper trophic level receptors listed above are known to occur at NSRR (Raffaele, 1989). The American robin was selected as a surrogate species to represent birds reported from NSRR with similar feeding habits and dietary preferences (e.g., red-legged thrush). Although not previously reported from NSRR, the double-crested cormorant is known to occur in Puerto Rico (Raffaele, 1989). A shore bird (e.g., spotted sandpiper) was not selected as an ecological receptor for the aquatic habitat (i.e., embayment) based on the availability of suitable habitat. As discussed in Section 4.1.2.2 and the habitat characterization report included as Appendix F, riprap is present from above MHW to approximately 3 feet below MLW along both sides of the embayment. Only the front end of the embayment offers suitable habitat for shore birds. A wading bird (e.g., great blue heron) also was excluded as an ecological receptor for this same reason. The action of waves within the embayment further minimizes the suitability of this surface water body as potential foraging habitat for wading birds.

As discussed previously in Section 4.3.1.3, terrestrial mammals were not selected as ecological receptors for the following reasons:

- With the exception of bats, all native terrestrial mammals have been extirpated from Puerto Rico. Life history information for Puerto Rico's native bat species is severely limited or lacking altogether.

- The terrestrial mammals represented by potentially complete and significant exposure pathways are limited to nonindigenous, nuisance species (i.e., Norway rat, black rat, and mongoose) that have been implicated in the decline of native reptilian and bird populations.

While exposure pathways to terrestrial reptiles, terrestrial amphibians, and aquatic reptiles are likely to be complete, specific reptilian and amphibian species were not selected as ecological receptors in the screening level ERA since the life history and toxicological database concerning the effects of chemicals on reptiles and amphibians is severely limited. It is assumed that reptiles and amphibians potentially present at the site are not exposed to significantly higher concentrations of chemicals and are not more sensitive to chemicals than the other receptor species evaluated by the screening-level ERA. This assumption is a source of uncertainty in the screening-level ERA.

4.3.3 Fate and Transport Mechanisms

In the absence of measured values of chemicals within biotic media, the transport and partitioning of constituents into particular environmental compartments, and their ultimate fate in those compartments, can be predicted from key physical-chemical characteristics. The physical-chemical characteristics that are most relevant for exposure modeling in this assessment include water solubility, adsorption to solids, octanol-water partitioning, and degradability. These characteristics are defined below.

The water solubility of a compound influences it's partitioning to aqueous media. Highly water-soluble chemicals, such as most VOCs, have a tendency to remain dissolved in the water column rather than partitioning to sediment (Howard, 1991). Compounds with high water solubility also generally exhibit a lower tendency to bioconcentrate in aquatic organisms and a greater likelihood of biodegredation, at least over the short term (Howard, 1991).

Adsorption is a measure of a compound's affinity for binding to solids, such as soil or sediment particles. Adsorption is expressed in terms of partitioning, with either the adsorption coefficient (K_d), a unitless expression of the equilibrium concentration in the solid phase versus the water phase) or as organic carbon partition coefficient (K_{oc}), K_d normalized to the organic carbon content of the solid phase; again unitless) (Howard, 1991). For a given organic chemical, the higher the K_{oc} or K_d, the greater the tendency for that chemical to adhere strongly to soil or sediment particles. K_{oc} values can be measured directly or can be estimated from either water solubility or the octanol-water partition coefficient using one of several available regression equations (Howard, 1991).

Octanol-water partitioning indicates whether a compound is hydrophilic or hydrophobic. The Octanol-water partition coefficient (K_{ow}) expresses the relative partitioning of a compound between octanol (lipids) and water. A high affinity for lipids equates to a high K_{ow} and vice versa. As discussed above, K_{ow} has been shown to correlate well with adsorption to soil or sediment particles and the potential to bioaccumulate in the food chain (Howard, 1991). Typically expressed as log K_{ow}, a value of 3.0 or less generally indicates that the chemical will not bioconcentrate to a significant degree (Maki and Duthie, 1978). Log K_{ow} values and K_{oc} values for organic chemicals analyzed in environmental media collected from SWMUs 1 and 2 (Appendix IX VOCs, SVOCs, organochlorine pesticides, organophosphorous pesticides, chlorinated herbicides, and dioxins/furans) are presented in Table 4-4.

Degradability is an important factor in determining whether there will be significant loss of mass or change in the form of a chemical over time in the environment. The half-life of a compound is typically used to describe losses from either degradation (biological or abiotic) or from transfer from one compartment to another (e.g., volatilization from soil to air). The half-life is the time required for one-half of the mass of a compound to undergo the loss or degradation process.

4.4 Screening-Level Effects Evaluation

The purpose of the screening-level effects evaluation is the establishment of chemical exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. One set of screening values is typically developed for each selected assessment endpoint. For this evaluation, two types of screening values were developed (media-specific screening values and ingestion-based screening values). Media-specific screening values were developed for surface soil, surface water, and sediment, while ingestion-based screening values were developed for food web (dietary) exposures.

4.4.1 Media-Specific Screening Values

The sections that follow describe the various criteria and toxicological benchmarks that were used as media-specific screening values (toxicological thresholds) for chemicals in surface soil, surface water, and sediment. The media-specific screening values, summarized in Tables 4-5 (surface soil), 4-6 (surface water), and 4-7 (sediment), represent conservative exposure thresholds above which adverse ecological effects may occur.

4.4.1.1 Surface Soil Screening Values

The literature-based toxicological benchmarks listed below, expressed as dry weight concentrations, were selected for use as surface soil screening values.

- Toxicological thresholds for earthworms and microorganisms (Efroymson et al., 1997a)
- Toxicological thresholds for plants (Efroymson et al., 1997b)

For a given chemical, when more than one screening value was available from the sources listed above, the lowest value was conservatively selected as the surface soil screening value. As evidenced by Table 4-5, the toxicological thresholds available from Efroymson et al., 1997a and 1997b for chemicals analyzed in surface soil samples collected at SWMU 45 are limited primarily to inorganics. For those chemicals lacking a toxicological threshold from Efroymson et al. (1997a and 1997b), the following literature-based values, listed in their order of decreasing preference, were used as surface soil screening values:

- Toxicity reference values for plants and invertebrates listed in USEPA (1999a).

- Soil standards developed by the Ministry of Housing, Spatial Planning and Environment (MHSPE, 1994) assuming a minimum default soil organic carbon content of 2.0 percent.

- Canadian soil quality guidelines (agricultural land use) developed by the Canadian Council of Ministers of the Environment (CCME, 2002).

- United States Fish and Wildlife Service (USFWS) screening values (Beyer, 1990) as listed in Friday (1998)

Screening values developed by Beyer (1990) were given the lowest preference since they are background-based values that do not represent effect concentrations.

4.4.1.2 Surface Water Screening Values

Chronic saltwater NAWQC (USEPA, 2002a) were selected for use as surface water screening values. USEPA NAWQC for cadmium, copper, chromium, lead, mercury, selenium, and zinc are expressed as dissolved concentrations. As a measure of conservatism in this screening-level ERA, they were converted to total recoverable concentrations using the appropriate conversion factors (USEPA, 2002a). For those chemicals lacking a saltwater NAWQC, surface water screening values were identified from the following information listed in their order of decreasing preference:

- Final Chronic Values (FCVs) for saltwater contained in Ecotox Thresholds (USEPA, 1996b)

- Chronic screening values for saltwater contained in Ecological Risk Assessment Bulletins – Supplement to Risk Assessment Guidelines (RAGS) (USEPA, 2001a)

- Minimum chronic toxicity test endpoints (No Observed Effect Concentration [NOEC] and Maximum Acceptable Toxicant Concentration [MATC] values) for saltwater species reported in the ECOTOX Database System (Aquatic Toxicity Information Retrieval [AQUIRE] database) (USEPA, 2003b)

- Chronic Lowest Observable Effect Levels (LOELs) for saltwater contained in National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQUIRTs) (Buchman, 1999)

The order of preference was selected based on their level of protection. For example, FCVs would be expected to offer a greater degree of protection than a single species NOEC, MATC, or LOEL since their derivation considers a larger toxicological database. In the absence of FCVs, USEPA Region IV chronic screening values, chronic test endpoints, and chronic LOELs, screening values were derived from the acute literature values listed below:

- Acute LOELs for saltwater contained in NOAA SQUIRTs (Buchman, 1999)

- Acute toxicity test endpoints (NOEC, Lowest Observed Effect Concentration [LOEC], median lethal concentration [LC_{50}], and median effective concentration [EC_{50}] values) for saltwater species contained in the ECOTOX Database System (AQUIRE database) (USEPA, 2003b).

- LC_{50} values for saltwater species contained in Superfund Chemical Matrix (USEPA, 1996a)

Chronic-based screening values were extrapolated from acute NOEC, LOEC, LOEL, LC_{50}, and EC_{50} values as follows:

- An uncertainty factor of 10 was used to convert an acute NOEC, LOEC, or LOEL to a chronic-based screening value.

- An uncertainty factor of 100 was used to convert an EC_{50} or LC_{50} to a chronic-based screening value.

When acute toxicity data were used to extrapolate a chronic screening value, NOECs were given preference over LOECs/LOELs, LOECs/LOELs were given preference over LC_{50} and EC_{50} values, and EC_{50} values were given preference over LC_{50} values. When more than one value was available from the literature for a given test endpoint (e.g., NOEC), the minimum value was conservatively used to extrapolate a chronic screening value. In some cases, chronic and acute LOELs for chemical classes (e.g., PAHs) were available from Buchman (1999). A LOEL based on a chemical class was used to derive a chronic screening value only if that chemical lacked literature-based benchmarks and/or toxicity test endpoints.

For those chemicals lacking saltwater toxicological thresholds and literature values, surface water screening values were identified or developed from freshwater values using the sources and procedures discussed in the preceding paragraphs with one exception. This exception involved the consideration of freshwater Secondary Chronic Values (SCVs) developed by the USEPA (1996b) and Suter II (1996).

4.4.1.3 Sediment Screening Values

The literature-based toxicological benchmarks listed below, expressed as bulk sediment concentrations (dry weight), were used as sediment screening values.

- Effects-Range low (ER-L) marine and estuarine sediment quality guidelines (Long and Morgan, 1991 and Long et al., 1995)

- Threshold Effects Level (TEL) marine sediment quality guidelines (MacDonald, 1994)

- Apparent Effects Threshold (AET) marine sediment quality guidelines (Buchman, 1999)

A description of ER-L, TEL, and AET values and the methods used in their derivation are provided in the paragraphs that follow.

Effect Range-Low (ER-L) marine and estuarine sediment quality guidelines. Long and Morgan (1991) developed effects-based sediment quality guidelines using literature-based data from Equilibrium Partitioning (EqP) modeling, spiked-sediment toxicity tests, and matched sediment chemistry and biological effects measures. For a given chemical, the data were arranged in ascending order of concentration with each data entry assigned an "effects" or "no effects" descriptor, and the 10th percentile and 50th percentile concentrations of the ‘effects” data were calculated. The 10^{th} and 50^{th} percentiles of the “effects” data represent the ER-L and Effects Range-Median (ER-M), respectively.

The ER-L and the ER-M delineate three concentration ranges for a given chemical. The concentration range below the ER-L value represents a minimal effects range (i.e., the concentration range in which effects would be rarely observed). Concentrations equal to or greater than the ER-L but less than the ER-M represent a possible effects range within which effects would occasionally occur, while concentrations greater than the ER-M represent a probable-effects range within which effects would frequently occur. The ER-L and ER-M values were recalculated by Long et al. (1995) after omitting a small amount of freshwater data included in the original calculations (Long and Morgan 1991) and incorporating more recent marine and estuarine data from the literature. Only ER-Ls were selected as sediment screening values in this screening-level ERA.

Threshold Effect Level (TEL) marine sediment quality guidelines. The updated and revised data set used by Long et al. (1995) also was used by MacDonald (1994) to calculate sediment quality assessment guidelines (TELs and Probable Effect Levels [PELs]) for Florida coastal waters. Unlike the methodology used by Long et al. (1991) to derive ER-L and ER-M values, the derivation of TELs and PELs took into consideration the "no effects" data set. Specifically, TELs were derived by calculating the geometric mean of the 15th percentile in the "effects" data set and the 50th percentile in the "no effects" data set, while PELs were derived by calculating the geometric mean of the 50th percentile in the “effects” data set and the 85th percentile in the “no effects” data set.

Identical to ER-Ls and ER-Ms, TELs and PELs delineate three concentration ranges for a given chemical. The TEL represents the upper limit of the range of sediment concentrations dominated by "no effects" data. Within this range, concentrations are not considered to represent significant hazards to sediment- associated biota. The PEL represents the lower limit of the range of sediment concentrations that are usually or always associated with adverse biological effects. The range of concentrations that could be associated with biological effects is delineated by the TEL and PEL. Within this range of concentrations, adverse biological effects are possible.

Apparent Effects Threshold (AET) marine sediment quality guidelines. The AET method, developed by Tetra Tech, Inc (1986), associates chemical concentrations in sediments with adverse biological effects (lethal and sub-lethal toxicity as measured using sediment toxicity tests or changes in benthic macroinvertebrate abundance and community structure as measured by *in situ* biological surveys). For a given chemical and measurement of biological effect (biological indicator), the AET value represents the sediment concentration above which statistically significant biological effects are always observed. The AET values shown in Table 4-7 represent the lowest AET value from a suite of seven biological indicators (amphipod mortality, oyster larval abnormality, Microtox luminescence, benthic macroinvertebrate abundance, bivalve larvae mortality/abnormality, Echinoderm larvae mortality/abnormality, and juvenile polychaete growth). It is noted that the AET values summarized in Table 7-6 are interim values subject to change (Buchman 1999).

Minimum chemical-specific AET values are used by the Washington Department of Ecology (1995) as sediment management standards for Puget Sound. Minimum AET values also are used by the U.S Army Corp of Engineers (USACE 1998) as “reason to believe” guidance for screening levels for the Dredged Material Management Program (DMMP). The DMMP screening levels are implemented for use in Puget Sound and Grays Harbor/Willapa Bay in the State of Washington. Current Washington State Department of Ecology sediment management standards and USACE DMMP screening levels do not reflect the interim AET values reported by Buchman (1999).

For a given chemical, when more than one sediment quality guideline was available from the sources listed above, the minimum value was conservatively selected as the sediment screening value. For those organic chemicals lacking a literature-based toxicological benchmark, screening values were either derived using the USEPA equilibrium partitioning (EqP) approach (USEPA, 1993a [see Appendix G]) or identified from the literature (Di Toro and McGrath, 2000). For a given chemical, when an EqP-based value was derived in accordance with USEPA 1993a and was also available from Di Toro and McGrath (2000), the minimum value was selected as the sediment screening value.

4.4.2 Ingestion-Based Screening Values

Ingestion-based screening values for dietary exposures were derived for each receptor species and chemical evaluated for food web exposures. Toxicological information from the literature for wildlife species most closely related to the receptor species was used if available. This information was supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) when necessary.

Chronic No Observed Adverse Effect Levels (NOAELs) based on growth or reproduction were preferentially used as ingestion-based screening values for upper trophic level receptors. NOAELs represent the highest dose of a chemical at which an effect being measured in a toxicity test does not occur. If several chronic toxicity studies were available from the literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint and test species. When chronic NOAEL values were unavailable, estimates were derived or extrapolated from chronic Lowest Observed Adverse Effect Levels (LOAELs) or median lethal dose acute values (LD_{50}). LOAELs represent the lowest dose of a chemical at which an effect being measured in a toxicity test occurs, while an LD_{50} represents the dose of a chemical at which half of the organisms being tested die. An uncertainty factor of 10 was used to convert a reported chronic LOAEL to a chronic NOAEL, while an uncertainty factor of 100 was used to convert the acute LD_{50} to a chronic NOAEL (i.e., the LD_{50} was multiplied by 0.01 to obtain the chronic NOAEL).

Ingestion-based screening values for the bird species selected as ecological receptors (American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant), expressed as milligrams of the chemical per kilogram body weight of the receptor per day (mg/kg-BW/day), are summarized in Table 4-8. Ingestion-based screening values for the West Indian manatee are summarized in Table 4-9. The mammalian NOAEL and LOAEL values summarized in Table 4-9 were adjusted to reflect differences in body weight between the mammalian test species and the West Indian manatee. Using the NOAEL as an example, this was accomplished by the using the following scaling equation (Sample et al., 1996):

$$NOAEL_r = NOAEL_t(BW_t/BW_r)^{1/4} \qquad \text{(Equation 4-1)}$$

where:

$NOAEL_r$	=	NOAEL of the receptor species (mg/kg-BW/day)
$NOAEL_t$	=	NOAEL of the test species (mg/kg-BW/day)
BW_r	=	Body weight of receptor species (kg)
BW_t	=	Body weight of test species (kg)

The adjusted NOAELs and LOAELs are included in Table 4-9. Sample et al. (1996) consider a scaling factor of 1.0 most appropriate for interspecies extrapolation between birds. Therefore, the

NOAEL and LOAEL values summarized in Table 4-8 were not adjusted to reflect differences in body weights between avian test species and avian receptor species.

Not all chemicals analyzed in abiotic media were evaluated for food web exposures. The organic chemicals evaluated for food web exposures were limited to those listed in Table 4-4 with the potential to bioaccumulate to a significant extent. Bioaccumulative organic chemicals are defined in the screening-level ERA as those with a maximum reported log octanol-water partition coefficient (log K_{ow}) greater than or equal to 3.0. Rational for using a log K_{ow} of 3.0 to define an organic chemical with the potential to bioaccumulate is included as Appendix H. For conservatism, all inorganic chemicals except cyanide also were evaluated for food web exposures. Cyanide was excluded from evaluation because it is readily metabolized and does not bioaccumulate (Eisler, 1991). The list of chemicals selected for evaluation of food web exposures contains many chemicals that are not identified as "important bioaccumulative compounds" by the USEPA (2000b). Their inclusion in the evaluation of terrestrial and aquatic food web exposures is consistent with the conservatism of this screening-level ERA.

4.5 Screening-Level Exposure Estimation

This section presents the analytical data, exposure assumptions, and the exposure models and input parameters that were used to estimate the potential exposure of ecological receptors to chemicals in surface soil, surface water, and sediment.

4.5.1 Selection Criteria for Analytical Data and Their Use in the Screening-Level ERA

The available analytical data (described in Section 4.2) were reviewed against a set of selection criteria to identify specific data that would be used to estimate potential ecological receptor exposures. The specific analytical data quantitatively evaluated in this screening-level ERA are included as Appendix F. The criteria used to select these analytical data are listed below.

- Data must have been validated by a qualified data validator using acceptable data validation methodology. Rejected (R) values were not used in the screening-level ERA. Unqualified data and data qualified as J were treated as detected, while data qualified as U or UJ were treated as non-detected.

- For surface soil, samples collected from 0 to 1-foot bgs were used since this depth range is the most active biological zone (Suter II, 1995), and thus represents the most realistic potential for exposure for most of the ecological receptors evaluated in terrestrial habitats.

- Surface soil collected prior to any major physical disturbance (such as the removal of PCB-contaminated soil in 1994) that would result in the elimination of exposure pathways were not used in the screening-level ERA.

- For surface water, total (unfiltered) metals data were used in the media-specific screening evaluation. However, dissolved (filtered) metals data were used in the food web model for piscivorous birds to address surface water-to-fish bioaccumulation (see Section 4.5.2.2.1).

- Groundwater data were not evaluated in the screening-level ERA since an adequate surface water and sediment data set was available for the embayment. Furthermore, the majority of groundwater samples were collected from hydropunch and temporary monitoring wells installed without sand packs and bentonite seals (samples may be impacted by high turbidity and thus elevated metal concentrations).

- Maximum detection limits were conservatively used to estimate exposure for non-detected chemicals.

- In some instances, duplicate samples were collected in the field. The maximum concentration of each chemical (or the maximum non-detected value) in the original or duplicate sample was used as a conservative estimate of contaminant concentration at a particular sampling point. Results from duplicate samples were not evaluated individually.

4.5.2 Exposure Estimation

Maximum detected concentrations in surface soil, surface water, and sediment were used to conservatively estimate potential chemical exposures for the ecological receptors selected to represent the assessment endpoints. For conservatism, maximum detection limits for chemicals that were analyzed for but not detected were also compared to media-specific screening values and (where appropriate) used for food web exposure modeling. This was done to ensure that reporting limits were similar to, or less than, chemical concentrations at which potential adverse effects to ecological receptors may occur. For samples with duplicate analyses, the higher of the two concentrations was used in the screening (when both values were detects or both values were non-detects). In cases where one result was a detection and the other a non-detect, the detected value was used in the assessment.

4.5.2.1 Terrestrial and Aquatic Receptor Groups

Maximum measured chemical concentrations in surface soil, surface water, and sediment were compared to the media-specific screening values (presented and discussed in Section 4.4.1) to conservatively evaluate the potential for adverse ecological effects to the lower trophic level receptor groups selected as assessment endpoints (terrestrial plants and invertebrates, aquatic plants and invertebrates, and fish). Exposure point concentrations for the terrestrial receptor groups (terrestrial plants and invertebrates) were maximum measured surface soil concentrations. Maximum measured surface water and/or sediment concentrations were used as exposure point concentrations for the aquatic receptor groups (aquatic plants, invertebrates, and fish).

4.5.2.2 Upper Trophic Level Receptors

Exposures for upper trophic level receptor species via the food web were determined by estimating chemical-specific concentrations in each dietary component using uptake and food web models. Incidental ingestion of surface soil or sediment was also included when calculating the total level of exposure. Drinking water exposures were not considered when estimating the total level of exposure (see Section 4.3.1.3). As indicated previously, maximum measured surface soil and sediment concentrations were used in all calculations to provide a conservative assessment.

Tissue concentrations were modeled for terrestrial plants (food item for American robin and mourning dove), soil invertebrates (food item for American robin), small mammals (food item for red-tailed hawk), aquatic plants (food item for the West Indian manatee), aquatic invertebrates (food item for the belted kingfisher), and fish (food item for the belted kingfisher and double-crested cormorant). Specific small mammals species were not selected as dietary items for the red-tailed hawk. Instead, a specific trophic level (omnivore) was used to represent the small mammals present in Puerto Rico that function as potential food items (e.g., Norway rat and black rat). Small mammal herbivores and insectivores were excluded as food items for the red-tailed hawk because they are not part of the Puerto Rican mammalian fauna (see Section 4.1.3.1).

4.5.2.2.1 Exposure Point Concentrations

The uptake of chemicals from the abiotic media into terrestrial and aquatic food items is based (where available) on conservative (e.g., maximum or 90th percentile) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) from the literature. A BCF indicates the degree to which a chemical may accumulate in organisms coincident with the concentration of the chemical in the surrounding media. They are calculated by dividing the concentration of a chemical in the tissue of organisms by the concentration in the surrounding media. BAF values consider both direct exposures to the surrounding media, as well as uptake from dietary exposures. As such, BAFs were given preference over BCFs when estimating prey item tissue concentrations. Default factors of 1.0 were used only when data are unavailable for chemicals in the literature. The methodology and models used to derive these estimates are described below.

Terrestrial Plants. Tissue concentrations in the aboveground vegetative portion of terrestrial plants were estimated by multiplying the maximum measured surface soil concentration for each chemical by chemical-specific soil-to-plant BCFs obtained from the literature. The BCF values used were based on root uptake from soil and on the ratio between dry-weight soil and dry-weight plant tissue. Literature values based on the ratio between dry-weight soil and wet-weight plant tissue were converted to a dry-weight basis by dividing the wet-weight BCF by the estimated solids content for terrestrial plants (15 percent [0.15]; Sample et al., 1997).

BCFs for terrestrial plants are those reported in Baes et al. (1984) or Bechtel Jacobs (1998). For organic chemicals without literature based BCFs, soil-to-plant BCFs were estimated using the algorithm provided in Travis and Arms (1988):

$$Log\ B_v = 1.588 - (0.578)\ (Log\ K_{ow}) \qquad \text{(Equation 4-2)}$$

where:

$Log\ B_v$ = Log soil-to-plant BCF (unitless; dry weight basis)
$Log\ K_{ow}$ = Log octanol-water partitioning coefficient (unitless)

The Log K_{ow} values used in the calculations were obtained primarily from USEPA 1995a and 1996a and are listed in Table 4-4. The soil-to-plant BCFs used in the screening-level ERA are summarized in Table 4-10.

Earthworms. Tissue concentrations in soil invertebrates (earthworms) were estimated by multiplying the maximum measured surface soil concentration for each chemical by chemical-specific BCFs or BAFs obtained from the literature. BCFs are calculated by dividing the concentration of a chemical in the tissues of an organism by the concentration of that same chemical in the surrounding environmental medium (in this case, surface soil) without accounting for uptake via the diet. BAFs consider both direct exposure to soil and exposure via the diet. Since earthworms consume soil, BAFs are more appropriate values and were used in the food web models when available. BAFs based on depurated analyses (soil was purged from the gut of the earthworm prior to analysis) were given preference over undepurated analyses when selecting BAF values since direct ingestion of surface soil is accounted for separately in the food web model.

The BCF/BAF values used in the screening-level ERA (see Table 4-10) are based on the ratio between dry-weight soil and dry-weight earthworm tissue. Literature values based on the ratio between dry-weight soil and wet-weight earthworm tissue were converted to a dry-weight basis by dividing the wet-weight BCF/BAF by the estimated solids content for earthworms (16 percent [0.16]; USEPA 1993b). For inorganic chemicals without available measured BCFs/BAFs, an earthworm BAF of 1.0 was assumed.

Small Mammals. Whole-body tissue concentrations in small mammals (omnivores) were estimated using one of two methodologies. For chemicals with literature-based soil-to-small mammal BAFs, the small mammal tissue concentration was obtained by multiplying the maximum measured surface soil concentration for each chemical by a chemical-specific soil-to-small mammal BAF. The BAF values used are based on the ratio between dry-weight soil and whole-body dry-weight tissue. Literature values based on the ratio between dry-weight soil and wet-weight tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for small mammals (32 percent [0.32]; USEPA, 1993b). The soil-to-small mammal BAFs used in the screening-level ERA (see Table 4-11) are those reported in Sample et al. (1998b) for omnivores (or for general small mammals if omnivore values were unavailable).

For those chemicals without soil-to-small mammal BAF values, an alternate approach was used to estimate whole-body tissue concentrations. Because most chemical exposure for small mammal species is via the diet, it was assumed that the concentration of each chemical in a small mammal's tissues is equal to the chemical concentration in its diet, that is, a diet to whole-body BAF (wet-weight basis) of one was assumed. Resulting tissue concentrations (wet-weight) were converted to dry weight using an estimated solids content of 32 percent (see above).

The use of a diet to whole-body BAF of one is likely to result in a conservative estimate of chemical concentrations for chemicals that are not known to biomagnify in terrestrial food chains (e.g., aluminum). For chemicals that are known to biomagnify (e.g., PCBs), a diet to whole-body BAF value of one will likely result in a realistic estimate of tissue concentrations based on reported literature values. For example, a maximum BAF (wet weight) value of 1.0 was reported by Simmons and McKee (1992) for PCBs based on laboratory studies with white-footed mice. Menzie et al. (1992) reported BAF values (wet-weight) for DDT of 0.3 for voles and 0.2 for short-tailed shrews. Reported BAF (wet-weight) values for dioxin are only slightly above one (1.4) for the deer mouse (USEPA 1990).

Aquatic Plants. Tissue concentrations in the vegetative portion of aquatic plants (i.e., sea grass) were estimated using the same methodologies as described above for terrestrial plants except that maximum sediment (not surface soil) concentrations were used in the calculation.

Aquatic Invertebrates. Tissue concentrations in aquatic invertebrates were estimated by multiplying the maximum measured sediment concentration for each chemical by chemical-specific sediment-to-invertebrate BCFs or BAFs obtained from the literature. The BCF/BAF values are based on the ratio between dry-weight sediment and dry-weight invertebrate tissue. Because BAFs consider both direct exposure to sediment and exposure via the diet, BAFs are more appropriate values and were used in the food web models when available. BAFs based on depurated analyses (sediment was purged from the gut of the organism prior to analysis) were given preference over undepurated analyses when selecting BAF values since direct ingestion of sediment is accounted for separately in the food web model.

Literature values based on the ratio between dry-weight sediment and wet-weight invertebrate tissue were converted to a dry-weight basis by dividing the wet-weight BCF/BAF by the estimated solids content for aquatic invertebrates (21 percent [0.21]; USEPA 1993b). For chemicals without available measured literature BCF/BAF values, a BCF/BAF of 1.0 was assumed. The sediment-to-invertebrate BCFs/BAFs used in the screening-level ERA are summarized in Table 4-12.

Fish. The estimation of tissue concentrations in whole-body fish took into consideration bioaccumulation from surface water, as well as bioaccumulation from sediment. The contribution that sediment bioaccumulation has on whole-body fish tissue concentrations was estimated by multiplying the maximum measured sediment concentration for each chemical by chemical-specific sediment-to-fish BAFs obtained from the literature. The sediment-fish BAF values used were based on the ratio between dry-weight sediment and dry-weight fish tissue. Literature values based on the ratio between dry-weight sediment and wet-weight fish tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for fish (25 percent [0.25]; USEPA 1993b). For chemicals without literature based sediment-to-fish BAFs, a BAF of 1.0 was assumed. A summary of the sediment-to-fish BAFs used in the screening-level ERA is provided in Table 4-12.

The contribution that surface water bioaccumulation has on whole-body fish tissue concentrations was estimated by multiplying the maximum measured surface water concentration for each chemical by chemical-specific surface water-to-fish BAFs obtained from the literature. In the absence of literature-based BAFs, the contribution that surface water bioaccumulation has on whole-body fish tissue concentrations was estimated by the following equation (USEPA, 1995b):

$$C_{xf} = [(C_{sw})(BCF_{sw})(FCM)] \qquad \text{(Equation 4-3)}$$

Where:

C_{xf} = Concentration of chemical x in whole-body fish (mg/kg)
C_{sw} = Maximum surface water concentration (mg/L)
BCF_{sw} = Measured surface water-to-fish BCF (L/kg)

The surface water-to-fish BAF values obtained from the literature and the BCF values used in Equation 4-3 to estimate surface water-to-fish BAFs were based on dry weight fish tissue. Literature values based on wet-weight fish tissue were converted to a dry-weight basis by dividing the wet-weight BAF by 0.25 (see above).

For a given organic chemical, surface water-to-fish bioaccumulation was only considered if the chemical was detected in surface water and the chemical's log K_{ow} value is greater than or equal to 3.0. If an organic chemical with a log K_{ow} value greater than or equal to 3.0 was not detected in surface water, the contribution that surface water bioaccumulation has on the tissue concentration in whole-body fish was considered to be negligible. In this instance, only sediment bioaccumulation was considered in the estimation of whole-body fish tissue concentrations. Specific organic chemicals detected in surface water samples collected from the embayment with log K_{ow} values greater than or equal to 3.0 were ethylbenzene, styrene, toluene, and xylene.

The surface water data used for metals in the estimation of surface water-to-fish bioaccumulation were based on the dissolved (filtered) fraction. Dissolved metals data were used since the dissolved fraction more closely approximates the bioavailable fraction of metals in the water column (USEPA, 1995b, 1999b, and 2002a). If a metal was not detected in the dissolved (filtered) fraction, the contribution that surface water bioaccumulation has on the whole-body fish tissue concentration of that metal was considered negligible. Specific metals detected in surface water samples (dissolved fraction) collected from the embayment were antimony, arsenic, barium, chromium, cobalt, copper, nickel, selenium, thallium, tin, vanadium, and zinc.

Surface water-to-fish BAFs used in the screening-level ERA are summarized in Table 4-13. With the exception of selenium, surface water-to-fish BAFs were estimated using Equation 4.3. For selenium, a literature BAF was identified from the literature and used in this screening-level ERA. An FCM of 1.0 was used to convert a measured surface water-to-fish BCF for metals to a surface water-to-fish BAF (USEPA, 1991b and 1995b and Sample et al., 1996). FCMs established by the USEPA (1995b) using a food chain model developed by Gobas (1993) were used to estimate surface water-to-fish BAF values for ethylbenzene, styrene, toluene, and xylene (see Table 4-13). For a given organic chemical, the FCM is based on the log K_{ow} of the chemical and the trophic level occupied by the prey. The USEPA (1995c) has reported that fish consumed by the belted kingfisher and double-crested cormorant are trophic level 3 fish. As such, trophic level 3 FCMs were used in Equation 4-3 to estimate surface water-to-fish BAFs. It is noted that the 1993 Gobas model includes an input parameter to account for metabolism (metabolic rate constant); however, this input parameter was set to zero by the USEPA (1995c). As such, the FCMs listed in Table 4-13 for ethylbenzene, styrene, toluene, and xylene likely overstate bioaccumulation from dietary food items.

A final fish tissue concentration was derived by summing the individual contributions that surface water-to-fish bioaccumulation and sediment-to-fish bioaccumulation have on whole-body fish tissue concentrations:

$$C_{xf} = [(C_{sw})(BAF_{sw})+(C_{sed})(BAF_{sed})] \qquad \text{(Equation 4-4)}$$

where:

C_{sed} = maximum sediment concentration (mg/kg)
BAF_{sed} = sediment-to-fish *BAF* (unitless)
BAF_{sw} = surface water-to-fish BAF
C_{xf}, and C_{sw}, are as previously described.

4.5.2.2.2 Dietary Intakes

Dietary intakes for each upper trophic level receptor species were calculated using the following formula (Equation 4-5) modified from USEPA (1993b).

$$DI_x = \frac{[[\sum_i [(FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)]][AUF]}{BW}$$

where:

DI_x = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = Food ingestion rate (kilograms per day [kg/day], dry-weight)
FC_{xi} = Maximum concentration of chemical x in food item i (mg/kg, dry weight)
PDF_i = Proportion of diet composed of food item i (mg/kg, dry weight)
SC_x = Maximum concentration of chemical x in surface soil/sediment (mg/kg, dry weight)
PDS = Proportion of diet composed of surface soil/sediment (dry weight basis)
BW = Body weight (kg, wet weight)
AUF = Area Use Factor (unitless)

Conservative, receptor-specific exposure parameters (maximum food ingestion rates and minimum body weights) for the American robin, mourning dove, and red-tailed hawk, belted kingfisher, double-crested cormorant, and West Indian manatee are provided in Table 4-14. The food items selected for each receptor species and the percent contribution to their total diet is provided in Table 4-15. As discussed previously in Section 4.3.1.3, receptor exposures via surface water ingestion were not included in the estimation of dietary intakes. As such, drinking water ingestion rates for the receptor species are not included in Table 4-14.

Table 4-14 contains exposure parameters and Table 4-15 contains a dietary composition for a small mammal omnivore. As discussed in Section 4.5.2.2, the diet of the red-tailed hawk (excluding surface soil) is assumed to be small mammal omnivores. This assumption is based on likely small mammal prey species present in Puerto Rico (rats). Identification of exposure parameters and food items was necessary when estimating small mammal whole body tissue concentrations for those chemicals that lack a literature-based soil-to-small mammal BAF (an exposure dose was necessary to estimate tissue concentrations). An assumed diet of 49 percent terrestrial vegetation, 49 percent terrestrial invertebrates, and 2 percent soil was selected as the diet for a small mammal omnivore.

For the screening-level ERA, an AUF of 1.0 was assumed (i.e., each receptor is assumed to spend 100 percent of its time on the site). As such, receptor-specific home ranges were not considered in the estimation of dietary intakes.

4.6 Screening-Level Risk Calculation

The screening-level risk calculation is the final step in a screening-level ERA. In this step, maximum chemical concentrations in abiotic media or maximum exposure doses for upper trophic level receptor species are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of potential ecological COPCs for each media-pathway-receptor combination evaluated or a conclusion of negligible risk.

4.6.1 Selection of Ecological Chemicals of Potential Concern

Ecological COPCs were selected using the hazard quotient (HQ) method. For a given chemical, an HQ was calculated by dividing the maximum chemical concentration in the medium being evaluated by the corresponding media-specific screening value or, in the case of upper trophic level receptors, by dividing the maximum exposure dose by the corresponding ingestion-based screening value.

The following conservative methodology was used to identify ecological COPCs for abiotic media:

- The maximum detected concentration in surface soil, surface water, and sediment were used to calculate media-specific HQs. For a given medium, chemicals with HQs greater than or equal to 1.0 based on maximum detected concentrations were identified as ecological COPCs.

- For non-detected chemicals, maximum reporting limits were used to calculate media-specific HQ values. Non-detected chemicals with HQs greater than or equal to 1.0 based on maximum reporting limits were identified as ecological COPCs.

- Detected and non-detected chemicals without media-specific screening values were identified as ecological COPCs.

To select ecological COPCs by evaluating food web exposures, maximum chemical concentrations in surface soil, surface water, and/or sediment were used to estimate dietary doses for each receptor. HQs were calculated with NOAELs, LOAELs, and Maximum Acceptable Toxicant Concentrations (MATCs). The MATC is derived by taking the geometric mean of the NOAEL and LOAEL. Calculations with NOAELs provide the most conservative risk estimate, while calculations with LOAELs provide the least conservative risk estimate. Calculations with MATCs provide realistic risk estimates since the MATC represents an estimation of the threshold concentration (i.e., the concentration above which a toxic effect on the test endpoint is produced). For the screening-level ERA, chemicals (detected and non-detected) with NOAEL-based HQs greater than or equal to 1.0 were identified as ecological COPCs. Identical to the media-specific screening evaluation, detected and non-detected chemicals without ingestion-based screening values were identified as ecological COPCs for upper trophic level receptor exposures.

HQs greater than or equal to 1.0 indicate the potential for risk since the chemical concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure doses are derived using intentionally conservative assumptions (maximum media concentrations, maximum ingestion rates, and minimum body weights) such that HQs greater than or equal to 1.0 do not necessarily indicate that risks are present or impacts are occurring. Rather, they identify chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs less than one indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

It is noted that the screening-level ERA considers independent effects of chemicals. However, the potential does exist for multiple chemicals in environmental media to interact. Much uncertainty is involved with the interpretation of chemical interactions due to the complexity of potential effects (e.g., synergistic, antagonistic, or additive), and due to varying toxicities of compounds in different species. For these reasons, cumulative effects were not addressed in this screening-level ERA. Chemical interactions can be addressed by site-specific studies conducted in Step 6 of the Navy ERA process (i.e., site investigation and data analysis [see Figure 4-1]).

4.6.1.1 Screening-level Risk Calculation for Surface Soil

Table 4-16 presents the results of the screening-level risk calculation for surface soil. Detected concentrations greater than or equal to surface soil screening values are depicted on Figure 4-7. As evidenced by Table 4-16, VOCs, SVOCs, and PAHs were not detected in surface soil samples collected at SWMU 45. However, one VOC (vinyl chloride) and six SVOCs (1,2,4,5-tetraclorobenzene, 1,3,5-trinitrobenzene, 2,4-dimethylphenol, o-cresol, m,p-cresol, pentachlorophenol) were identified as ecological COPCs because maximum reporting limits exceeded surface soil screening values. An additional twenty-six non-detected VOCs and fifty-seven non-detected SVOCs were identified as ecological COPCs based on the lack of surface soil screening values.

Aroclor-1260 was detected in two of four surface soil samples (see Table 4-16). However, because the maximum detected concentration (150 ug/kg) was less than the surface soil screening value (HQ = 0.06), this PCB was not identified as an ecological COPC.

Six RCRA metals (arsenic, barium, cadmium, chromium, lead, and mercury) were each detected in at least three surface soil samples. Chromium was identified as an ecological COPC because the maximum detected concentration (29.9 mg/kg) exceeded the surface soil screening value (HQ = 74.8). HQ values for the five remaining detected metals, as well as HQ values for the non-detected RCRA metals (selenium and silver) were less than surface soil screening values. As such, they were not identified as ecological COPCs for surface soil.

4.6.1.2 Screening-Level Risk Calculation for Surface Water

Table 4-17 presents the results of the screening-level risk calculation for surface water. Detected concentrations greater than or equal to surface water screening values are depicted on Figure 4-8. Five VOCs (2-butanone, ethylbenzene, styrene, toluene, and xylene) were detected in one or more of the surface water samples. Because maximum detected concentrations were less than surface water screening values, these five VOCs were not identified as ecological COPCs. Six non-detected VOCs (chloroethane, chloroprene, ethyl methacrylate, iodomethane, methacrylonitrile, and trans-1,4-dichloro-2-butene) were identified as ecological COPCs based on the lack of surface water screening values.

SVOCs, PAHs, and PCBs were not detected in surface water collected from the embayment. However, nineteen non-detected SVOCs and seven non-detected PCBs were identified as ecological COPCs because maximum-reporting limits exceeded surface soil screening values. The non-detected PAH benzo(a)pyrene also was identified as an ecological COPC because the maximum reporting limit for this organic chemical equaled the surface water screening value (HQ = 1.0). An additional seventeen non-detected SVOCs were identified as ecological COPCs based on the lack of surface water screening values.

Fourteen metals were detected in surface water collected from the embayment. Copper was identified as an ecological COPC because the maximum detected concentration (5 J ug/L) exceeded the surface water screening value (HQ = 1.35). Tin also was detected and identified as an ecological COPC based on the lack of a surface water screening value. Although not detected, cyanide was identified as an ecological COPC because the maximum reporting limit for this inorganic chemical equaled the surface water screening value (HQ = 10.0).

4.6.1.3 Screening-Level Risk Calculation for Sediment

Table 4-18 presents the results of the screening-level risk calculation for sediment. Detected concentrations greater than or equal to sediment screening values are depicted on Figure 4-9. Five VOCs (2-butanone, 2-hexanone, acetone, ethylbenzene, and toluene) were detected in at least one embayment sediment sample. 2-Hexanone and acetone were identified as ecological COPCs because maximum detected concentrations exceeded sediment screening values (HQ = 10.2 and 55.1, respectively. Eleven non-detected VOCs also were identified as ecological COPCs because maximum reporting limits exceeded sediment screening values. An additional five non-detected VOCs (chloroprene, ethyl methacrylate, iodomethane, methacrylonitrile, and trans-1,4-dichloro-2-butene) were identified as ecological COPCs based on the lack of sediment screening values.

Two SVOCs [bis(2-ethylhexyl)phthalate and di-n-butylphthalate] were detected in sediment collected from the embayment. As evidenced by Table 4-18, both SVOCs were identified as ecological COPCs because maximum detected concentrations exceeded sediment screening values. HQ values were 3.85 for bis(2-ethylhexyl)phthalate and 7.93 for di-n-butylphthalate. Fifty-nine non-detected SVOCs also were identified as ecological COPCs because maximum reporting limits exceeded sediment screening values. An additional nineteen non-detected SVOCs were identified as ecological COPCs due to the lack of sediment screening values.

Eighteen PAHs were detected in sediment collected from the embayment. Maximum detected concentrations for sixteen PAHs exceeded sediment screening values (see Table 4-18). HQ values ranged from 1.11 for benzo(k)fluoranthene to 93.3 for dibenzo(a,h)anthracene.

Aroclor-1260 was detected in nineteen of twenty-three sediment samples. This PCB was identified as an ecological COPC because the maximum detected concentration (150 ug/kg) exceeded the sediment screening value (HQ = 6.94). Six non-detected PCBs also were identified as ecological COPCs because maximum reporting limits exceeded sediment screening values.

Seventeen metals were detected in sediment collected from the embayment. Arsenic, cadmium, copper, mercury tin, and vanadium were identified as ecological COPCs because maximum detected concentrations exceeded sediment screening values. Although not detected, cyanide also was identified as an ecological COPC due to the lack of a sediment screening value.

4.6.1.4 Terrestrial and Aquatic Food Web Exposures

Results of the screening-level risk calculation for terrestrial and aquatic food web exposures are presented in Tables 4-19 and 4-20, respectively. A discussion of these results is presented in the sections that follow.

4.6.1.4.1 Terrestrial Food Web Exposures

Results of the risk calculation for food web exposures to chemicals in surface soil are presented in Table 4-19. Based on the comparison of maximum exposure doses to NOAEL-based screening values, two detected RCRA metals (chromium and mercury) had HQ values greater than or equal to 1.0 for one or more of the terrestrial avian receptors. These two metals were identified as ecological COPCs for terrestrial food web exposures. Ten non-detected VOCs and thirty non-detected SVOCs also were identified as ecological COPCs based on the lack of ingestion-based screening values for each of the avian receptors.

4.6.1.4.2 Aquatic Food Web Exposures

Results of the risk calculation for food web exposures to chemicals in surface water and/or sediment are presented in Table 4-20. Based on the comparison of maximum exposure doses to NOAEL-based screening values, four detected metals (arsenic, cobalt, mercury, and vanadium) and one detected PCB (Aroclor-1260) had HQ values greater than or equal to 1.0 for one or more of the aquatic receptors. These five chemicals were identified as ecological COPCs for aquatic food web exposures. One detected metal (beryllium) and three detected VOCs (ethylbenzene, styrene, and toluene) also were identified as ecological COPCs for aquatic food web exposures based on the lack of ingestion-based screening values for the aquatic avian receptors. In addition to the detected chemicals identified above, four non-detected SVOCs (1,2,4,5-tetrachlorobenzene, dinoseb, hexachlorobenzene, and hexachloeoethane) and three non-detected PCBs (Aroclor-1221, Aroclor-1248, and Aroclor-1254) were identified as ecological COPCs for aquatic food web exposures because maximum exposure doses (based on the maximum reporting limit) exceeded NOAEL-based screening values for one or more of the aquatic receptors. Six non-detected VOCs and thirty non-detected SVOCs also were identified as ecological COPCs for aquatic food web exposures based on the lack of ingestion-based screening values for either the West Indian manatee or the aquatic avian receptors.

4.6.2 Uncertainties Associated With the Screening-Level Risk Assessment

The procedures used in this evaluation to assess risks to ecological receptors, as in all such assessments, are subject to uncertainties because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. The major uncertainties associated with the screening-level ERA for SWMU 45 and their effect on risk conclusions are presented and discussed below.

Analytical Data

- The analytical data used in the screening-level ERA for surface soil were obtained from samples collected on November 11, 1996 during the Phase I RFI field investigation. Given the age of these data, they do not represent current levels of potential exposure.

- A second source of uncertainty related to the analytical data also applies to surface soil. Surface soil samples collected during the Phase I RFI field investigation were analyzed for RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). As such, analytical data for nine Appendix IX metals (antimony, beryllium, cobalt, copper, nickel, thallium, tin, vanadium and zinc) were not available for evaluation in the screening level ERA.

  As discussed in Section 4.1.1, Building 38 operated as a power plant from the early 1940s to 1949. The facility used Bunker C fuel, which was stored in two 50,000-gallon USTs. From 1956 to 1964, transformer maintenance was performed at Building 38. Although metals are not likely to be associated with transformer maintenance activities at Building 38, oil soluble metals (i.e., nickel and vanadium) are found in Bunker C fuel (Potter and Simmons, 1998). As discussed above, surface soil samples collected during the Phase I

RFI field investigation were not analyzed for these two Appendix IX metals. The available analytical data for surface soil samples collected in the vicinity of the USTs do not indicate that a historical release of Bunker C fuel to surface soil has occurred at SWMU 45. Composition data reported by Potter and Simmons (1998) show that PAHs, including anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene, are components of Bunker C fuel. PAHs were not detected in surface soil (see Appendix F.3); therefore, there is no indication that a surface release Bunker C fuel and, therefore, oil soluble metals has occurred at SWMU 45. In summary, based on the preliminary conceptual model, as well as available surface soil data, there is no indication that a release of Appendix IX metals to surface soil has occurred at SWMU 45. As such, the lack of surface soil analytical data for the full suite of Appendix IX metals is not considered a significant data gap that warrants the collection of additional surface soil samples.

Reporting Limits

- Reporting limits for many chemicals exceeded surface soil, surface water, and sediment screening values. The specific media primary affected by elevated reporting limits were surface soil and sediment.

Identification of Ecological COPCs

- Chemicals without available screening values were identified as ecological COPCs even if they were not detected. Non-detected chemicals with reporting limits greater than screening values were also identified as ecological COPCs in the screening-level ERA. This approach likely overstates the number of actual COPCs.

- A second source of uncertainty related to the selection of ecological COPCs applies to surface water and sediment. As discussed in Section 4.3.1.2, two storm water outfalls (Outfall 015 and Outfall NR-020) discharge to the embayment. Drainage areas for both outfalls include roadways and parking lots, as well as roof drainage from administrative, industrial, and storage areas (see Figure 4-6). Chemicals that were identified as ecological COPCs for embayment surface water, sediment, and aquatic food web exposures may not be associated with a release from SWMU 45. This uncertainty is further complicated by the lack of background surface water and sediment data from a surface water body that receives similar anthropogenic inputs.

- A third source of uncertainty related to the selection of ecological COPCs applies to the use of NOAEL-based screening values in risk calculations for upper trophic level receptors. The use of NOAEL-based screening values is extremely conservative since they give no indication as to how much higher a concentration must be before adverse effects are observed.
-

Exposure Point Concentrations

- The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges and for species populations (even those that are immobile or have limited home ranges) are those based on the mean chemical concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the Wildlife Exposure Factors

Handbook (USEPA, 1993b), which specify the use of average media concentrations. Given the mobility of the upper trophic level receptor species used in the screening-level ERA, the use of maximum chemical concentrations (rather than mean concentrations) to estimate the exposure via food webs is very conservative. The use of mean concentrations to estimate receptor exposure in Step 3a of the baseline ERA is more likely to provide a more accurate estimate of potential risks at SWMU 45.

Media-Specific Screening Values

- Literature-based toxicological thresholds were not available for many of the chemicals evaluated in the screening-level ERA. Furthermore, many of the surface soil screening values used in the comparison to surface soil analytical data were background-based concentrations (see Table 4-5). Because the background-based screening values do not represent effect-based concentrations, their use in the screening-level ERA likely resulted in an overstatement of the actual number of ecological COPCs.

- A second source of uncertainty related to media-specific screening values applies to cyanide. For all media, only total cyanide data were available for evaluation in the screening-level ERA. This analysis incorporates cyanide in all its forms, including the free form (both hydrogen cyanide [HCN] and the cyanide ion [CN-], weak metal complexes (including those with copper, zinc, and nickel), and tightly bound metal complexes (including those with silver, gold, cobalt, and iron) (Souren, 2000). Cyanide speciation in the environment is a function of a variety of chemical, physical, and biological parameters and processes, including the cyanide source, the availability of metal ions, the presence of certain degrading microorganisms, light, temperature, pH, and redox potential (Kjeldsen, 1998 and Souren, 2000). Iron-cyanide complexes are both the most common and the most stable in the environment. This form is considered relatively inert and has a half-life of 100 to 1000 years (Ghosh et al., 1999 and Kjeldsen, 1998). Free cyanide, however is very rare in soils (Shifrin et al., 1996), and is often negligible when compared to complexed forms at contaminated sites (0.5 to 5 percent [Meeussen et al 1992]; 2 percent [Ghosh et al., 1999]). If present, free cyanide will primarily (70 to 100 percent) be in the form at common soil pHs (6 to 9 standard units) that rapidly volatilizes and diffuses through the soil (Kjeldsen, 1998).

  Cyanide toxicity is highly relative to its chemical form. For example, a safe dose of the iron complexed form for humans is 2 grams/day, while a one-time lethal dose of weakly bound thiocyanates can range from 50 to 80 mg/kg body weight/day, and free cyanide is fatal in doses of 0.5 to 3.5 mg/kg body (Kjeldsen, 1998). Though the literature directly relating to cyanide speciation and toxicity to ecological receptors is limited, both the scientific and regulatory community recognize that it is free, biologically available form of cyanide in the environment that is of concern (Eisler, 1991, MADEP, 1998, Meeussen et al., 1992, and Sample et al., 1997). Therefore, exposure estimates based on total cyanide likely overestimated the potential for risk.

- A third source of uncertainty related to media-specific screening values applies to surface soil screening values. When a toxicological threshold was available for both plants and invertebrates, the minimum value was selected as the screening value. For several chemicals, only a plant or earthworm toxicological threshold was available from the literature. It was assumed in the screening-level ERA that the screening value selected for these chemicals are protective of both receptor communities. If a given chemical does not have an available screening value for both terrestrial plants and invertebrates, this approach will result in an underestimation of potential risks if the screening value is not based on the most sensitive receptor community.

- A fourth source of uncertainty related to media-specific screening values applies to surface water screening values. USEPA NAWQC were used as surface water screening values for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc. Although USEPA NAWQC for these nine metals are expressed in terms of the dissolved fraction in the water column, the surface water screening values used were expressed as the total recoverable concentrations. Because the filtered fraction more closely approximates the bioavailable fraction of these nine metals in the water column (USEPA, 1999b and 2002a), use of screening values expressed as total recoverable concentrations likely resulted in an overstatement of the actual number of ecological COPCs. This uncertainty does not apply to filter feeding organisms (e.g., clams and mussels), which may receive exposure from total metals in surface water.

- A fifth source of uncertainty related to media-specific screening values applies to sediment screening values. The literature-based toxicological thresholds (i.e., TELs, ER-Ls, and AETs) used as screening values in the screening-level ERA do not take into consideration site-specific conditions that can influence chemical bioavailability and toxicity. These conditions include total organic carbon (TOC) and acid volatile sulfide (AVS), which can influence the bioavailability of organic chemicals and metals, respectively.

<u>Ingestion-Based Screening Values</u>

- Data on the toxicity of many chemicals to the receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation for ecological risk assessments because so few wildlife species have been tested directly for most chemicals. The uncertainties associated with toxicity extrapolation were minimized through the selection of the most appropriate test species for which suitable toxicity data were available. The factors that were considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet.

- A second source of uncertainty related to the derivation of ingestion screening values applies to metals. Most of the toxicological studies on which the ingestion-based screening values for metals were based used forms of the metal (such as salts) that have high water solubility and high bioavailability to receptors. Since the analytical samples on which site-specific exposure estimates were based measured total metal concentrations, regardless of form, and these highly bioavailable forms are expected to compose only a fraction of the total metal concentration, this is likely to result in an overestimation of potential risks for these chemicals.

- A third source of uncertainty related to the derivation of ingestion screening values concerns the use of uncertainty factors. For example, in some cases NOAELs were extrapolated from LOAELs using an uncertainty factor of ten. This approach is likely to be conservative since Dourson and Stara (1983) determined that 96 percent of the chemicals included in a data review had LOAEL/NOAEL ratios of five or less.

- A fourth source of uncertainty related to the derivation of ingestion screening values also concerns uncertainty factors. The NOAEL and LOAEL values summarized in Tables 4-8 and 4-9 were not adjusted to reflect interspecies differences between the test species and receptor species. Wentsel et al. (1996) recommend an extrapolation factor of two (2) for NOAELs/LOAELs derived from studies using test species that are not within the same genus as the receptor species and an extrapolation factor of four (4) when test species are not within the same family/order as the receptor species. The authors further recommend an extrapolation factor of two (2) for threatened or endangered species. For a given chemical, if NOAEL and LOAEL values used in this ERA were derived from studies with test species that are less sensitive than the receptor species, the lack of interspecies extrapolations resulted in an underestimation of potential risks.

To evaluate the uncertainty associated with the lack of NOAEL and LOAEL adjustments using the extrapolation factors discussed above, risk estimates for the West Indian manatee were derived by adjusting NOAEL and LOAEL values using an extrapolation factor of eight (8). An extrapolation factor of eight reflects interspecies differences between the test species and the West Indian manatee (factor of four) and the endangered status of the West Indian manatee (factor of two). As evidenced by Table 4-20a, use of an extrapolation factor of eight would result in the identification of ten detected metals (antimony, arsenic, barium, cadmium, copper, lead, mercury, selenium, vanadium, and zinc) as ecological COPCs for West Indian manatee food web exposures. This compares to the identification of six detected metals (i.e., arsenic, cadmium, mercury, selenium, vanadium, and zinc) as ecological COPCs when NOAEL and LOAEL values were not adjusted to reflect interspecies differences and the Federal status of the West Indian manatee (see Table 4-20).

- A fifth source of uncertainty related to the derivation of ingestion-based screening values applies to mercury. The NOAEL-based mercury screening value used for birds (0.0064 mg/kg-BW/day) was based on an organometallic (methylated) form (methyl mercury dicyandiamide). Avian screening values for inorganic forms of mercury are substantially higher (0.45 mg/kg-BW/day for mercuric chloride [see Table 4-8]). The USEPA (2001b) reports that less than 20 percent of the total mercury in the water column and 0.5 to 5.3 percent of the total mercury in soil is present as methyl mercury. The USEPA (2001b) further reports that sediment mercury levels follow the same trends as soil in regard to methyl mercury percentages. These data indicate that methyl mercury represents a fraction of the total mercury in surface water, sediment, and soil. However, the use of an ingestion-based screening value based on a methylated form assumes that 100 percent of the detected mercury is present as methyl mercury, likely resulting in an overestimation of potential risk.

<u>Ecological Receptors</u>

- Although exposure pathways to terrestrial reptiles and amphibians and aquatic reptiles are likely to be complete, reptilian and amphibian species were not selected as ecological receptors because the life history and toxicological database concerning the effects on reptiles and amphibians is severely limited. It was assumed that any reptiles and amphibians present at SWMU 45 are not exposed to significantly higher concentrations of chemicals and are not more sensitive to chemicals than the other receptor species evaluated in the risk assessment. If reptiles and amphibians are exposed to significantly higher concentrations of chemicals and/or are more sensitive to chemicals than the other receptor species evaluated by this ERA, the approach used resulted in an underestimation of potential risks to herpetofauna.

Exposure Routes

- Although inhalation and/or dermal adsorption represent potential exposure routes for upper trophic level receptors, they were not evaluated in the screening-level ERA because they were considered insignificant relative to ingestion exposures (see Section 4.3.1.3). While this is a reasonable assumption for the terrestrial birds selected as ecological receptors, the exclusion of inhalation and dermal adsorption represents a source of uncertainty that may have resulted in an underestimation of potential risks.

Food Web Exposure Modeling

- Chemical concentrations in terrestrial and aquatic food items (plants, earthworms, and small mammal omnivores) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and bioaccumulation factors introduces some uncertainty into the resulting estimates. The values selected and the methodology employed was intended to provide a reasonable estimate of potential food web exposure concentrations.

- A second source of uncertainty related to the food web models is the use of default assumptions for exposure parameters such as BCFs and BAFs. Although BCFs or BAFs for many chemicals were readily available from the literature and were used in the ERA, the use of a default factor of 1.0 to estimate the concentration of some chemicals in receptor prey items is a source of uncertainty. The assumption that the chemical body burden in the prey item is at the same concentration as in soil is conservative for chemicals that are not known not to accumulate to any significant degree. However, if a chemical does accumulate in receptor prey items, the use of a default factor of 1.0 may have resulted in an underestimation of potential risks to the upper trophic level receptors evaluated by this ERA.

- A third source of uncertainty related to the food web models is the use of unrealistically conservative exposure parameters. The use of maximum ingestion rates and minimum body weights resulted in a conservative estimate of exposure. In addition, AUFs were assumed to equal one. This is a conservative assumption since a significant percentage of each upper trophic level receptor species time could be spent foraging off-site in areas not impacted by site-related chemicals or areas where chemical concentrations are expected to be significantly lower. For example, the Florida population of the West Indian manatee ranges over fairly large areas during the summer (covering up to 200 linear km of river or coastline). Unlike the Florida population, which aggregates within the confines of natural or artificial warm water refuges during winter periods (USFWS, 1996b), there is no evidence of periodicity in manatee behavior in Puerto Rico (USFWS, 1986). As such, it cannot be expected that West Indian manatees would exclusively forage within the embayment downgradient from SWMU 45.

Chemical Mixtures

- Information on the ecotoxicological effects of chemical interactions is generally lacking, which required (as is standard for ecological risk assessments) that the chemicals be evaluated on a compound-by-compound basis during the comparison to screening values. This could result in an underestimation of risk (if there are additive or synergistic effects among chemicals) or an overestimation of risks (if there are antagonistic effects among chemicals).

4.6.3 Screening-Level Risk Assessment Decision Point and Recommendations

The screening-level ERA for SWMU 45 indicated that, based on a set of conservative exposure assumptions, there are multiple chemicals that may present risks to one or more of the receptor species/receptor groups evaluated (see Table 4-21). Therefore, the ERA process at SWMU 45 proceeded to Step 3a of the baseline ERA. This evaluation is presented in the sections that follow.

4.7 Step 3a of the Baseline Ecological Risk Assessment

The results of the screening-level risk calculation indicated that, based on a set of conservative assumptions, there are one or more chemicals that may present a risk to ecological receptor groups and/or specific species. As such, the ERA process at SWMU 45 proceeded to the baseline risk assessment.

According to Superfund guidance (USEPA, 1997), Step 3 initiates the problem formulation phase of the baseline ERA. Under Navy guidance (CNO, 1999), the baseline ERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a (see Figure 4-1). In Step 3a, the conservative assumptions employed in the screening-level ERA (Tier 1) are refined and risk estimates are recalculated using the same conceptual model. Step 3a may also include consideration of background data, the frequency at which chemicals were detected, and chemical bioavailability.

The specific assumptions, parameters, and methods that were modified for the recalculation of media-specific and food web HQ values are identified below, along with justification for each modification. These refinements and methods were used in Step 3a of the baseline ERA to weigh the evidence of potential risk for each ecological COPC identified for each media and receptor to determine whether the ecological COPCs should be identified as potential ecological risk drivers and carried on to Step 3b of the baseline ERA.

- Refined risk estimates for surface soil, surface water, sediment, and terrestrial and aquatic food web exposures (excluding the West Indian manatee) were derived using average (arithmetic mean) chemical concentrations. For individual receptor species, average chemical concentrations provide a better estimate of the likely level of chemical exposure because each receptor would be expected to forage in several different areas of the site, and, in many cases, off-site. Average concentrations are also appropriate for evaluating impacts *to populations* of lower trophic level receptors (i.e., terrestrial invertebrates, terrestrial plants, aquatic plants, benthic invertebrates, and fish). Because some of these receptors are relatively immobile, *individuals* are likely to be impacted by locations of maximum concentrations. However, evaluation of the average exposure case is more indicative of the level of impact that might be expected at the *population* level. Based on the status of the West Indian manatee (Federally endangered species, refined risk estimates using mean chemical concentrations were not derived for this receptor.

- Literature-based BCFs and BAFs based on, or modeled from, central tendency estimates (e.g., mean, median, midpoint) were used in place of maximum or high-end (e.g., 90th percentile) estimates for many chemicals. An assumed BCF/BAF of 1.0 will still be used for those chemicals lacking a literature-based BAF/BCF. The refined BCFs and BAFs used for those chemicals carried into Step 3a of the baseline ERA are summarized in Tables 4-22 through 4-24 (soil-to-terrestrial plant BCFs and soil-to-terrestrial invertebrate BAFs, soil-to-small mammal BAFs, and sediment-to-aquatic invertebrate BAFs, respectively). The surface water-to-fish BAFs used in the screening-level ERA (see Table 4-13) were used in Step 3a since many of the values shown are based on a single study. As discussed above, refined risk estimates were not derived for the West Indian manatee. For this reason, sediment-to-plant BCFs based on central tendency estimates were not identified from the literature.

- Central tendency estimates (e.g., mean, median, midpoint) for body weight and food ingestion rate (see Table 4-25) were used to develop exposure estimates for upper trophic level receptors rather than the minimum body weights and maximum food ingestion rates used in the screening-level ERA. The use of central tendency estimates is more relevant because they represent the characteristics of a greater proportion of the individuals in the population. The evaluation of food web exposures still assumed an AUF of 1.0. Because refined risk estimates were not derived for the West Indian manatee, Table 4-25 does not include central tendency estimates for West Indian manatee body weight and food ingestion rate.

- In addition to the NOAEL-based risk estimates used in the screening-level ERA, consideration also was given to food web exposure risk estimates based on LOAELs and MATCs. However, NOAEL-based risk estimates were used exclusively for the West Indian manatee.

- Consideration was given to available surface soil, surface water, and sediment background data provided in Appendix I. This was accomplished by statistically comparing site concentrations to background concentrations in accordance with Navy guidance (NFESC, 2002a and 2002b). The process used to statistically evaluate the SWMU 45 surface soil, surface water, and sediment analytical data is depicted on Figure 4-10a. As evidenced by the figure, statistical comparisons included descriptive summaries of each data set (e.g., maximum, minimum, and mean concentrations), statistical tests on the mean of the distributions (e.g., student's t-test, Wilcoxin rank sum test, or Gehan test), and statistical tests on the right tail of the distributions (i.e., quantile test and/or slippage test). The significance level (the probability criteria for rejecting the null hypotheses that data sets were sampled from the same population) was set at 0.05 for all statistical tests (NFESC, 2002a and 2002b).

  The background surface soil data used in Step 3a of the baseline ERA were basewide background data and SWMU 9 background data. Sampling locations are depicted on Figures 4-11 and 4-12. The basewide background surface soil sampling locations and associated analytical data were previously presented and discussed in the Revised Draft RCRA Facility Investigation Report for Operable Unit 3/5, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker, 1999; approved by the USEPA September 9, 1999). The SWMU 9 background surface soil sampling locations and associated analytical data were previously presented and discussed in the Final Corrective Measures Study Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker, 2003b; approved by the USEPA February 19, 2003). This USEPA approved document also contained an evaluation that justified a unified basewide and SWMU 9 background surface soil data set.

The open water surface water and sediment sampling locations are depicted on Figure 4-13. Open water surface water and sediment background sampling locations were previously presented and discussed in the Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment at SWMU 45, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker, 2001b; approved by the USEPA October 4, 2001). A discussion of the sampling locations, including the associated analytical data also was presented in the Final Additional Data

Collection Investigation Report, Tow Way Fuel Farm, Naval Station Roosevelt Roads, Ceiba, Puerto Rico (Baker, 2003a; approved by the USEPA June 10, 2003).

4.7.1 Refined Risk Calculation and Risk Evaluation

Refined media-specific screening evaluations for abiotic media and refined food web exposure evaluations for terrestrial and aquatic upper trophic level receptors are presented and discussed in the sections that follow. As discussed in Section 4.6.1, detected chemicals with maximum concentrations or maximum exposure doses greater than screening values, as well as detected chemicals lacking screening values were identified as ecological COPCs in Step 2 of the screening-level ERA. Non-detected chemicals with maximum reporting limits or maximum exposures doses greater than screening values, as well as non-detected chemicals lacking screening values also were identified as ecological COPCs in the Step 2 risk calculation.

4.7.1.1 Refined Risk Calculation and Risk Evaluation for Surface Soil

Table 4-16 presented the results of the Step 2 screening-level risk calculation for SWMU 45 surface soil. Chromium was identified as an ecological COPC in Step 2 of the screening-level ERA because the maximum detected concentration of this metal exceeded the surface soil screening value. Detected concentrations of chromium exceeding surface soil screening values were presented in Figure 4-7. One non-detected VOC (vinyl chloride) and six non-detected SVOCs (1,2,4,5-tetrachlorobenzene, 1,3,5-trinitrobenzene, 2,4-dimethylphenol, o-cresol, m,p-cresol, and pentachlorophenol) were identified as ecological COPCs because maximum reporting limits exceeded surface soil screening values. An additional twenty-six non-detected VOCs and fifty-seven non-detected SVOCs were identified as ecological COPCs based on the lack of surface soil screening values. Table 4-26 presents the results of the refined screening-level risk calculation for those chemicals identified as ecological COPCs for surface soil in Step 2 of the screening-level ERA. An evaluation of the refined screening-level risk calculation is presented below.

As discussed above, the non-detected VOC vinyl chloride and the non-detected SVOCs 1,2,4,5-tetrachlorobenzene, 1,3,5-trinitrobenzene, 2,4-dimethylphenol, o-cresol, m,p-cresol, and pentachlorophenol were identified as ecological COPCs because maximum reporting limits exceeded sediment screening values. Mean concentrations of vinyl chloride and pentachlorophenol were less than surface soil screening values (HQs = 0.51 and 0.53, respectively), while mean concentrations of 1,2,4,5-tetrachlorobenzene, 1,3,5-trinitrobenzene, 2,4-dimethylphenol, o-cresol, m,p-cresol exceeded surface soil screening values (HQs = 3.73 for 1,2,4,5-tetrachlorobenzene, 37.5 for 1,3,5-trinitrobenzene, and 1.86 for 2,4-dimethylphenol, o-cresol, and m,p-cresol). These chemicals are not components of Bunker C fuel (Potter and Simmons, 1998), nor are they likely associated with transformer maintenance activities conducted at Building 38. As such, it is unlikely that they are present in SWMU 45 surface soil at ecologically important concentrations. Based on mean HQ values less than 1.0 and/or historical activities conducted at SWMU 45, vinyl chloride, 1,2,4,5-tetrachlorobenzene, 1,3,5-trinitrobenzene, 2,4-dimethylphenol, o-cresol, m,p-cresol, and pentachlorophenol are not identified as ecological COPCs for SWMU 45 surface soil and additional evaluation is not recommended. The non-detected VOCs and SVOCs lacking surface soil screening values (see Table 4-26) also are not identified as ecological COPCs since there is no indication that they are associated with historical activities at the SWMU (i.e., they are not components of Bunker C fuel [Potter and Simmons, 1998]), nor are they likely components of transformer oil).

As evidenced by Table 4-26, the mean concentration of chromium exceeded the surface soil screening value. (HQ = 60.8). Chromium was detected in each of the surface soil samples at a concentration greater than the screening value. Detected concentrations were fairly consistent across the site, ranging from 19.5 mg/kg in 45MW04 to 29.9 mg/kg in 45MW03.

To evaluate the significance of potential risks presented by chromium relative to background concentrations, the chromium data were compared to background surface soil data (combined background data set consisting of base background and SWMU 9 background surface soil data) in accordance with Navy guidance (NFESC, 2002a). Table 4-27 provides a summary and results of the statistical evaluation, while Figure 4-14 presents a boxplot diagram illustrating the distribution of each data set. As evidenced by Table 4-27, the statistical method evaluating the mean of the distributions (t-test), as well as the statistical methods evaluating the right-tail of the distributions (quantile test and slippage test) concluded that the distribution of chromium concentrations is statistically equivalent to background concentrations, indicating that this metal is not likely to be site-related and not presenting a risk to terrestrial plants and invertebrates at SWMU 45 above background levels. The descriptive statistics presented in Table 4-27 also support this conclusion. Chromium was detected in nine of nine background surface soil samples, with maximum and 95 percent UCL concentrations (44.1 J mg/kg and 31.8 mg/kg) greater than SWMU 45 maximum and 95 percent UCL concentrations (29.9 mg/kg and 29.4 mg/kg, respectively). The mean chromium concentration in SWMU 45 surface soil (24.3 mg/kg) was only slightly elevated above the mean background concentration (24.0 mg/kg).

In summary, chromium is not identified as a potential risk driver for terrestrial plants and invertebrates at SWMU 45. Although chromium was detected in surface soil and identified as an ecological COPC in Step 2 of the screening-level ERA, this metal is not recommended for further evaluation based on the statistical evaluation (descriptive and distributional statistics) presented in Table 4-27. Additional evaluation also is not recommended for the non-detected chemicals identified as ecological COPCs in the Step 2 screening-level risk calculation.

4.7.1.2 <u>Refined Risk Calculation and Risk Evaluation for Surface Water</u>

Table 4-17 presented the results of the Step 2 screening-level risk calculation for embayment surface water. Copper was identified as identified as an ecological COPC in Step 2 of the screening-level ERA because the maximum detected concentration of this metal exceeded the surface water screening value. Tin also was detected and identified as an ecological COPC based on the lack of a surface water screening value. Nineteen non-detected SVOCs, one non-detected PAH [benzo(a)pyrene], seven non-detected PCBs, and one non-detected inorganic (cyanide) were identified as ecological COPCs because maximum reporting limits equaled or exceeded surface water screening values. Six non-detected VOCs and seventeen non-detected SVOCs also were identified as ecological COPCs based on the lack of surface water screening values. Figure 4-8 presented the concentration distribution across the site for each detected chemical identified as an ecological COPC with a maximum HQ greater than or equal to 1.0. Table 4-28 presents the results of the refined screening-level risk calculation for those chemicals identified as ecological COPCs for surface water in Step 2 of the screening-level ERA. An evaluation of the refined screening-level risk calculation is presented below.

As discussed above, cyanide, benzo(a)pyrene, nineteen non-detected SVOCs, and seven non-detected PCBs were identified as ecological COPCs because maximum reporting limits equaled or exceeded surface water screening values. Mean concentrations of 2,4-dinitrophenol, 2-nitroaniline, 3,3'-dichlorobenzidine, 4-chlorophenylphenyl ether, hexachlorobenzene, hexachloroethane, and benzo(a)pyrene were less than surface water screening values (see Table 4-28). Mean concentrations for the remaining non-detected chemicals identified as ecological COPCs (based on maximum reporting limits) exceeded surface water screening values. Of the twenty-eight non-detected chemicals with maximum reporting limits greater than surface water screening values, only Aroclor-1260, 2,4-dichlorophenol, benzo(a)pyrene, and di-n-butylphthalate were detected in SWMU 45 surface soil, subsurface soil, or groundwater collected during the 1996 and/or 1997 RFI field investigations. Based on the absence of detections in SWMU 45 surface soil, subsurface soil, and groundwater, there is no indication that the remaining twenty-four chemicals are site related or migrating with groundwater to embayment surface water at ecologically important concentrations. For this reason, they are not identified as potential ecological risk drivers for embayment surface water and no additional evaluation is recommended.

Aroclor-1260 was detected in two of four surface soil samples collected during the 1996 RFI field investigation (100 ug/kg in 45MWS02-00 and 150 ug/kg in 45MW04-00), five of eighteen subsurface soil samples collected during the 1997 RFI field investigation (320 J ug/kg in 11-SB01-02, 110 J ug/kg in 11-SB05-02, 60 J ug/kg in 11-SB06-02, 75 J ug/kg in 11-SB07-02, and 46 ug/kg in 11-SB18-02), and one of eight groundwater samples collected during the 1996 RFI field investigation (0.35 ug/L in 45HP02). The presence of Aroclor-1260 in SWMU 45 surface soil and subsurface soil is likely related to historical transformer maintenance activities at Building 38. As discussed in Section 4.3.1.2, leaching of chemicals from surface soil and/or subsurface soil by infiltrating precipitation and subsequent transport with groundwater represents the only current migration pathway from SWMU 45 to embayment surface water. The single Aroclor-1260 groundwater detection occurred in a hydropunch sample. Because the hydropunch was installed without a sand pack or bentonite seal, the presence of Aroclor-1260 in the 45HP02 groundwater sample may have resulted from the inclusion of soil in the sample (the log K_{ow} value for Aroclor-1260 [8.27] indicates that this hydrophobic chemical has a high affinity for adsorption to soil particles). As such, it is not likely that Aroclor-1260 would be present within the dissolved fraction of SWMU 45 groundwater at ecologically important concentrations. The location of the single detected groundwater concentration also indicates that Aroclor-1260 is not likely to be migrating with groundwater to embayment surface water. The 45HP02 groundwater sample was collected north of Building 38. Groundwater samples collected from ten temporary monitoring wells installed downgradient from Building 38 during the 1997 RFI field investigation did not contain detected concentrations of Aroclor-1260 (Baker, 1999).

The Aroclor-1260 surface water screening value used in the Step 2 and Step 3a risk calculations (0.03 ug/L) was a marine CCC value developed using the FRV procedure (USEPA, 2002a). An FRV is intended to (1) prevent concentrations in commercially or recreationally important aquatic species from affecting marketability because of the exceedance of applicable Food and Drug Administration (FDA) action levels, and (2) protect wildlife that consume aquatic organisms from demonstrated unacceptable effects (USEPA, 1986). Therefore, the CCC value does not represent a direct contact effect concentration for aquatic receptors (e.g., plants, invertebrates, and fish). Since publication of the Great Lakes aquatic life criteria guidelines in 1995 (60FR15393-15399, March 23, 1995), the USEPA no longer uses the FRV procedure to derive CCCs for new or revised aquatic life criteria. The USEPA anticipates that future revisions of the Aroclor-1260 CCC will not be based on the FRV procedure (USEPA, 2002b). Suter II and Tsao (1996) report a Tier II SCV of 94 ug/L. The maximum groundwater concentration detected at SWMU 45 (0.35 ug/L) and the maximum reporting limit for embayment surface water (1 ug/l) are less than this effect-based toxicological benchmark. Based on the discussion presented above, Aroclor-1260 is not identified as a potential ecological risk driver for embayment surface water, and no additional evaluation is recommended.

Benzo(a)pyrene was detected in two of seventeen subsurface soil samples (110 J ug/kg in 11SB01-02 and 260 J ug/kg in 11SB08-02) and one of fourteen groundwater samples (7 J ug/kg in 11GW05) collected during the 1997 RFI field investigation (Baker, 1999). This PAH was not detected in surface soil, subsurface soil, or groundwater collected during the 1996 RFI field investigation (Baker, 1999). The single benzo(a)pyrene detection occurred in a sample collected from a temporary monitoring well. Identical to Aroclor-1260, the log K_{ow} value for this PAH (6.11) indicates that benzo(a)pyrene has a high affinity for adsorption to soil particles. Because the temporary monitoring wells at SWMU 45 were installed without a sand pack or bentonite seal, the presence of benzo(a)pyrene in the 11GW05 groundwater sample may have resulted from the inclusion of soil with the sample. The location of the single detected groundwater concentration also indicates that benzo(a)pyrene is not likely to be migrating with groundwater to embayment surface water. The 11GW05 groundwater sample was collected adjacent to Building 38. Groundwater collected from ten temporary monitoring wells installed downgradient from Building 38 did not contain detected concentrations of benzo(a)pyrene. Based on the discussion presented above, benzo(a)pyrene is not likely to be migrating with groundwater to embayment surface water. The K_{oc} value for this PAH (1,014,900 L/kg) also indicates that benzo(a)pyrene has a high affinity for adsorption to sediment particles. As such, this PAH is not likely to be present within the dissolved fraction of embayment surface water at ecologically important concentrations. For the reasons discussed above, benzo(a)pyrene is not identified as a potential ecological risk driver for embayment surface water, and no additional evaluation is recommended.

2,4-Dichlorophenol was detected in one of fourteen groundwater samples collected during the 1997 RFI field investigation (2 J ug/L in 11GW07). This SVOC was not detected in surface soil, subsurface soil, or groundwater samples collected during the 1996 RFI field investigation, nor was it detected in the subsurface soil samples collected during the 1997 RFI field investigation (Baker, 1999). Based on the low frequency of detection in upgradient media, 2,4-dichlorophenol is not likely to be related to historical activities at SWMU 45. Furthermore, the single groundwater detection (2 J ug/L) is less than the surface water screening value used in the Step 2 and Step 3a risk calculations (5.0 ug/L [USEPA, 2003b]), indicating that 2,4-dichlorophenol is not migrating with SWMU 45 groundwater to embayment surface water at ecologically important concentrations. For the reasons discussed above, 2,4-dichlorophenol is not identified as a potential ecological risk driver for embayment surface water, and no additional evaluation is recommended.

Di-n-butylphthalate was detected in four of eighteen subsurface soil samples collected during the 1997 RFI field investigation (84 J ug/kg in 11SB01-02, 140 J ug/kg in 11-SB06-02, 240 J ug/kg in 11SB07-02, and 270 J ug/kg in 11SB08-02). This SVOC was not detected in surface soil, subsurface soil, or groundwater collected during the 1996 RFI field investigation, nor was it detected in groundwater samples collected during the 1997 RFI field investigations. The lack of detections in SWMU 45 groundwater indicate that di-n-butylphthalate is not likely to migrating to embayment surface water at ecologically important concentrations. The K_{oc} value for di-n-butylphthalate (34,034 L/kg [see Table 4-4) also indicates that this hydrophobic chemical has a high affinity for adsorption to sediment particles. As such, it is not likely that this SVOC would be present within the dissolved fraction of embayment surface water at ecologically important concentrations. For the reasons discussed above, di-n-butylphthalate is not identified as a potential risk driver for embayment surface water, and no additional evaluation is recommended.

Six non-detected VOCs and seventeen non-detected SVOCs were identified as ecological COPCs in the Step 2 screening-level risk calculation based on the lack of surface water screening values (see Table 4-17). These VOCs and SVOCs were not detected in upgradient surface soil, subsurface soil, or groundwater collected during the 1996 and 1997 RFI (Baker, 1999). Based on the lack of detections in upgradient media, the non-detected VOCs and SVOCs are not likely to be site-related, nor are they likely to be migrating with SWMU 45 groundwater to embayment surface water at ecologically important concentrations. For these reasons, they are not identified as potential ecological risk drivers for embayment surface water, and no additional evaluation is recommended.

Copper was identified as identified as an ecological COPC in Step 2 of the screening-level ERA because the maximum detected concentration of this metal exceeded the surface water screening value. As evidenced by Table 4-28, the mean concentration of copper was less than the surface water screening value (HQ = 0.60). This metal was detected within the total recoverable fraction of each surface water sample; however, only two detections exceeded the surface water screening value (3.9 J ug/L in 11OWSW10 and 5.0 J ug/L in 11OWSW13). A mean concentration less than the surface water screening value and the low spatial coverage and magnitude of detections above the surface water screening value do not indicate that copper is impacting aquatic receptor communities (i.e., plants, invertebrates, and fish) within the embayment.

To further evaluate the significance of potential risks presented by copper, the mean dissolved concentration of copper was compared to a toxicological threshold expressed as a dissolved concentration. The screening value used in the Step 2 and Step 3a risk calculations was a USEPA CCC value expressed as a total (unfiltered) concentration. Because the filtered fraction of copper more closely approximates the bioavailable fraction of this metal in the water column (USEPA, 1999b 2002a), the mean dissolved (filtered) concentration of copper was compared to a USEPA CCC value expressed as a dissolved concentration (3.1 ug/L [USEPA 2002a]). As evidenced by Table 4-29, the mean concentration of dissolved copper in surface water was less than the dissolved CCC value (HQ = 0.19). The maximum dissolved copper concentration (0.88 J ug/L in 11OWSW16) is also less than the dissolved CCC value (HQ = 0.28).

Because filter-feeding organisms (e.g., clams and mussels) may receive exposure and thus risk to total metals in the surface water column, the significance of total and dissolved copper concentrations in embayment surface water was further evaluated by comparing total and dissolved copper concentrations to background surface water data in accordance with Navy guidance (NFESC, 2002). Table 4-30 provides a summary and results of the statistical evaluation, while Figure 4-15 presents boxplot diagrams illustrating the distribution of each data set. As evidenced by Table 4-30, the statistical methods evaluating the mean of the distributions (t-test [total recoverable statistical comparison] and Wilcoxin rank sum test [dissolved statistical comparison]), as well as the statistical method evaluating the right-tail of the distributions (slippage test) concluded that the distributions of total recoverable and dissolved copper concentrations in embayment surface water are statistically equivalent to background concentrations. This indicates that this metal is not likely to be site-related and not presenting risks to aquatic receptor groups within the embayment above background levels. The descriptive statistics presented in Table 4-30 also support this conclusion. Total recoverable maximum, mean, and 95 percent UCL concentrations for embayment surface water data are only slightly elevated above total recoverable background values, while dissolved maximum, mean, and 95 percent UCL concentrations for embayment surface water data are less than dissolved background values. Based on mean HQs less than 1.0 for both total recoverable and dissolved concentrations and the statistical evaluations presented in Table 4-30, copper is not considered a potential risk driver for aquatic receptor groups and additional evaluation is not recommended.

Additional evaluation also is not recommended for tin. As discussed above, this metal was identified as an ecological COPC in Step 2 of the screening level ERA based on the lack of a surface water screening value. Although detected in each embayment surface water sample, the statistical evaluation presented in Table 4-30 demonstrates that the distribution of tin concentrations is statistically equivalent to background concentrations. This indicates that this metal is not site-related and not presenting risks to aquatic receptor groups above background levels. The descriptive statistics presented in Table 4-30 also show that maximum, mean, and 95 percent UCL concentrations for embayment surface water data are less than background values.

In summary, there are no potential risk drivers identified for aquatic receptor groups (aquatic plants, invertebrates, and fish) and additional evaluation is not recommended. Although copper and tin were detected in embayment surface water and identified as an ecological COPCs in Step 2 of the screening-level ERA, they are not recommended for further evaluation based on the discussion presented above. Additional evaluation also is not recommended for the non-detected chemicals identified as ecological COPCs in the Step 2 screening-level risk calculation.

4.7.1.3 Refined Risk Calculation and Risk Evaluation for Sediment

Table 4-18 presented the results of the Step 2 screening-level risk calculation for embayment sediment. Two VOCs (2-Hexanone and acetone), two SVOCs [bis(2-ethylhexyl)phthalate, di-n-butylphthalate], one PCB (Aroclor-1260), sixteen PAHs, and six metals (arsenic, cadmium, copper, mercury, tin, and vanadium) were identified as ecological COPCs in Step 2 of the screening-level ERA because maximum detected concentrations exceeded sediment screening values Two metals (beryllium and thallium) also were detected in embayment sediment and identified as ecological COPCs in Step 2 of the screening-level ERA based on the lack of sediment screening values. Eleven non-detected VOCs, fifty-nine non-detected SVOCs, six non-detected PCBs, and one inorganic (cyanide) were identified as ecological COPCs because maximum reporting limits exceeded sediment screening values. An additional five non-detected VOCs and nineteen non-detected SVOCs were identified as ecological COPCs based on the lack of sediment screening values. Figure 4-9 presented the concentration distribution across the site for each detected chemical identified as an ecological COPC with a maximum HQ greater than or equal to 1.0. Table 4-31 presents the results of the refined screening-level risk calculation for those chemicals identified as ecological COPCs for embayment sediment in Step 2 of the screening-level ERA. An evaluation of the refined screening-level risk calculation is presented below.

As discussed above, eleven non-detected VOCs, fifty-nine non-detected SVOCs, six non-detected PCBs, and one non-detected inorganic were identified as ecological COPCs in the Step 2 screening-level risk calculation because maximum reporting limits exceeded sediment screening values. With the exception of 1,2-dibromomethane, 4-methyl-2-pentanone, bromomethane, cis-1,3-dichloropropene, propionitrile, trans-1,3-dichloropropene, 2-picoline, and N-nitrosomethylethylamine, mean concentrations also exceeded sediment screening values (see Table 4-31). In addition to the non-detected VOCs, SVOCs, and inorganics with maximum reporting limits greater than screening values, an additional five non-detected VOCs and nineteen non-detected SVOCs were identified as ecological COPCs based on the lack of sediment screening values. Of the ninety-one non-detected ecological COPCs identified as ecological COPCs in the Step 2 screening-level risk calculation, eight were detected in upgradient abiotic media collected during the 1996 and 1997 RFI field investigations (4-methyl-2-pentanone, 2,4-dichlorophenol, benzyl alcohol, o-cresol, m,p-cresol, diethylphthalate, dimethylphthalate, and phenol). Based on the absence of detections in SWMU 45 surface soil, subsurface soil, and groundwater, there is no indication that the remaining eighty-three non-detected chemicals identified as ecological COPCs in the step 2 screening-level risk calculation are site related or migrating with groundwater to embayment sediment at ecologically important concentrations. For this reason, they are not identified as potential ecological risk drivers for embayment sediment, and no additional evaluation is recommended.

2,4-dichloropenol, benzyl alcohol, and o-cresol were each detected in one of fourteen groundwater samples collected during the 1997 RFI field investigation (2 J ug/L in 11GW07, 1 J ug/L in 11GW19, and 3 J ug/L in 11GW19, respectively), and m,p-cresol was detected in two of fourteen groundwater samples collected during the 1997 RFI field investigation (2 J ug/kg in 11GW08 and 7 J ug/L in 11GW19) (Baker, 1999). These four SVOCs were not detected in surface soil, subsurface soil, and groundwater collected during the 1996 RFI field investigation, nor were they detected in subsurface soil collected during the 1997 RFI field investigation (Baker, 1999). Diethylphthalate was detected in one of seventeen subsurface soil samples (44 J in 11SB19-04) and two of fourteen groundwater samples (34 ug/L in 11GW10 and 12 ug/L in 11GW13) collected during the 1997 RFI field investigation, dimethylphthalate was detected in two of fourteen groundwater samples collected during the 1997 RFI field investigation (27 ug/L in 11GW10 and 2 J ug/L in 11GW13), and phenol was detected in one of seventeen subsurface soil samples (130 J ug/kg in 11SB16-04) and two of fourteen groundwater samples (2 J ug/L in 11GW07 and 3 J ug/L in 11GW08) collected during the 1997 RFI field investigation. These three SVOCs were not detected in surface soil, subsurface soil, or groundwater collected during the 1996 RFI field investigation.

The maximum detected groundwater concentrations for 2,4-dichloropenol, benzyl alcohol, o-cresol, m,p-cresol, diethylphthalate, dimethylphthalate, and phenol are less than the surface water screening values listed in Table 4-6 for these seven SVOCs. These data indicate that these seven SVOCs are not migrating with groundwater to the embayment at ecologically important concentrations. The preliminary conceptual model for SWMU 45 also indicates that these seven SVOCs are not site-related (i.e., are not associated with a release from the SWMU). Based on the low frequency of detections in upgradient abiotic (maximum detected concentrations are less than surface water screening values, and the preliminary conceptual model, 2,4-dichloropenol, benzyl alcohol, o-cresol, m,p-cresol, diethylphthalate, dimethylphthalate, and phenol are not identified as potential ecological risk drivers for embayment sediment, and no additional evaluation is recommended.

Acetone and 2-hexanone were identified as ecological COPCs in the Step 2 screening-level risk calculation because maximum detected concentrations exceeded sediment screening values. As evidenced by Table 4-31, the mean concentration of 2-hexanone and acetone exceeded sediment screening values (HQ = 1.38 and 12.73, respectively). 2-Hexanone was detected in a single sediment sample (220 J ug/kg in 11OWSD), while acetone was detected in each sediment sample (eighteen of eighteen sediment samples). The sediment screening values used for these two VOCs were derived using the USEPA equilibrium partitioning (EqP) approach (USEPA 1993a [see Appendix G]). As discussed in Appendix G, the USEPA EqP-approach derives a sediment benchmark by setting the dissolved chemical concentration in pore water equal to the surface water benchmark and calculates a corresponding particle-sorbed chemical concentration. This approach is appropriate for highly sorptive chemicals (e.g., PAHs), but it produces overly conservative sediment quality benchmarks for VOCs (Fuchsman, 2003).

To evaluate the significance of the 2-hexanone and acetone detections in embayment sediment, alternative screening values were identified from the literature. Di Toro and McGrath (2000) reported a Sediment Quality Guidelines (SQGs) of 4,427 ug/kg for 2-hexanone and 2,265 ug/kg for acetone based on a target lipid model and one percent organic carbon. Given that maximum detected concentrations of 2-hexanone and acetone (230 J ug/kg and 320 J ug/kg, respectively) are an order of magnitude below the Di Toro and McGrath (2000) values and the uncertainty associated with the EqP-based screening values derived in accordance with USEPA (1993a) methodology, it is unlikely that 2-Hexanone and acetone are present at ecologically relevant concentrations. Furthermore, given that the minimum TOC concentration measured in sediment collected from the embayment was 19,000 mg/kg (i.e., 1.9 percent), the Di Toro and McGrath (2000) target lipid model would predict even lower potential for bioavailability and risk when site-specific TOC is considered (i.e., 2-hexanone SQG of 8,411 ug/kg and acetone SQG of 4,304 ug/kg based on 1.9 percent TOC). Based on the comparison of maximum detected concentrations to EqP-based SQGs derived by Di Toro and McGrath (2000), 2-hexanone and acetone are not considered potential risk drivers for the embayment's benthic macroinvertebrate community, and additional evaluation is not recommended.

Sixteen PAHs were detected and identified as ecological COPCs in Step 2 of the screening-level ERA because maximum concentrations exceeded sediment screening values. Mean concentrations of benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were less than sediment screening values (HQs = 0.34, 0.40, 0.17, and 0.44, respectively [see Table 4-31]). Mean concentrations for the remaining PAHs identified as ecological COPCs in Step 2 of the screening-level ERA exceeded sediment screening values. Mean HQ values ranged from 1.58 for 2-methylnaphthalene to 28.2 for acenaphthene. As evidenced by Figure 4-9, the frequency of detections above sediment screening values was high for many of the PAHs. The sediment screening values for PAHs in the Step 2 and Step 3a risk calculations were bulk-sediment toxicological thresholds developed by MacDonald (1994) or reported by Buchman (1999). Bulk-sediment screening values do not take into consideration site-specific factors that can influence a chemical's bioavailablity. For non-ionic chemicals such as PAHs, the primary factor affecting bioavailability is TOC (USEPA, 1993a, Di Toro and McGrath, 2000, and Fuchsman, 2003). A comparison of mean PAH concentrations to EqP-based sediment screening values derived by Di Toro and McGrath (2000) using a target lipid model and 1.0 percent organic carbon is presented in Table 4-32. As evidenced by the table, mean PAH concentrations are less than EqP-based SQGs developed by Di Toro and McGrath (2000). Maximum detected PAH concentrations also are less than the Di Toro and McGrath (2000) EqP-based SQGs. Furthermore, given that the minimum TOC concentration measured in embayment sediment was 19,000 mg/kg (i.e., 1.9 percent), the Di Toro and McGrath (2000) target lipid model would predict even lower potential for bioavailability and risk when site-specific TOC is considered. As such, PAHs are not considered potential risk drivers for the embayment's benthic macroinvertebrate community, and additional evaluation is not recommended.

Based on the evaluation of potential transport pathways presented in Section 4.3.1.2, PAHs may have historically migrated to embayment sediment via the cooling water intake tunnel (an unknown volume of Bunker C fuel was discharged to the embayment through the cooling intake tunnel in 1979 [NEESA, 1984]). Migration with groundwater also represents a potential transport pathway for PAHs at SWMU 45. However, existing data for SWMU 45 do not indicate that PAHs are migrating with groundwater at ecologically relevant concentrations (Baker, 1999). Five PAHs [anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, and pyrene] were detected in groundwater samples collected at SWMU 45. Maximum detected concentrations ranged from 5 J ug/L for anthracene to 15 J ug/L for pyrene. Potential sources of the PAHs detected in sediment collected from the embayment include the two storm water outfalls (Outfall 015 and NR-020) discharging to this surface water body (see Section 4.3.1.2). As evidenced by Figure 4-6, drainage areas for both outfalls include roadways and parking lots, as well as roof drainage from administrative and industrial areas outside of the Building 38 drainage area.

Mean concentrations of bis(2-ethylhexylphthalate and di-n-butylphthalate were greater than sediment screening values (HQs = 3.85 and 7.93, respectively). Both chemicals were detected in nine of eighteen sediment samples. Detected concentrations exceeded sediment screening values. The sediment screening values used in the Step 2 and Step 3a risk calculations for bis(2-ethylhexyl)phthalate and di-n-butylphthalate were bulk-sediment toxicological thresholds from MacDonald (1994) and Buchman (1999), respectively. As discussed above, bulk sediment screening values do not take into consideration site-specific factors (i.e., TOC) that can influence the bioavailability of nonionic organic chemicals. Using the USEPA EqP-approach presented in Appendix G, sediment screening values can be derived that take into consideration site-specific

TOC concentrations. Based on an assumed organic carbon content of 1.0 percent (a conservative assumption given that the minimum organic carbon content measured in embayment sediment was 1.9 percent), the EqP-based sediment screening value for di-n-butylphthalate is 3,021 ug/kg. The USEPA Region 5 (2003c) also developed an EqP-based sediment screening value for di-n-butylphthalate (1,114 ug/kg) using the USEPA (1993a) approach. Finally, Suter II et al. (1997) reported EqP-based sediment screening values for bis(2-ethylhexyl)phthalate and di-n-butylphthalate (11,000 ug/kg and 890,000 ug/kg, respectively). Given that maximum detected concentrations are less than derived and/or literature-based EqP values, these two phthalates are not considered potential risk drivers for benthic macroinvertebrate populations, and additional evaluation is not recommended.

Di-n-butylphthalate was not detected in groundwater samples collected at SWMU 45 during the Phase 1 and Phase 2 RFI investigations. Bis(2-ethylhexyl)phthalate was detected in one of nine groundwater sample collected during the Phase 1 RFI investigation in 1996 (64 J ug/L in 45MW02) and one of sixteen groundwater samples collected during the Phase 2 RFI investigation in 1997 (24 ug/L in 11GW16) (Baker, 1999). These data indicate that bis(2-ethylhexyl)phthalate and di-n-butylphthalate are not site-related and are not migrating with SWMU 45 groundwater to the embayment at ecologically relevant concentrations. Furthermore, because phthalate esters are not associated with activities conducted at Building 38, a historical discharge through the cooling water intake tunnel was not likely.

The mean concentration of Aroclor-1260 exceeded the sediment screening value (HQ = 2.03). This PCB was detected in seventeen sediment samples at a concentration greater than the sediment screening value (see Figure 4-9). Based on historical activities conducted at Building 38 (storage and maintenance of PCB transformers) and the evaluation of potential transport pathways presented in Section 4.3.1.2, PCBs may have migrated to the embayment via the cooling water intake tunnel. PCBs were not detected in groundwater samples collected during the Phase 1 and 2 RFI field investigations (Baker 1999). As such, horizontal transport with groundwater does not represent a potential transport pathway. Based on a mean concentration greater than the sediment screening value, the frequency of detections above the sediment screening value, and historical activities conducted at Building 38 (transformer storage and maintenance), Aroclor-1260 is considered a potential risk driver for benthic macroinvertebrates populations, and additional evaluation is recommended.

Mean concentrations of arsenic, cadmium, mercury, and vanadium were less than sediment screening values (HQs = 0.78, 0.31, 0.36, and 0.51, respectively). Arsenic was detected in eighteen of eighteen sediment samples collected from the embayment; however, only three detected concentrations exceeded the sediment screening value (12 mg/kg in 11SD01, 7.8 J mg/kg in 11SD08, and 7.3 mg/kg in 11OWSD11). Cadmium was detected in eleven of eighteen sediment samples. Only one detected concentration exceeded the sediment screening value (1.3 mg/kg in 11OWSD18). Mercury was detected in nine of eighteen sediment samples and vanadium was detected in eighteen of eighteen sediment samples. Identical to arsenic and cadmium, the frequency and magnitude of detections greater than sediment screening values was low for each metal. Both metals were detected in a single sediment sample (11SD01) at a concentration greater than the sediment screening value (0.42 mg/kg [mercury] and 73.4 J mg/kg [vanadium]).

To evaluate the significance of potential risks presented by arsenic, cadmium, mercury, and vanadium relative to background concentrations, the sediment data were statistically compared to background concentrations. Table 4-33 provides a summary and results of the statistical evaluation, while Figure 4-16 presents boxplot diagrams illustrating the distribution of each data set. As evidenced by Table 4-33, the distribution of arsenic, cadmium, mercury, and vanadium concentrations in embayment sediment are elevated above background concentrations.

The sediment screening values used for arsenic, cadmium, and mercury in the Step 2 and Step 3a risk calculations were TEL values developed by MacDonald (1994). To further evaluate the significance of arsenic, cadmium, and mercury detections in embayment sediment, maximum concentrations (12 mg/kg, 1.3 mg/kg, and 0.42 mg/kg) were compared to alternative toxicological thresholds available from the literature. In addition to TEL values, MacDonald (1994) developed Probable Effect Levels (PELs) for these three metals (41.6 mg/kg [arsenic], 4.21 mg/kg [cadmium], and 0.7 mg/kg [mercury]). Maximum detected arsenic, cadmium, and mercury concentrations were below these PEL values. Long et al. (1995) derived arsenic, cadmium, and mercury ER-L (8.2 mg/kg, 1.2 mg/kg, and 0.15 mg/kg, respectively) and Effects Range-Median (ER-M) values (70 mg/kg, 9.6 mg/kg, and 0.71 mg/kg, respectively). Maximum detected concentrations for each metal exceeded ER-L values; however, they were less than ER-M values. Finally, MacDonald et al. (2000) developed consensus-based Threshold Effect Concentrations (TECs) and Probable Effect Concentrations (PECs) for arsenic, cadmium, and mercury. Maximum detected arsenic, cadmium, and mercury concentrations exceeded the consensus-based TEC values (9.79 mg/kg, 0.99 mg/kg, and 0.18 mg/kg, respectively); however, they did not exceed consensus-based PEC values (33 mg/kg, 4.98 mg/kg, and 1.06 mg/kg, respectively). The frequency of detections above ER-L and consensus-based TEC values were low (identical to the frequency of detections above TEL values). Furthermore, mean arsenic, cadmium, and mercury concentrations (5.6 mg/kg, 0.21 mg/kg, and 0.05 mg/kg, respectively) were less than all alternative screening values, including ER-L and consensus-based TEC values. It is noted that the preliminary conceptual model for SWMU 45 does not indicate that arsenic, cadmium, and mercury are associated with historical activities at SWMU 45 (i.e., arsenic and mercury are not components of Bunker C fuel [Potter and Simmons, 1998], nor are they likely associated with transformer maintenance activities). Based on mean concentrations less than TEL, ER-L, and/or consensus-based TEC values, the low magnitude and frequency of detections above TEL, ER-L, and/or consensus-based TEC values, and the preliminary conceptual model, arsenic, cadmium, mercury, and vanadium are not considered potential risk drivers for benthic macroinvertebrate populations, and additional evaluation is not recommended.

A geochemical evaluation of vanadium and zinc and vanadium and chromium presented in Section 4.7.1.4.2, indicates that detected vanadium concentrations in embayment sediment are likely to represent a reliable estimate of the background concentration range. Based on the geochemical evaluation, vanadium is not identified as a potential ecological risk driver for embayment sediment.

The mean concentration of copper and tin exceeded sediment screening values (HQs = 1.71 and 1.18). Copper was detected in seventeen of seventeen sediment samples. All detected concentrations exceeded the sediment screening value. Tin was also detected at a frequency of 100 percent (eighteen of eighteen sediment samples), with detected concentrations greater than or equal to the screening value occurring in twelve sediment samples. The statistical evaluation presented in Table 4-33 shows that the distribution of copper concentrations in embayment sediment are elevated above background concentrations. A statistical evaluation of the tin data could not be conducted due to the absence of detections in the background data set.

The sediment screening value used in the risk calculations for tin was an AET value reported in Buchman (1999) for tributyltin. The AET value, reported as >3.5 mg/kg, is based on tributyltin (TBT) toxicity to *Neanthes sp*. Use of this value as a sediment screening value is extremely conservative since it does not represent a threshold effect concentration. Furthermore, the AET value is based on the most toxic form of tin (USEPA 2002b). An alternative value for tin, also based on tributyltin, was identified from the literature. Kristin et al. (1998) investigated the toxicity of tributyltin in sediment using spiked sediment toxicity tests with four benthic macroinvertebrate species (an oligochaete [*Tubifex tubifex*], a chironomid (*Chironomus riparius*], an amphipod [*Hyalella azteca*], and a mayfly [*Hexagenia sp.*]). *Hexagonia sp.* was the most sensitive benthic invertebrate tested. The test endpoint for this species was a median inhibition concentration (IC_{50}) based on growth. The reported IC_{50} value of 600 mg/kg (dry weight) resulted in a fifty percent reduction in the growth of the test organism when compared to a control. The maximum detected tin concentration in embayment sediment, (15.6 mg/kg; expressed as TBT) is an order of magnitude below the minimum IC_{50} value reported by Kristan et al. (1998). Based on this comparison, it is unlikely that tin concentrations are adversely impacting the benthic macroinvertebrate community within the embayment.

As discussed in Section 4.3.1.2, the only current mechanism of contaminant transport from SWMU 45 to downgradient surface water and sediment is leaching of chemicals from surface soil and/or subsurface soil by infiltrating precipitation and transport with groundwater. The maximum tin concentration detected in upgradient subsurface soil was 2.7 J ug/kg in 11SB01-02 (Baker, 1999). This compares to a maximum background subsurface soil concentration of 3.4 J ug/kg (Baker, 1999). These data indicate that tin is not likely to leach from subsurface soil and migrate with groundwater to embayment sediment at concentrations above what would be expected under background conditions. Furthermore, the preliminary conceptual model does not indicate that tin is associated with historical activities conducted at Building 38 (i.e., tin is not likely associated with transformer maintenance activities, nor is it a known constituent of Bunker C fuel [Potter and Simmons, 1998]). Based on the comparison of the maximum sediment concentration to literature-based toxicity values, the comparison of the maximum subsurface soil concentration to the maximum background concentration, and the preliminary conceptual model, tin is not identified as a potential risk driver for benthic macroinvertebrate populations within the embayment, and no additional evaluation is recommended.

Identical to arsenic, cadmium, and mercury, the maximum detected concentration of copper (59 J mg/kg) exceeded ER-L (30 mg/kg) and consensus-based TEC (31.6 mg/kg) values, but was less than PEL (108 mg/kg), ER-M (270 mg/kg) and consensus-based PEC (149 mg/kg) values. The frequency of detections exceeding TEL, ER-L, and consensus-based TEC values was high, ranging from seven of seventeen samples for the comparison to the consensus-based TEC value to sixteen of seventeen samples for the comparison to the TEL value. As was previously discussed, the statistical evaluation presented in Table 4-33 showed that the distribution of copper concentrations in embayment sediment is elevated above background concentrations. However, the presence of copper in embayment sediment is not likely to be related to SWMU 45. Maximum detected copper concentrations in SWMU 45 subsurface soil, total recoverable groundwater, and dissolved groundwater (131 J ug/kg, 98.9 J ug/L, and 2.4 J ug/L, respectively [Baker, 1999]) are less than maximum basewide background subsurface soil, total recoverable groundwater, and dissolved groundwater concentrations (148 J ug/kg, 352 ug/L, and 32 ug/L, respectively [Baker, 1999]). These data support the preliminary conceptual model for SWMU 45, which does not indicate that copper is associated with historical activities. A geochemical correlation of copper with zinc and chromium in embayment sediment and basewide background open water sediment also suggests that copper is not a site-related metal. The geochemical method uses techniques that can graphically distinguish between metal concentrations that reflect natural background conditions and concentrations that may represent a chemical release. Copper, chromium, and zinc, and the other transition metals tend to occur together in natural rocks, soils, and sediments (i.e., they exhibit elemental association). If a plot of metal concentrations (e.g., copper versus zinc) indicates a strong correlation, the concentrations are likely to represent a reliable estimate of the background concentration range. High metal concentrations that are not observed to fit an observed strong relationship are likely to represent contamination (i.e., concentrations are not consistent with geochemical background [Krauskopf and Bird, 1995]). As evidenced by Figure 4-17, the pooled data sets follow a strong correlation (0.96 for copper and zinc and 0.95 for copper and chromium), suggesting that copper concentrations in embayment sediment are not indicative of a release. In summary, based on the comparison of SWMU 45 subsurface soil and groundwater data to basewide background subsurface soil and groundwater data, as well as the geochemical correlations presented in Figure 4-17, copper is not identified as a potential ecological risk driver for embayment sediment, and no additional evaluation is recommended.

Beryllium and thallium were detected and identified as ecological COPCs in Step 2 of the screening-level ERA based on the lack of sediment screening values. Identical to other metals detected and identified as ecological COPCs, the range of detected thallium and beryllium concentrations were fairly even. Detected concentrations of beryllium ranged from 0.054 J mg/kg to 0.12 J mg/kg, while thallium detections ranged from 0.046 J mg/kg to 0.23 J mg/kg. The evenness of the detections does not indicate that hot spots are present. The statistical evaluation presented in Table 4-33 demonstrates that the distribution of thallium concentrations in embayment sediment are statistically equivalent to background concentrations. It is noted that the statistical evaluation was limited to the right tail of the distribution (i.e., quantile test and slippage test). A statistical evaluation of the mean of the distributions (e.g., t-test) could not be performed due to the low number of detections in the background data set (detected in one of nine background sediment samples). The descriptive statistics support the conclusion of the distributional statistics. Although detected in a single background sediment sample, this single thallium detection (0.91 J mg/kg) exceeded the maximum concentration detected in embayment sediment. A statistical evaluation of the beryllium data could not be performed due to the absence of detections in the background data set (see Table 4-33).

Due to the limitations of the background data set and the lack of literature-based toxicological thresholds, an evaluation of beryllium's potential to impact aquatic life could not be performed. The maximum detected concentration (0.12 J mg/kg) is lower than conservative sediment screening values established for other metals. A review of the surface water screening values presented in Table 4-6 also indicates that beryllium is less toxic to aquatic life than the majority of Appendix IX metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Based on the absence of detected concentrations above available sediment screening values for other metals and the surface water screening values presented in Table 4-6, which indicate that beryllium is less toxic to aquatic life than the majority of Appendix IX metals, this metal is not identified as a potential risk driver for the embayment's benthic invertebrate community, and additional evaluation in not recommended.

In summary, Aroclor-1260 is identified as a potential risk driver for the embayment's benthic macroinvertebrate community, and additional evaluation is recommended. Although 2-hexanone, acetone, bis(2-ethylhexylphthalate, di-n-butylphthalate, arsenic, beryllium, cadmium, copper, mercury, thallium, tin, and vanadium, and sixteen PAHs were detected and identified as ecological COPCs in Step 2 of the ERA, they are not recommended for further evaluation based on the discussion presented in the preceding paragraphs. Additional evaluation also is not recommended for the non-detected chemicals identified as ecological COPCs in the Step 2 screening-level risk calculation.

4.7.1.4 Refined Risk Calculation and Risk Evaluation for Terrestrial and Aquatic Food Web Exposures

The sections that follow present and discuss the refined screening-level risk calculation for terrestrial and aquatic food web exposures.

4.7.1.4.1 Terrestrial Food Web Exposures

Table 4-19 presented the results of the Step 2 screening-level risk calculation for terrestrial food web exposures to chemicals in surface soil. Based on the comparison of maximum exposure doses to NOAEL-based screening values, chromium and mercury had HQ values greater than or equal to 1.0 for one of more of the terrestrial avian receptors. Nine non-detected VOCs and thirty non-detected SVOCs also were identified as ecological COPCs based on the lack of ingestion-based screening values for each of the avian receptors. Table 4-34 presents the results of the refined screening-level risk calculation for detected chemicals identified as ecological COPCs in Step 2 of the screening-level ERA. An evaluation of the refined screening-level risk calculation is presented in paragraph below.

As discussed above, ten non-detected VOCs and thirty non-detected SVOCs were identified as ecological COPCs in Step 2 of the screening-level ERA based on the lack of ingestion-based screening values. These non-detected VOCs and SVOCs are not identified as potential ecological risk drivers for terrestrial food web exposures since there is no indication that they are associated with historical activities at the SWMU (i.e., they are not components of Bunker C fuel [Potter and Simmons, 1998], nor are they expected to be associated with transformer oil).

Chromium and mercury were identified as ecological COPCs for terrestrial food web exposures because maximum detected concentrations exceeded NOAEL-based screening values for one or more of the terrestrial avian receptors. As evidenced by the Table 4-34, mean chromium and mercury exposure doses were less than NOAEL-based screening values for each terrestrial receptor (mean HQs less than 1.0). The statistical evaluation presented in Table 4-27 also demonstrated that the distribution of chromium and mercury concentrations in SWMU 45 surface soil are statistically equivalent to background concentrations, indicating that these metals are not site-related and presenting risks to terrestrial avian receptors above background levels. Based on mean exposure doses less than NOAEL-based screening values and the statistical evaluation presented in Table 4-27, chromium and mercury are not considered potential risk drivers for terrestrial food web exposures and additional evaluation is not recommended.

In summary, there are no potential ecological risk drivers identified for terrestrial food web exposures. Although chromium and mercury were detected and identified as potential ecological COPCs in Step 2 of the screening-level ERA, they are not recommended for further evaluation based on the discussion presented in the preceding paragraphs. Additional evaluation also is not recommended for the non-detected chemicals identified as ecological COPCs in the Step 2 screening-level risk calculation.

4.7.1.4.2 Aquatic Food Web Exposures

Table 4-20 presented the results of the Step 2 screening-level risk calculation for aquatic food web exposures. Based on a comparison of maximum exposure doses to NOAEL-based screening values Aroclor-1260, arsenic, cobalt, mercury, and vanadium were detected and identified as ecological COPCs because maximum exposure doses exceeded NOAEL-based screening values for the belted kingfisher. The maximum mercury exposure dose for the double-crested cormorant and West Indian manatee also exceeded NOAEL-based screening values. Arsenic, cadmium, selenium, vanadium, and zinc were detected and identified as ecological COPCs for aquatic food web exposures because maximum exposure doses for the West Indian manatee exceeded NOAEL-based screening values. Ethylbenzene, styrene, toluene, and beryllium were detected and identified as ecological COPCs based on the lack of ingestion-based screening values for the aquatic avian receptors (i.e., belted kingfisher and double-crested cormorant). In addition to the detected chemicals identified above, the non-detected SVOCs 1,2,4,5-tetrachlorobenzene, dinoseb, hexachlorobenzene, and hexachloroethane and three PCBs (Aroclor-1221, Aroclor-1248, and Aroclor-1254) were identified as ecological COPCs because maximum exposure doses (based on maximum reporting limits) exceeded NOAEL-based screening values for the West Indian manatee, belted kingfisher, and/or double-crested cormorant. Nine non-detected VOCs and thirty non-detected SVOCs also were identified as ecological COPCs based on the lack of avian and/or mammalian ingestion-based screening values. Table 4-35 presents the results of the refined screening-level risk calculation for chemicals detected in surface water and/or sediment and identified as ecological COPCs in Step 2 of the screening-level ERA. An evaluation of the refined screening-level risk calculation and risk characterization for aquatic food web exposures is presented in the paragraphs below. As discussed in Section 4.7, refined risk estimates were not derived for the West Indian manatee. As such, the risk characterization for this receptor did not include an evaluation of refined screening-level risk estimates.

As discussed above, 1,2,4,5-tetrachlorobenzene, dinoseb, hexachlorobenzene, hexachloroethane, and three PCBs were identified as ecological COPCs because maximum exposure doses exceeded NOAEL-based screening values for the West Indian manatee, belted kingfisher, and/or double-crested cormorant. These four SVOCs were not detected in surface soil, subsurface soil, or groundwater collected during the RFI field investigations (Baker, 1999). These data indicate that 1,2,4,5-tetrachlorobenzene, dinoseb, hexachlorobenzene, and hexachloroethane are not likely to be site-related or migrating with groundwater to embayment surface water and sediment at ecologically important concentrations. For the reasons discussed above, 1,2,4,5-tetrachlorobenzene, dinoseb, hexachlorobenzene, hexachloroethane, Aroclor-1221, Aroclor-1248, and Aroclor-1254 are not identified as ecological COPCs for aquatic food web exposures, and no additional evaluation is recommended.

Seven non-detected VOCs and thirty non-detected SVOCs were identified as ecological COPCs based on the lack of avian and/or mammalian ingestion-based screening values. With the exception of diethylphthalate, these VOCs and SVOCs were not detected in surface soil, subsurface soil, and groundwater collected during the RFI field investigations (Baker, 1999). Diethylphthalate was not detected in surface soil or groundwater collected during the Phase I RFI field investigation. However, this SVOV was detected in one of seventeen subsurface soil samples and two of fourteen groundwater samples collected during the Phase II RFI field investigation (Baker, 1999). The maximum detected groundwater concentration (34 ug/L) is less than the surface water screening value listed in Table 4-6 (i.e., 75.9 ug/L [USEPA, 2001a]), indicating that diethylphthalate is not migrating with groundwater to the embayment at ecologically important concentrations. The low frequency of detection in upgradient abiotic media also indicates that this SVOC is not likely to be site-related. Based on the discussion presented above, the non-detected VOCs and SVOCs lacking ingestion-based screening values are not identified as potential ecological risk drivers for aquatic food web exposures, and no additional evaluation is recommended.

Aroclor-1260, cobalt, and vanadium were identified as ecological COPCs in the Step 2 screening-level risk calculation because maximum belted kingfisher exposure doses exceeded NOAEL-based screening values. As evidenced by Table 4-35, mean exposure doses for these three chemicals were less than NOAEL-based screening values. To further evaluate the significance of Aroclor-1260, cobalt, and vanadium concentrations in embayment sediment, a spatial examination of the data was performed to determine if individually detected concentrations have the potential to impact avian piscivore populations that may use the embayment as foraging habitat. This was accomplished by calculating sediment concentrations that would result in mean exposure doses greater than the NOAEL-based screening value. If maximum detected concentrations are less than the minimum concentrations that would result in mean exposure doses greater than NOAEL-based screening value, it can be concluded that these chemicals are not presenting unacceptable risks to avian piscivore populations. Aroclor-1260, cobalt, and vanadium concentrations in embayment sediment that would result in mean exposure doses greater than or equal to NOAEL-based screening values were derived using the following formula (Equation 4-6):

$$SC_x = \frac{(0.99)(NOAEL_{ij})(BW_j)}{[[\sum_i (FIR_j)(BCF_{xi} / BAF_{xi})(PDF_{ij})] + [(FIR_j)(PDS_j)]][AUF_j]}$$

where:

SC_x	=	Mean concentration of chemical x in sediment (mg/kg, dry weight)
$NOAEL_{ij}$	=	Ingestion-based screening value for chemical i applied to receptor j (mg chemical/kg body weight/day)
BCF_{xi}	=	Mean/median sediment-to-biota BCF for chemical x and food item i (dry weight basis)
BAF_{xi}	=	Mean/median sediment-to-biota BAF for chemical x and food item i (dry weight basis)
BW_j	=	Mean body weight for receptor j (kg, wet weight)
FIR_j	=	Mean food ingestion rate for receptor j (kg/day, dry-weight)
PDF_{ij}	=	Proportion of receptor j diet composed of food item i (mg/kg, dry weight)
PDS_j	=	Proportion of receptor j diet composed of sediment (dry weight basis)
AUF_j	=	Area Use Factor for receptor j (unitless)

As discussed in Section 4.5.2.2.1, if an organic chemicals was detected in surface water or if a metal was detected within the dissolved fraction, the estimation of tissue concentrations in fish, a prey item for the belted kingfisher, took into consideration surface water-to-fish bioaccumulation. Aroclor-1260 was not detected in surface water samples collected from the embayment. As such, the sediment concentration resulting in a modeled mean exposure dose greater than the NOAEL-based screening value is based only on sediment-to-fish and sediment-to-invertebrate bioaccumulation. Cobalt and vanadium were both detected within the dissolved fraction of each surface water sample. As such, the derivation of sediment concentrations resulting in modeled mean exposure doses greater than NOAEL-based screening values reflect a contribution from surface water-to-fish bioaccumulation. This contribution is based on the mean dissolved cobalt and vanadium concentration detected in embayment surface water. Using Equation 4-6 above, Aroclor-1260, cobalt, and vanadium concentrations greater than 178 ug/kg, 11.8 ug/kg, and 91 mg/kg, respectively would result in modeled mean exposure doses greater than NOAEL-based screening values for the belted kingfisher. Given that the maximum Aroclor-1260, cobalt, and vanadium concentrations detected in embayment sediment were 150 ug/kg, 7.3 J ug/kg, and 73.4 J ug/kg, respectively, these three chemicals would not be expected to impact avian piscivore populations. Based on mean HQ values less than 1.0 and the spatial examination of the data presented above, Aroclor-1260, cobalt, and vanadium are not identified as potential ecological risk drivers for aquatic food web exposures and no additional evaluation is recommended.

Mercury was identified as an ecological COPC in Step 2 of the screening-level ERA because maximum exposure doses for the belted kingfisher and double-crested cormorant exceeded NOAEL-based screening values. As evidenced by Table 4-35, the mean mercury exposure dose exceeded the NOAEL-based screening value for the belted kingfisher (HQ = 2.81), while the mean exposure dose was less than the NOAEL-based screening value for the double-crested cormorant. Mercury was not detected within the dissolved fraction of surface water collected from the embayment; therefore, risks to this receptor are driven by mercury in sediment. The statistical evaluation presented in Table 4-33 demonstrated that the distribution of mercury concentrations in sediment collected from the embayment is elevated above background concentrations. Furthermore, the frequency of mercury detections exceeding the concentration resulting in a modeled, mean exposure dose greater than the NOAEL-based screening value (0.0165 ug/kg [calculated using Equation 4-6]) for the belted kingfisher is high (seven of eighteen samples). However, MATC- and LOAEL-based HQ values are less than 1.0 (0.89 and 0.28, respectively).

To further evaluate the significance of mercury detections in embayment sediment, feeding ranges for the belted kingfisher were identified from the literature and used to derive site-specific AUFs. Appendix A of USEPA's Wildlife Exposure Factors Handbook (USEPA, 1993b) lists belted kingfisher foraging ranges in units of area (i.e., hectares) or distance (i.e., foraging radius or kilometers of shoreline). The USEPA (1993b) report a foraging area of 14.2 hectares from a study conducted by Sayler and Langler (1948) in an aquatic system consisting of pond and marsh habitat. Based on the approximate area of the cove (2.04 hectares) and a foraging area of 14.2 hectares, the belted kingfisher AUF is 0.14. Input of this AUF into Equation 4-5 yields a NOAEL-based HQ of 0.39 when less conservative input parameters are used (e.g., mean body weight, mean ingestion rate, and mean sediment concentration). Cornwell (1963; as cited in USEPA, 1993b) reported a minimum and maximum foraging radius of 0.8 and 8.0 kilometers and a mean foraging radius of 1.6 kilometers for Minnesota lake and forest habitat. The minimum foraging radius can be converted to a unit of area (i.e., square kilometers by calculating the area of a circle with a radius of 0.8 kilometers (8.04 square kilometers or 201 hectares). Based on a minimum foraging area of 201 hectares and the approximate area of the cove (2.04 hectares), an AUF of 0.04 is calculated. Input of this AUF into Equation 4-5 also yields a NOAEL-based HQ value (0.11) when less conservative input parameters are used.

The average foraging area, expressed as kilometers of shoreline, for studies reported by the USEPA (1993b) is 1.5 kilometers. Based on an embayment shoreline of approximately 0.4 kilometers, this foraging range corresponds to an AUF of 0.27 at SWMU 45. Identical to the AUFs derived using foraging territories expressed as an area or radius, use of this AUF results in a mean exposure dose less than the NOAEL-based screening value (i.e., HQ = 0.76). It is worth noting that territory sizes reported by the USEPA (1993b) as kilometers of shoreline were derived from studies that investigated belted kingfisher foraging ranges along streams, rivers, and lakes. The shallow water zones associated with these surface water bodies (especially streams) offer preferred feeding habitat for belted kingfishers (belted kingfishers seen to prefer water depths less than 60 centimeters when foraging [USEPA, 1993b]). As discussed in Section 4.3.2, riprap is present from above MHW to approximately three feet below MLW along both sides of the embayment. As such, preferred feeding habitat within the embayment is limited to approximately 375 feet or 0.11 kilometers of shoreline along the front end of the embayment (length of embayment shoreline that does not contain riprap). Given that the actual length of embayment shoreline offering preferred feeding habitat is approximately 0.11 kilometers, the HQ value of 0.76 is considered a conservative risk estimate. A factor not considered in the Step 3a risk calculation and risk evaluation was the assumption that belted kingfishers are year-round residents of Puerto Rico, when in fact they are non-breeding migrates common to the island from October to April (Raffaele, 1989). Consideration of the migratory behavior of the belted kingfisher in the Step 3a risk calculation would result in an even lower estimate of potential exposure and risk. Based on the discussion presented above, it cannot be expected that mercury concentrations within the embayment would impact piscivorous bird populations. As such, mercury is not considered a potential risk driver for aquatic piscivore food web exposures, and additional evaluation is not recommended.

Arsenic, cadmium, selenium, vanadium, and zinc were identified as ecological COPCs for aquatic food web exposures in Step 2 of the screening-level ERA because maximum exposure doses for the West Indian manatee exceeded NOAEL-based screening values. Figure 4-17 presented a geochemical evaluation of chromium, copper, and zinc in embayment sediment. The evaluation demonstrated that copper and zinc fit an observed strong relationship indicating that concentrations are likely to represent a reliable estimate of the background concentration range for these metals. A geochemical correlation of vanadium with zinc and chromium in embayment sediment and basewide background open water sediment also suggests that vanadium is not a site-related metal. As evidenced by Figure 4-18, the pooled data sets follow a strong correlation (0.95 for vanadium and zinc and 0.97 for vanadium and chromium), suggesting that vanadium concentrations in embayment sediment are not indicative of a release. Based on the geochemical evaluations presented in Figures 4-17 and 4-18, zinc and vanadium are not identified as potential ecological risk drivers for mammalian herbivore food web exposures, and no further evaluation is recommended.

Selenium was detected in ten of eighteen sediment samples at concentrations ranging from 0.25 J ug/kg to 0.78 J ug/kg. Selenium was not detected in SWMU 45 surface and subsurface soil collected during the Phase I RFI field investigation and subsurface soil collected during the Phase II RFI field investigation, nor was it detected within the total recoverable or dissolved fraction of groundwater samples collected during the Phase II RFI field investigation. These data indicate that selenium is not associated with a release from SWMU 45. The surface soil, subsurface soil, and groundwater data support the preliminary conceptual model for SWMU 45, which indicates that selenium is not associated with historical activities at Building 38. Based on the lack of detections in upgradient surface soil, subsurface soil, and groundwater, selenium is not identified as a potential ecological risk driver for mammalian herbivore aquatic food web exposures, and no additional evaluation is recommended.

Cadmium was detected in eleven of eighteen sediment samples at concentrations ranging from 0.08 J ug/kg to 1.3 ug/kg. This metal was detected in four of four surface soil samples, seven of eight subsurface soil samples, and eight of eight groundwater samples collected during the Phase I RFI field investigation. This metal also was detected in nine of seventeen subsurface soil samples and one of four groundwater samples collected during the Phase II RFI field investigation (Baker, 1999). The maximum detected surface soil concentration (0.42 ug/kg in sample 45MW03-00 collected during the Phase I RFI field investigation) is less than the maximum background subsurface soil concentration (0.92 J; see Appendix I.2). The maximum detected subsurface soil concentration (0.86 ug/L in sample 11-SB19-04 collected during the Phase II RFI field investigation) is slightly elevated above the maximum background subsurface soil concentration (0.62 ug/kg [Baker, 1999]). The maximum groundwater concentration (27.8 ug/L in sample 45MW04 collected during the Phase II RFI field investigation [Baker, 1999]) also is greater than the maximum background groundwater concentration (7.5 ug/L [Baker, 1999]). Although detected in SWMU 45 groundwater collected during the Phase I RFI field investigation at a concentration greater than the maximum background concentration, this metal was not detected in groundwater collected during the Phase II RFI field investigation above the maximum background concentration (maximum cadmium concentration detected in Phase II FRI groundwater samples was 0.54 ug/L [Baker, 1999]). Given that the Phase II RFI groundwater samples were collected downgradient from the Phase I RFI groundwater samples (Baker, 1999), there is no indication that cadmium is migrating with groundwater to the embayment at concentrations above background levels. Furthermore, the preliminary conceptual model does not indicate that cadmium is associated with historical site activities at SWMU 45 (i.e., cadmium is not a component of Bunker C fuel [Potter and Simmons, 1998], nor is it likely to be associated with transformer maintenance activities). For the reasons discussed above, cadmium is not identified as a potential ecological risk driver, and no further evaluation is recommended.

Ingestion-based screening values are not available for ethylbenzene, styrene, toluene, and beryllium from the literature. Ethylbenzene was detected in one of eighteen sediment samples (0.78 J ug/kg in 11OWSD14), while toluene was detected in two of eighteen sediment samples (2.1 J ug/kg in 11OWSD17) and 2.5 J ug/kg in 11OWSD18). Ethylbenzene was also detected in one of nine surface water samples (0.13 J ug/kg in 11OWSW12). In addition to ethylbenzene, styrene was detected in two of nine surface water samples (0.57 J ug/kg in 11OWSW12 and 0.45 J ug/kg in 11OWSW13). Although ethylybenzene, styrene, and toluene were evaluated for aquatic food web exposures, they are not considered important bioaccumulative chemicals by the USEPA (2002a). This is shown by the low surface water-to-fish BCF values presented in Table 4-13 (BCF = 15.1 for ethylbenzene, 13.9 for styrene, and 38.2 for toluene). Given the low frequency and magnitude of detections and their low potential to bioaccumulate in aquatic prey items, ethylbenzene, styrene, and toluene are not likely to impact aquatic piscivore populations foraging within the embayment. These three VOCs also were not detected in SWMU 45 groundwater samples collected during the Phase I and Phase RFI field investigations. As such, they are not likely to be migrating with groundwater to the embayment at ecologically important concentrations. Finally, these three VOCs are not components of Bunker C fuel (Potter and Simmons, 1998), nor are they likely to be associated with transformer maintenance activities. For the reasons discussed above, ethylbenzene, styrene, and toluene are not identified as potential risk drivers for aquatic food web exposures, and additional evaluations are not recommended.

Beryllium was detected in twelve of eighteen sediment samples (detected concentrations ranged from 0.054 J mg/kg in 11OWSD16 to 0.12 J ug/kg in 11OWSD18). This metal was not detected in surface water collected from the embayment (total recoverable or dissolved fraction). A statistical evaluation of the embayment and background data could not be performed due to the lack of detected concentrations in the background data set (see Table 4-33). As discussed in Section 4.4.2, all metals were conservatively evaluated for aquatic food web exposures. However, there is no indication that beryllium is an important bioaccumulative chemical (USEPA 2002a). This is exemplified by the low surface water-to-fish BCF value reported by Sample et al. (1996) for this metal (BCF = 19). The preliminary conceptual model also indicates that this metal is not associated with historical site activities at SWMU 45. Based on the low magnitude of detections, the low potential to bioaccumulate in aquatic prey items, and the preliminary conceptual model, beryllium is not considered a potential risk driver for aquatic food web exposures, and additional evaluation is not recommended.

In summary, there are not potential ecological risk drivers identified for aquatic food web exposures. Although arsenic, cadmium, cobalt, beryllium, mercury, selenium, vanadium, and zinc, Aroclor-1260, ethylbenzene, styrene, and toluene were detected and identified as potential ecological COPCs in Step 2 of the screening-level ERA, they are not recommended for further evaluation based on the discussion presented in the preceding paragraphs. Additional evaluation also is not recommended for the non-detected chemicals identified as ecological COPCs in the Step 2 screening-level risk calculation.

4.7.2 Uncertainties Associated With the Refined Screening-Level Risk Characterization

Many of the uncertainties identified in Section 4.6.2 also apply to the refined screening-level risk characterization. Those uncertainties unique to the refined risk calculation apply to the identification of potential risk drivers:.

- Non-detected chemicals lacking media-specific and/or ingestion-based screening values were not evaluated in the refined risk calculation, nor were they considered potential risk drivers. This could result in an understatement of the number of potential risk drivers if non-detected chemicals are present at ecologically significant concentrations. Non-detected chemicals can be addressed by site-specific studies conducted in Step 6 of the Navy ERA process (i.e., site investigation and data analysis [see Figure 4-1]).

- A second source of uncertainty related to the identification of potential risk drivers applies to sediment. Cadmium, mercury, and vanadium were eliminated (in part) from further evaluation in Step 3a by comparing detected concentrations to a range of toxicological benchmarks available from the literature. If the most conservative literature-based screening value, which was used in the Step 2 screening-level ERA, is an accurate estimation of potential impacts, the use of alternative toxicological benchmarks presents some potential for underestimation of risks. This uncertainty was reduced by taking into consideration the preliminary conceptual model for SWMU 45 and analytical data for upgradient media that do not indicate that cadmium, mercury, and vanadium concentrations in embayment sediment related to activities conducted at SWMU 45.

- A second source of uncertainty related to the identification of potential risk drivers applies to the use of NOAEL-based screening values in risk calculations for upper trophic level receptors. The use of NOAEL-based screening values is extremely conservative since they give no indication as to how much higher a concentration must be before adverse effects are observed. This uncertainty was reduced in the risk evaluation by considering HQ values derived using MATC- and LOAEL-based screening values. Because actual effect levels are less than LOAEL-based screening values and can be less than MATC-based screening values, their use presents some potential for underestimation of risks.

- A third source of uncertainty related to the identification of potential risk drivers applies to sediment. As discussed in Section 4.3.1.2, two outfall (Outfall 015 and Outfall NR-020) discharge to the embayment downgradient from SWMU 45. Both outfalls discharge storm water runoff from roadways and parking lots, as well as runoff from building associated with administrative, industrial, and material storage areas activities unrelated to SWMU 45. Based on the presence of these two storm water outfalls, elevated metal concentrations detected in embayment sediment are not likely associated with a release from SWMU 45. This is supported by the preliminary conceptual model for SWMU 45 and/or the evaluation of upgradient analytical data for surface soil, subsurface soil, and groundwater.

4.7.3 Step 3a Decision Point and Recommendations

Table 4-36 presents a summary of the ecological COPCs identified in Step 2 of the screening-level ERA, as well as the potential risk drivers identified in Step 3a of the baseline ERA. Based on refined media-specific risk calculation and risk evaluation presented in Sections 4.7.1.1 and 4.7.1.2, additional evaluation is not recommended for chemicals detected in surface soil and surface water, respectively. Additional evaluation also is not recommended for terrestrial and aquatic food web exposures (see Section 4.7.1.4).

Based on the refined media-specific risk calculation and risk evaluation presented in Section 4.7.1.3, Aroclor-1260 has the potential to impact aquatic receptor communities (i.e., benthic macroinvertebrates) within the embayment downgradient from SWMU 45. Aroclor-1260 was detected in eighteen of twenty-three sediment samples. The detected concentration in seventeen samples exceeded the sediment screening value. Based on historical activities conducted at Building 38 (storage and maintenance of PCB transformers) and the evaluation of potential transport pathways presented in Section 4.3.1.2, Aroclor-1260 may have migrated to the embayment via the cooling water intake tunnel. Based on a mean HQ greater than 1.0 (2.03) and the frequency of detections exceeding the sediment screening value (17/23), it is recommended that Aroclor-1260 be carried on to Step 3b of the baseline ERA (baseline ERA problem formulation).

As discussed in Section 4.3.1.3, potentially complete exposure pathways have been identified for aquatic reptiles (i.e., sea turtles). However, based on the paucity of data concerning the toxicological effects of chemicals for reptiles, a quantitative evaluation could not be performed. Given the Federal status of sea turtles in Puerto Rico, additional evaluation is recommended in Step 3b of the baseline ERA. This evaluation will include an examination of their life history information to determine their potential for exposure to chemicals detected in embayment sediment. Any toxicological data identified from the literature for aquatic reptiles also will be presented and discussed in Step 3b.

4.8 References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995a. Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs). U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. August.

ATSDR. 1995b. Toxicological Profile for Naphthalene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. August.

ATSDR. 1995c. Toxicological Profile for PCBs. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

ATSDR. 1993a. Toxicological Profile for N-Nitrosodiphenylamine. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

ATSDR. 1993b. Toxicological Profile for Cadmium. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. TP-92/06.

ATSDR. 1992a. Toxicological Profile for Cobalt. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. July.

ATSDR. 1992b. Toxicological Profile for Zinc. Draft. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

ATSDR. 1990. Toxicological Profile for Silver. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. TO-90/24.

ATSDR. 1989. Toxicological Profile for Hexachlorobenzene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. Draft.

Baes III, C.F., R.D. Scharp, A.L. Sjoreen, and R.W. Shor. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture. ORNL 5786. Oak Ridge National Laboratory, Oak Ridge, TN.

Baker Environmental, Inc. (Baker). 2003a. Final Additional Data Collection Investigation Report, Tow Way Fuel Farm, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. April 22, 2003.

Baker. 2003b. Final Corrective Measures Study Investigation Report for SWMU 9. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. April 25, 2003.

Baker. 2001a. Draft Screening-Level Ecological Risk Assessment Problem Formulation (Step 1) and Exposure Estimate SWMU 45, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. August 10, 2001.

Baker. 2001b. Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment at SWMU 45, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. August 10, 2001.

Baker. 1999. Revised Draft RCRA Facility Investigation Report for Operable Unit 3/5, Naval Station, Roosevelt Roads, Puerto Rico. Baker Environmental, Inc. April 1, 1999.

Baker. 1993. Draft Supplemental Investigation, Installation Restoration Program Activities, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. 1993.

Bechtel Jacobs. 1998a. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Prepared for U.S. Department of Energy. BJC/OR-133. September 1998.

Bechtel Jacobs. 1998b. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for Oak Ridge Reservation. Prepared for U.S. Department of Engery. BJC/OR-112. August 1998.

Beliles, R.P., J.H. Butala, and C.R. Stack. 1985. Chronic Toxicity and Three-Generation Reproduction Study of Styrene Monomer in the Drinking Water of Rats. Fundamental and Applied Toxicology. 5:855-868.

Beyer, W. N. and C. Stafford. 1993. Survey and Evaluation of Contaminants in Earthworms and in Soils Derived from Dredged Material at Confined Disposal Facilities in the Great Lakes Region. Environmental Monitoring and Assessment. 24:151-165.

Beyer, W.N. 1996. Accumulation of Chlorinated Benzenes in Earthworms. Bulletin of Environmental Contamination and Toxicology. 57:729-736.

Beyer, N., E. Connor, and S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife. Patuxent Wildlife Research Center, Laurel, MD.

Beyer, W.N. 1990. Evaluating Soil Contamination. U.S. Fish and Wildlife Service Biological Report 90(2). 25 pp.

Bivings, A.E., M.D. Hoy, and J.W. Jones. 1989. Fall food habits of double-crested cormorants in Arkansas. Pages 142-143 IN Bjugstad, A.J., D.W. Ursek, and R.H. Hamre (tech. coord.). Ninth Great Plains Wildlife Damage Control Workshop Proceedings. USDA Forest Service General Technical Report RM-171.

Buchman, M.F. 1999. NOAA Screening Quick Reference Tables. NOAA HAZMAT Report 99-1. National Oceanic and Atmospheric Administration, Seattle, WA. 12 pp.

Canadian Council of Ministers of the Environment (CCME). 2002. Canadian Soil Quality Guidelines (CSQGs). http://www.ec.gc.ca/ceqg-rcqe/English/ceqg/soil/default.cfm.

Chief of Naval Operations (CNO). 1999. Navy Policy for Conducting Ecological Risk Assessments. Memorandum from Chief of Naval Operations to Commander, Naval Facilities Engineering Command. Ser. N453E/9U595355. April 5, 1999.

Cope, W.G., J.G. Wiener, and R.G. Rada. 1990. Mercury Accumulation in Yellow Perch in Wisconsin Seepage Lakes: Relation to Lake Characteristics. Environ. Toxicol. Chem. 9: 931-940.

Cornwell, G.W. 1963. Observations on the Breeding Biology and Behavior of a Nesting Population of Belted Kingfishers. Condor. 65:426-431.

Coulston, F. and A.C. Kolbye, Jr. (eds). 1994. Interpretive Review of the Potential Adverse Effects of Chlorinated Organic Chemicals on Human Health and the Environment. Regulatory Toxicology and Pharmacology. 20:S1-S1056.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79-31. Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior, Washington, DC.

Diaz, G.J., R.J. Julian, and E.J. Squires. 1994. Lesions in Broiler Chickens Following Experimental Intoxication with Cobalt. Avian Diseases. 38:308-316.

Di Toro, D.M. and J.A. McGrath. 2000. Technical Basis for Narcotic Chemicals and Polycyclic Aromatic Hydrocarbon Criteria. II. Mixtures and Sediments. Environ. Toxicol. and Chem. 19:1971-1982.

Dourson, M.L. and J.F. Stara. 1983. Regulatory History and Experimental Support of Uncertainty (Safety) Factors. Regulatory Toxicology and Pharmacology. 3:224-238.

Dunning, J.B., Jr. (editor). 1993. CRC Handbook of Avian Body Masses. CRC Press, Boca Raton, FL. 371 pp.

Efroymson, R.A., Will, M.E., and Suter II, G.W. (1997a). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. (ES/ER/TM-126/R2).

Efroymson, R.A., Will, M.E., Suter II, G.W., and Wooten, A.C. (1997b). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory. Oak Ridge, TN. (ES/ER/TM-85/R3).

Eisler, R. 1991. Cyanide Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish and Wildlife Service Biological Report 85(1.23), Contaminant Hazard Reviews Report No. 23. 55 pp.

Eisler, R. 1989. Pentachlorophenol Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish and Wildlife Service Biological Report 85(1.17), Contaminant Hazard Reviews Report No. 17. 72 pp.

Etheridge, K., G.B. Rathbun, J.A. Powell, and H.I. Kochman. 1985. Consumption of Aquatic plants by the West Indian Manatee. Journal of Aquatic Plant Management. 23: 21-25.

Ewel, J.J., and J.L. Whitmore. 1973. The Ecological Life Zones of Puerto Rico and the U.S. Virgin Islands. Institute of Tropical Forestry, Rio Piedras, PR. (U.S. Forest Service Research Paper ITF-18).

Friday, G.P. 1998. Ecological Screening Values for Surface Water, Sediment, and Soil. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC. WSRC-TR-98-00110.

Fuchsman, P.C. 2003. Modification of the Equilibrium Partitioning Approach for Volatile Organic Compounds in Sediment. Environ. Toxicol. Chem. 22(7): 1532-1534.

Geo-Marine, Inc. 1998. Integrated Natural Resource Management Plan for U.S. Naval Station Roosevelt Roads: Plan Years 1998-2007. Geo-Marine, Inc., Plano, TX.

Geo-Marine, Inc. 2000. Habitat Characterization of Solid Waste Management Units (SWMU) 1, SWMU 2, and SWMU 45, Naval Station Roosevelt Roads, Puerto Rico. Geo-marine, Inc., Plano, TX. October 11, 2000.

Ghosh, R.S., D.A. Dzombak, R.G. Luthy, and D.V. Nakles. 1999. Subsurface Fate and Transport of Cyanide Species at a Manufactured-Gas Plant Site. Water Environment Research. 71(6): 1205 – 1216.

Gobas, F.A.P.C. 1993. A Model for Predicting Bioaccumulation of Hydrophobic Organic Chemicals in Aquatic Food Webs: Application to lake Ontario. Ecol. Model. 69:1-17.

Grimes, J. and M. Jaber. 1989. Para-dichlorobenzene: An Acute Oral Toxicity Study with the Bobwhite, Final Report. Prepared by Wildlife International Ltd. - Easton, MD under project No. 264-101 and submitted to Chemical Manufacturers Association, Washington, D.C. July 19, 1989.

Hill, E.F. and M.B. Camardese. 1986. Lethal Dietary Toxicities of Environmental Contaminants and Pesticides to Coturnix. U.S. Fish and Wildlife Services Technical Report 2.

Hirsch, M.P. 1998. Bioaccumulation of Silver from Laboratory-Spiked Sediments in the Oligochaete (*Lumbriculus variegates*). Environ. Toxicol. Chem. 17:605-609.

Howard, P.H. 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume III. Lewis Publishers, Chelsea, MI.

Humphreys, D.J. 1988. Veterinary Toxicology, 3rd Edition. B. Tindall, London, England. 356 p. (ISBN 0702012491).

International Programme on Chemical Safety (IPCS). 1994. Environmental Health Criteria 156 - Hexachlorobutadiene. World Health Organization, Geneva.

Integrated Risk Information System (IRIS). 1998. U.S. Environmental Protection Agency, Washington D.C.

Jackson, W.B. 1992. Norway Rat and Allies. Chapter 54 In Chapman, J.A. and G.A. Feldhamer (eds.), Wild Mammals of North America: Biology, Management, and Economics. The John Hopkins University Press, Baltimore MD. pp. 1077-1088.

Kjeldsen, P. 1998. Behavior of Cyanides in Soil and Groundwater: A Review. Water, Air, and Pollution 115: 279-307.

Krantzberg, G. and D. Boyd. 1992. The Biological Significance of Contaminants in Sediment from Hamilton Harbor, Lake Ontario. Environ. Toxicol. Chem.

Kristin, E.D., R.J. Maguire, D. Milani, and S.P. Batchelor. Toxicity of Tributyltin to Four Species of Freshwater Benthic Invertebrates Using Spiked Sediment Bioassays. Water Quality Research Journal of Canada. 33(1):111-132.

Krausekopt, K.B. and D.K. Bird. 1995. Introduction to Geochemistry. Third Edition. McGraw-Hill, New York, New York.

Kushlan, J.R. 1978. The Feeding Ecology of Wading Birds. In: A. Sprunt, J. Ogden, and S. Winekler (eds.), Wading birds. National Audubon Society Research Report 7.

Levey, D.J. and W.H. Karasov. 1989. Digestive Responses of Temperate Birds Switched to Fruit or Insect Diets. Auk. 106:675-686.

Little, E.L. and F.H. Wadsworth. 1964. Common Trees of Puerto Rico and the Virgin Islands. Agricultural U.S Department of Agriculture, Forest Department, Washington, D.C. Agricultural Handbook No. 249.

Long, E.R. and L.G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. National Oceanic and Atmospheric Administration, Seattle, WA. NOAA Technical Memorandum NOS OMA 52.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environ. Management 19(1): 81-97.

MacDonald, D.D., C.G. Ingersoll, T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Waters: Volume 1 – Development and Evaluation of Sediment Quality Assessment Guidelines. Florida Department of Environmental Protection, Tallahassee, Fl.

Maki, A.W. and J.R. Duthie. 1978. Summary of Propose Procedures for the Evaluation of Aquatic Hazard. In Cairns, J., Jr., K.L Dickson, and A.W. Maki (eds.), Estimating the Hazard of Chemical Substances to Aquatic Life. ASTM STP 657. pp 153-163.

Martin, A.C., H.S. Zim, and A.L. Nelson. 1951. American Wildlife and Plants: A Guide to Wildlife Food Habits. Dover Publications, Inc. New York, NY. 500 pp.

Maruya, K.A., R.W Risebrough, and A.J. Horne. 1997. The Bioaccumulation of the Polynuclear Aromatic Hydrocarbons by Benthic Invertebrates in an Intertidal Marsh. Environ. Toxicol. Chem. 11:245-260.

Massachusetts Department of Environmental Protection (MADEP). 1998. Background Documentation for the Development of "Available Cyanide" Benchmark Concentration. www.state.ma.us/dep/ors/files/cn_soil.htm.

Meeussen, J.C.L., G.K. Meindert, and F.A.M. de Haan. 1992. Chemical Stability and Decomposition Rate of Iron Cyanide Complexes in Soil Solutions. Environmental Science and Technology. 26: 511-516.

Menzie, C.A., D.E. Burmaster, J.S. Freshman, and C.A. Callahan. 1992. Assessment of Methods for Estimating Ecological Risk in the Terrestrial Component: A Case Study at the Baird & McGuire Superfund Site in Holbrook, Massachusetts. Environ. Toxicol. and Chem.11:245-260.

Ministry of Housing, Spatial Planning and Environment (MHSPE). 1994. Intervention Values. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, Netherlands. May 9 1994. DBO/07494013.

McCollister, DD, P.T. Lockwood, and V.K. Rowe. 1961. Toxicologic Information on 2,4,5-Trichlorophenol. Toxicology and Applied Pharmacology. 3:63-70.

Nagy, K. A. 1987. Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds. Ecol. Monogr. 57:111-128.

Naval Facilities Engineering Command. (NFEC). 1996. Survey of Potential Habitat for Yellow-Shouldered Blackbird on U.S. Naval Station Roosevelt Road, Puerto Rico. Naval Facilities Engineering Command, Atlantic Division, Norfolk, VA.

Naval Facilities Engineering Command (NFEC). 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-209-ENV. April 2002.

Naval Energy and Environmental Support Activity (NEESA). 1984. Initial Assessment Study of Naval Station Roosevelt Roads, Puerto Rico. NEESA 13-051.

NTP. 1989. Toxicology and Carcinogenesis Studies of 2,4-Dichlorophenol in F344/N rats and B6C3F1 Mice (Feed Studies). Technical Report Series No. 353. Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institute of Health

Odell, D.K. 1992. West Indian Manatee. Pages 828 to 837 in Chapman, J.A. and Feldhamer, G.A. (eds.). Wild Mammals of North America: biology, management and economics. The Johns Hopkins University Press, Baltimore, MD.

OHM, 1995. Final Closeout Report for Interim Remedial Action of PCB Contaminated Soils, Sites 15 and 16 at Naval Station Roosevelt Roads, Puerto Rico. May, 1995.

Oliver, B.G. and A.J. Niimi. 1988. Trophodynamic Analysis of Polychlorinated Biphenyl Congeners and Other Chlorinated Hydrocarbons in the Lake Ontario Ecosystem. Environmental Science and Technology. 22:388-397.

Opresko, D.M., B.E. Sample, and G.W. Suter II. 1993. Toxicological Benchmarks for Wildlife. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-86.

Pascoe, G.A., R.J. Blanchet, and G. Linder. 1996. Food Chain Analysis of Exposures and Risks to Wildlife at a Metals-Contaminated Wetland. Archives of Environmental Contamination and Toxicology. 30: 306-318.

Patton, J.F. and M.P. Dieter. 1980. Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck. Comp. Biochem. Physiol. 65C:33-36.

Potter, T.L. and K.E. Simmons. 1998. Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 2: Composition of Petroleum Mixtures. Amherst Scientific Publishers, Amherst, MA. 102 pp.

Raffaele, H.A. 1989. A Guide to the Birds of Puerto Rico and the Virgin Islands. Princeton University Press, Princeton, N.J. 254 pp.

Rigdon, R.H. and J. Neal. 1963. Fluorescence of Chickens and Eggs Following the Feeding of Benzpyrene Crystals. Texas Reports on Biology and Medicine. 21(4):558-566.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, and T.L. Ashwood. 1998a. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-220.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter II. 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-219.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter, II and C.J.E. Welsh. 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National laboratory, Oak Ridge TN. ORNL/TM-13391.

Sample, B.E., D.M. Opresko and W. Suter. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory, Health Sciences Research Division, Oak Ridge, Tennessee.

Sample, B.E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-125.

Salyer, J.C. and K.F. Lagler (1946). The Eastern Belted Kingfisher, *Megaceryle alcyon alcyon* (Linnaeus), in Relation to Fish Management. Trans. Am. Fish. Soc. 76 :97-117.

Shifrin, N.S., B.D. Beck, T.D. Gauther, S.D. Chapnick, and G. Goodman. 1996. Chemistry, Toxicology, and Human Health Risk of Cyanide Compounds in Soils at Former Manufactured Gas Plant Sites. Regulatory Toxicology and Pharmacology. 23: 106 – 116.

Simmons, G.J. and M.J. McKee. 1992. Alkoxyresorufin Metabolism in White-Footed Mice at Relevant Environmental Concentrations of Aroclor 1254. Fundamental and Applied Toxicology. 19:446-452.

Souren, A.W.M.G. 2000. Living With Cyanide. The Geochemical News, Quarterly Newsletter of the Geochemical Society. Number 105. ISSN 0016-7010. October 2000.

Stickel, L.F. 1973. Pesticide Residues in Birds and Mammals. Pages 254-312 *In* C.A. Edwards (ed). Environmental Pollution by Pesticides. Plenum Press, New York.

Suter II, G.W., R.E. Efroymson, B.E. Sample, and D.S. Jones. 2000. Ecological Risk Assessment for Contaminated Sites. Lewis Publishers, Boca Raton, FL. 438 pp.

Suter II, G.W. 1996. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Freshwater Biota. Environ. Toxicol. and Chem. 15:1232-1241.

Suter II, G.W. 1995. Guide for Performing Screening Ecological Risk Assessments at DOE Facilities. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-153.

Suter, G.W. II. 1993. Ecological Risk Assessment. Lewis Publishers, Chelsea, MI. 538 pp.

Suter, G.W. II. 1990. Endpoints for Regional Ecological Risk Assessment. Environmental Management. 14:9-23.

Suter, G.W. II. 1989. Ecological Endpoints. Chapter 2 *In* Warren-Hicks, W., B.R. Parkhurst, and S.S. Baker, Jr. (eds), Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference. EPA/600/3-89/013.

Syracuse Research Corporation (SRC). 1998. Experimental Octanol/Water Partition Coefficient (Log P) Database. http://esc.syrres.com/~esc1/srckowdb.htm.

Terrestrial Toxicity Database (TERRETOX). 1998. Environmental Research Laboratory, U.S. Environmental Protection Agency, Duluth, MN.

Tomlinson, R.E., D.D. Dolton, R.R. George, and R.R. Mirarchi. 1994. Mourning Dove. In T.C. Tacha and C.E. Braun (eds), Migratory Shore and Upland Game Bird Management in North America. Int. Assoc. Fish and Wildlife Agencies, Washington, D.C. pp. 1-26.

Travis, C.C., R.K. White, and R.C. Wards. 1990. Interspecies Extrapolation of Pharmacokinetics. J. Theor. Biol. 142: 285-304.

Travis, C.C. and R.K. White. 1988. Interspecific Scaling of Toxicity Data. Risk Analysis. 8:119-125.

Travis, C.C. and A.D. Arms. 1988. Bioconcentration of Organics in Beef, Milk, and Vegetation. Environ. Science and Technology. 22:271-274.

U.S. Army Corps of Engineers (USACE). 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

United States Environmental Protection Agency (USEPA). 2004. Ecological Risk Assessment Frequently Asked Questions: Ecological Receptors. http://www.epa.gov/reg3hwmd/riskdraft/faws/ecorecept.html.

USEPA. 2003a. Guidance for Developing Ecological Soil Screening Levels. Office of Solid Waste and Emergency Response. Washington, D.C. OSWER Directive 9285.7-55.

USEPA. 2003b. ECOTOX Database System, Aquatic Toxicity Information Retrieval (AQUIRE) Database. Mid-Continent Ecology Division (MED), Duluth, MN. http://www.epa.gov/ecotox/.

USEPA. 2003c. USEPA Region V RCRA Corrective Action Ecological Screening Levels. August 22, 2003 Update. http://www.epa.gov/Region5/rcraca/edql.htm

USEPA. 2002a. National Recommended Water Quality Criteria: 2002. Office of Water. EPA 822-R-02-047

USEPA. 2002b. Ambient Aquatic Life Water Quality Criteria for Tributyltin (TBT) – Draft. Office of Water. EPA 822-B-02-001.

USEPA 2001a. Region 4 Ecological Risk Assessment Bulletins – Supplement to RAGS. Waste Management Division, Atlanta, GA. http://www.epa.gov/region4/waste/ots/ecolbul.htm.

USEPA. 2001b. Water Quality Criteria for the Protection of Human Health: Methylmercury. Office of Science and Technology, Office of Water, Washington, D.C. EPA-823-R-01-001.

USEPA. 2000a. Draft Ecological Soil Screening Level Guidance. Office of Emergency and Remedial Response, Washington, D.C. July 2000.

USEPA. 2000b. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs. Bioaccumulation Analysis Workgroup, Washington, D.C.(EPA-823-R-00-001).

USEPA. 1999a. Screening-Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/D-99/001A.

USEPA. 1999b. National Recommended Water Quality Criteria – Correction. 1999. Office of Water. EPA 822-Z-99-001.

USEPA. 1998. Guidelines for Ecological Risk Assessment. Risk Assessment Forum, Washington, DC. EPA/630/R-95/002B.

USEPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final). Office of Solid Waste and Emergency Response. EPA/540/R-97-006.

USEPA. 1996a. Superfund Chemical Data Matrix. EPA/540/R-96/028.

USEPA. 1996b. Ecotox thresholds. Eco Update, Volume 3, Number 2. Office of Solid Waste and Emergency Response, Washington, D.C. EPA 540/F-95/038.

USEPA. 1995a. Internal Report on Summary of Measured, Calculated and Recommended Log K_{ow} Values. Environmental Research Laboratory, Athens, GA. April 10, 1995.

USEPA. 1995b. Final Water Quality Guidance for the Great Lakes System. Fed. Reg. March 23, 1995 (Volume 60, Number 56).

USEPA. 1995c. Water Quality Guidance for the Great Lakes System: Supplementary Information Document (SID). EPA/820/B-95/001.

USEPA. 1993a. Technical Basis for Deriving Sediment Quality Criteria for Nonionic Organic Contaminants for the Protection of Benthic Organisms by Using Equilibrium Partitioning. Office of Water, Washington, D.C. EPA-822-R-93-011.

USEPA. 1993b. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

USEPA. 1992. Framework for Ecological Risk Assessment. USEPA, Risk Assessment Forum, Washington, DC. EPA/630/R92/001.

USEPA. 1991a. Criteria for Choosing Indicator Species for Ecological Risk Assessments at Superfund Sites. EPA/101/F-90/051.

USEPA. 1991b. Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft). Regulations and Standards, Criteria and Standards Division, Office of Water, Washington, D.C.

USEPA. 1990. Assessment of Risks from Exposure of Humans, Terrestrial and Avian Wildlife, and Aquatic Life to Dioxins and Furans from Disposal and Use of Sludge from Bleached Kraft and Sulfide Pulp and Paper Mills. EPA/560/5-90/013.

USEPA. 1986. Quality Criteria for Water. Office of Water Regulations and Standards. EPA-440/5-86-001.

USEPA. 1984. Health Assessment Document for Hexachlorocyclopentadiene. EPA/600/8-84/001F.

U.S. Fish and Wildlife Service (USFWS). 1996a. Recovery Plan for the Yellow-Shouldered Blackbird (*Agelaius xanthomus*). USFWS, Southeast Region, Atlanta, GA.

USFWS. 1996b. Species Account for the West Indian Manatee (*Trichechus manatus*). USFWS.

USFWS. 1987. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Puerto Rican Crested Toad. Federal Register, 52 (149): 28828-28831.

USFWS. 1986. Recovery Plan for the Puerto Rico Population of the West Indian (Antillean) Manatee (*Trichechus Manatus Manatus L.*).

USFWS. 1984. Recovery plan for the Golden Coqui (*Eleutherodactylus jasperi*). USFWS, Southeast Region, Atlanta, GA.

USFWS. 1983. Yellow-Shouldered Blackbird Recovery Plan. USFWS, Southeast Region, Atlanta, GA.

United States Geological Survey (USGS). 2000. Personal Correspondence with Cathy Beck, USGS. Biological Resources Division. Florida Caribbean Science Center, Sirenia Project, Gainesville, FL.

USGS. 1999. Status and Trends of the Nation's Biological Resources. http://biology.usgs.gov/s+t/SNT/index.htm van Gestel, C.A.M. and W. Ma. 1988. Toxicity and Bioaccumulation of Chlorophenols in Earthworms, in Relation to Bioavailability in Soil. Ecotoxicology and Environmental Safety. 15:289-297.

Van Straallen, N.M. and R.A. Verweij. 1991. Effects of benzo(a)pyrene on food assimilation and growth efficiency in *Porcellio scaber* (Isopoda). Bull. of Environ. Contam. and Toxicol. 46: 134-140.

Varanasi, U., J.E. Stein, and M. Nishimoto. 1989. Biotransformation and Disposition of Polycyclic Aromatic Hydrocarbons (PAH) in Fish. In U. Varanasi (ed), Metabolism of Polycyclic Aromatic Hydrocarbons in the Aquatic Environment. CRC Press, Inc., Boca Raton, FL. pp.93-149.

Wentsel, R.S., T.W. La Point, M. Simini, R.T. Checkai, D.T., Ludwig, and L.W. Brewer. 1996. Tri-Service Procedural Guidelines for Ecological Risk Assessments. U.S. Army Edgewood Research, Development and Engineering Center, Aberdeen Proving Ground, MD.

Wolf, M.A., V.K. Rowe, D.D. McCollister, R.L. Hollinsworth, and F. Oyen. 1956. Toxicological Studies of Certain Alkylated Benzenes and Benzene. Arch. Ind. Health. 14:387-398.

SECTION 4.0
TABLES

TABLE 4-1

**LIST OF BIRDS REPORTED FROM NAVAL STATION ROOSEVELT ROADS
SWMU 45 – AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO**

Common Name (1)		
Pied-billed grebe	Red-billed tropicbird	Brown pelican (2)
Brown booby	Magnificent frigatebird	Great blue heron
Louisiana heron	Snowy egret	Great egret
Striated heron	Little blue heron	Cattle egret
Least bittern	Yellow-crowned night heron	Black-crowned night heron
White-cheeked pintail	Blue-winged teal	American widgeon
Red-tailed hawk	Osprey	Merlin
Clapper rail	American coot	Caribbean coot
Common gallinule	Piping plover (3)	Semipalmated plover
Black-bellied plover	Wilson's plover	Killdeer
Ruddy turnstone	Black-necked stilt	Whimbrel
Spotted sandpiper	Semipalmated sandpiper	Short-billed dowitcher
Greater yellowlegs	Lesser yellowlegs	Willet
Stilt sandpiper	Pectoral sandpiper	Laughing gull
Royal tern	Sandwich tern	Bridled tern
Least tern	Brown noddy	White-winged dove
Zenaida dove	White-crowned pigeon	Mourning dove
Red-necked pigeon	Common ground dove	Bridled quail dove
Ruddy quail dove	Caribbean parakeet	Smooth-billed ani
Yellow-billed cuckoo	Mangrove cockoo	Short-eared owl
Chuck-will's-widow	Common nighthawk	Antillean crested hummingbird
Green-throated carib	Antillean mango	Belted kingfisher

TABLE 4-1

**LIST OF BIRDS REPORTED FROM NAVAL STATION ROOSEVELT ROADS
SWMU 1 (ARMY CREMATOR DISOSAL SITE) AND SWMU 2 (LANGLEY DRIVE DISPOSAL SITE)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE
ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO**

Common Name [(1)]		
Gray kingbird	Loggerhead kingbird	Stolid flycatcher
Caribbean elaenia	Purple martin	Cave swallow
Barn swallow	Northern mockingbird	Pearly-eyed thrasher
Red-legged thrush	Black-whiskered vireo	American redstart
Parula warbler	Prairie warbler	Yellow warbler
Magnolia warbler	Cape May warbler	Black-throated blue warbler
Adelaide's warbler	Palm warbler	Black and white warbler
Ovenbird	Northern water thrush	Bananaquit
Striped-headed tanager	Shiny cowbird	Black-cowled oriole
Greater Antillean grackle	Yellow-shouldered blackbird [(2)]	Hooded mannikin
Yellow-faced grassquit	Black-faced grassquit	Least sandpiper
Western sandpiper	Puerto Rican woodpecker	Rock dove
Puerto Rican emerald	Puerto Rican flycatcher	Pin-tailed whydah
Spice finch	Ruddy duck	Peregrine falcon
Marbled godwit	Puerto Rican lizard cuckoo	Prothonotary warbler
Green-winged teal	Orange-cheeked waxbill	Roseate tern [(3)(4)]
Least grebe	West Indian whistling duck	Puerto Rican screech owl
Puerto Rican tody		

Notes:

(1) List of birds taken from Geo-Marine, Inc. (1998).
(2) Federally-designated endangered species.
(3) Federally-designated threatened species.
(4) Species has the potential to occur at Naval Station Roosevelt Roads.

TABLE 4-2

SUMMARY OF ANALYTICAL DATA USED IN THE SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Investigation	Sample Media	Environment	Sample ID
Phase I RFI	Surface Soil	SWMU 45	45MW01-00
			45MW02-00
			45MW03-00
			45MW04-00
Phase II RFI	Sediment	SWMU 45 Open Water Marine	11SD01
			11SD02
			11SD03
			11SD04
			11SD05
			11SD06
			11SD07
			11SD08
			11SD09
Additional Data Collection Investigation	Sediment	SWMU 45 Open Water Marine	11OWSD10
			11OWSD11
			11OWSD12
			11OWSD13
			11OWSD14
			11OWSD15
			11OWSD16
			11OWSD17
			11OWSD18
			11OWSD20
			11OWSD21
			11OWSD22
			11OWSD23
			11OWSD24
	Surface Water	SWMU 45 Open Water Marine	11OWSW10
			11OWSW11
			11OWSW12
			11OWSW13
			11OWSW14
			11OWSW15
			11OWSW16
			11OWSW17
			11OWSW18

TABLE 4-3

PRELIMINARY ASSESSMENT ENDPOIINTS, RISK HYPOTHESES, AND MEASUREMENT ENDPOIINTS
SWMU 45 - AREA OUTSIDE BUILDNG 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint
Terrestrial Habitat: Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-retated chemical concentrations in surface soil sufficient to adversely effect terrestrial soil invertebrate communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with surface soil screening values.
Survival, growth, and reproduction of terrestrial plant communities	Are site-related surface soil concentrations sufficient to adversely effect terrestrial plant communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with surface soil screening values.
Survival, growth, and reproduction of terrestrial avian herbivores	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface soil.
Survival, growth, and reproduction of terrestrial avian omnivores	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume terrestrial plants and soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface soil.
Survival, growth, and reproduction of terrestrial avian carnivores.	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface soil.
Survival, growth, and reproduction of terrestrial reptiles.	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to terrestrial reptiles?	Qualitative examination of exposures and risks to ecological receptors occupying similar trophic levels.

TABLE 4-3

PRELIMINARY ASSESSMENT ENDPOIINTS, RISK HYPOTHESES, AND MEASUREMENT ENDPOIINTS
SWMU 45 - AREA OUTSIDE BUILDNG 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint
Terrestrial Habitat (continued): Survival, growth, and reproduction of terrestrial amphibians.	Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to terrestrial reptiles?	Qualitative examination of exposures and risks to ecological receptors occupying similar trophic levels.
Aquatic Habitat: Survival, growth, and reproduction of benthic invertebrate communities.	Are site-related chemical concentrations in surface water/sediment sufficient to adversely effect benthic invertebrate communities?	Comparison of maximum chemical concentrations in surface water and sediment with surface water and sediment screening values, respectively.
Survival, growth, and reproduction of aquatic plant communities.	Are site-related chemical concentrations in surface water sufficient to adversely effect aquatic plant communities?	Comparison of maximum chemical concentrations in surface water with surface water screening values.
Survival, growth, and reproduction of fish communities.	Are site-related chemical concentrations in surface water sufficient to adversely effect fish communities?	Comparison of maximum chemical concentrations in surface water with surface water screening values.
Survival, growth, and reproduction of avian fish and benthic invertebrate consumers.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume fish and benthic invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface water and sediment.
Survival, growth, and reproduction of avian piscivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume fish from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface water and sediment.

TABLE 4-3

PRELIMINARY ASSESSMENT ENDPOIINTS, RISK HYPOTHESES, AND MEASUREMENT ENDPOIINTS
SWMU 45 - AREA OUTSIDE BUILDNG 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint
Aquatic habitat (continued): Survival, growth, and reproduction of mammalian herbivores (Order Sirenia).	Are site-related chemical concentrations in sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian herbivores that may consume aquatic plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in sediment.

TABLE 4-4

LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} (1) (L/Kg)	Bioaccumulative Chemical (2)
Volatile Organics:					
1,1,1,2-Tetrachloroethane	2.63 to 3.03	2.63	USEPA 1995a	385	Yes
1,1,1-Trichloroethane	2.47 to 2.51	2.48	USEPA 1995a	274	No
1,1,2,2-Tetrachloroethane	2.31 to 2.64	2.39	USEPA 1995a	224	No
1,1,2-Trichloroethane	2.03 to 2.07	2.05	USEPA 1995a	104	No
1,1-Dichloroethane	1.78 to 1.85	1.79	USEPA 1995a	57.5	No
1,1-Dichloroethene	2.13 to 2.37	2.13	USEPA 1995a	124	No
1,2,3-Trichloropropane	1.98 to 2.63	2.25	USEPA 1995a	163	No
1,2-Dibromo-3-chloropropane	2.26 to 2.41	2.34	USEPA 1995a	200	No
1,2-Dibromoethane (EDB)	Not Reported	2.00	USEPA 1996a	92.5	No
1,2-Dichloroethane	1.4 to 1.48	1.47	USEPA 1995a	27.9	No
1,2-Dichloropropane	1.94 to 1.99	1.97	USEPA 1995a	86.5	No
2-Butanone (Methyl ethyl ketone)	0.28 to 0.69	0.28	USEPA 1995a	1.89	No
2-Hexanone	Not Reported	1.38	USEPA 1996a	22.7	No
3-Chloropropene (Allyl chloride)	Not Reported	1.93	SRC 1998	79.0	No
4-Methyl-2-pentanone (MIBK)	Not Reported	1.31	SRC 1998	19.4	No
Acetone	-0.21 to -0.24	-0.24	USEPA 1995a	0.58	No
Acetonitrile	-0.34 to -0.39	-0.34	USEPA 1995a	0.46	No
Acrolein (Propenal)	-0.01 to 0.90	-0.01	USEPA 1995a	0.98	No
Acrylonitrile	-0.92 to 1.20	0.25	USEPA 1995a	1.76	No
Benzene	1.83 to 2.50	2.13	USEPA 1995a	124	No
Bromodichloromethane	1.88 to 2.14	2.10	USEPA 1995a	116	No
Bromoform	2.30 to 2.38	2.35	USEPA 1995a	204	No
Bromomethane (Methyl bromide)	Not Reported	1.19	USEPA 1996a	14.8	No
Carbon disulfide	1.84 to 2.16	2.00	USEPA 1995a	92.5	No
Carbon tetrachloride	2.03 to 3.10	2.73	USEPA 1995a	483	Yes
Chlorobenzene	2.56 to 3.79	2.86	USEPA 1995a	648	Yes
Chloroethane	Not Reported	1.43	USEPA 1996a	25.5	No
Chloroform	1.81 to 3.04	1.92	USEPA 1995a	77.2	Yes
Chloromethane (Methyl chloride)	Not Reported	0.91	USEPA 1996a	7.85	No
Chloroprene	2.03 to 2.13	2.08	USEPA 1995a	111	No
cis-1,3-Dichloropropene	Not Reported	2.06	SRC 1998	106	No
Dibromochloromethane	2.13 to 2.24	2.17	USEPA 1995a	136	No
Dibromomethane (Methylene bromide)	Not Reported	1.53	USEPA 1996a	31.9	No
Dichlorodifluoromethane	2.0 to 2.37	2.16	USEPA 1995a	133	No
Ethylbenzene	3.07 to 3.57	3.14	USEPA 1995a	1,222	Yes
Ethyl methacrylate	1.59 to 1.65	1.59	USEPA 1996a	36.6	No
Iodomethane (Methyl iodide)	Not Reported	1.51	SRC 1998	30.5	No
Isobutanol (Isobutyl alcohol)	0.65 to 0.76	0.75	USEPA 1995a	5.46	No
Methacrylonitrile	0.54 to 0.70	-0.54	USEPA 1996a	0.29	No
Methylene chloride (Dichloromethane)	1.22 to 1.40	1.25	USEPA 1995a	16.9	No
Methyl methacrylate	1.11 to 1.38	1.38	USEPA 1995a	22.7	No
Pentachloroethane	Not Reported	3.06	USEPA 1996a	1,019	Yes
Propionitrile (ethyl cyanide)	Not Reported	0.16	SRC 1998	1.44	No
Styrene	2.76 to 3.16	2.94	USEPA 1995a	777	Yes
Tetrachloroethene	2.53 to 2.98	2.67	USEPA 1995a	422	No
Toluene	2.21 to 3.13	2.75	USEPA 1995a	505	Yes
trans-1,2-Dichloroethene	1.77 to 2.10	2.07	USEPA 1995a	108	No
trans-1,3-Dichloropropene	Not Reported	2.03	SRC 1998	99.0	No
trans-1,4-Dichloro-2-butene	Not Reported	2.60	SRC 1998	360	No

TABLE 4-4

LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} (1) (L/Kg)	Bioaccumulative Chemical (2)
Volatile Organics:					
Trichloroethene	2.42 to 3.14	2.71	USEPA 1995a	462	Yes
Trichlorofluoromethane	2.44 to 2.58	2.53	USEPA 1995a	307	No
Vinyl acetate	0.21 to 0.83	0.73	USEPA 1995a	5.22	No
Vinyl chloride	1.23 to 1.52	1.50	USEPA 1995a	29.8	No
Xylene (3)	2.77 to 3.54	3.13	USEPA 1995a	1,194	Yes
Xylenes (total)	3.11 to 3.68	3.11	USEPA 1995a	1399.2	Yes
Semi-Volatile Organics:					
1,2,4,5-Tetrachlorobenzene	4.51 to 4.83	4.64	USEPA 1995a	36,425	Yes
1,2,4-Trichlorobenzene	3.89 to 4.23	4.01	USEPA 1995a	8,752	Yes
1,3,5-Trinitrobenzene	1.18 to 1.37	1.18	USEPA 1995a	14.5	No
1,2-Dichlorobenzene (o-Dichlorobenzene)	3.20 to 3.61	3.43	USEPA 1995a	2,355	Yes
1,3-Dichlorobenzene (m-Dichlorobenzene)	Not Reported	3.60	USEPA 1996a	3,460	Yes
1,4,-Dichlorobenzene (p-Dichlorobenzene)	3.26 to 3.78	3.42	USEPA 1995a	2,302	Yes
1,4-Dioxane	Not Reported	-0.27	USEPA 1996a	0.54	No
1,4-Naphthoquinone	Not Reported	1.71	SRC 1998	48.0	No
1,4-Phenylenediamine (p-Phenylenediamine)	Not Reported	-0.30	SRC 1998	0.51	No
1-Naphthylamine	2.09 to 2.40	2.24	USEPA 1995a	159	No
2,3,4,6-Tetrachlorophenol	Not Reported	4.45	USEPA 1996a	23,694	Yes
2,4,5-Trichlorophenol	Not Reported	3.72	USEPA 1996a	4,540	Yes
2,4,6-Trichlorophenol	3.29 to 4.05	3.70	USEPA 1995a	4,339	Yes
2,2'-Oxybis(1-Chloropropane)	Not Reported	2.48	USEPA 1996a	274	No
2,4-Dichlorophenol	2.80 to 3.30	3.08	USEPA 1995a	1,066	Yes
2,4-Dinitrotoluene	1.98 to 2.05	2.01	USEPA 1995a	94.6	No
2,4-Dimethylphenol	1.99 to 2.49	2.36	USEPA 1995a	209	No
2,4-Dinitrophenol	1.40 to 1.79	1.55	USEPA 1995a	33.4	No
2,6-Dichlorophenol	Not Reported	2.75	SRC 1998	505	No
2,6-Dinitrotoluene	1.72 to 2.03	1.87	USEPA 1995a	68.9	No
2-Acetylaminofluorene	Not Reported	3.12	SRC 1998	1,167	Yes
2-Chloronaphthalene	Not Reported	3.38	USEPA 1996a	2,103	Yes
2-Chlorophenol	0.83 to 2.32	2.15	USEPA 1995a	130	No
2-Naphthylamine	2.09 to 2.42	2.28	USEPA 1995a	174	No
2-Nitroaniline (o-Nitroaniline)	Not Reported	1.85	USEPA 1996a	65.9	No
2-Nitrophenol (o-Nitrophenol)	Not Reported	1.79	USEPA 1996a	57.5	No
2-Picoline	Not Reported	1.11	SRC 1998	12.3	No
3,3'-Dichlorobenzidine	3.51 to 3.95	3.51	USEPA 1995a	2,822	Yes
3,3'-Dimethylbenzidine	2.34 to 3.01	2.68	USEPA 1995a	431	Yes
3-Methylcholanthrene	6.42 to 6.76	6.42	USEPA 1995a	2,047,104	Yes
3-Nitroaniline (m-nitroaniline)	Not Reported	1.37	USEPA 1996a	22.2	No
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	Not Reported	2.12	USEPA 1996a	121	No
4-Aminobiphenyl	Not Reported	2.86	SRC 1998	648	No
4-Bromophenylphenyl ether	4.89 to 5.24	5.00	USEPA 1995a	82,277	Yes
4-Chloro-3-methylphenol	Not Reported	3.10	SRC 1998	1,116	Yes
4-Chloroaniline	1.57 to 2.02	1.85	USEPA 1995a	65.9	No
4-Chlorophenylphenyl ether	4.08 to 5.09	4.95	USEPA 1995a	73,473	Yes
4-Nitroaniline (p-Nitroaniline)	Not Reported	1.39	USEPA 1996a	23.3	No
4-Nitrophenol (p-Nitrophenol)	Not Reported	1.91	SRC 1998	75.5	No

TABLE 4-4

LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} [(1)] (L/Kg)	Bioaccumulative Chemical [(2)]
Semi-Volatile Organics:					
4-Nitroquinoline-1-oxide	Not Reported	1.09	SRC 1998	11.8	No
5-Nitro-o-toluidine	Not Reported	1.87	SRC 1998	68.9	No
7,12-Dimethylbenz(a)anthracene	5.98 to 6.66	6.62	USEPA 1995a	3,219,141	Yes
Acetophenone	1.55 to 1.72	1.64	USEPA 1995a	41.0	No
A, A-Dimethylphenethylamine	Not Reported	1.90	USEPA 1996a	73.8	No
Aniline	0.78 to 1.24	0.98	USEPA 1995a	9.20	No
Aramite	Not Reported	4.82	SRC 1998	54,744	Yes
Benzyl alcohol	0.87 to 1.22	1.11	USEPA 1995a	12.3	No
bis(2-Chloroethoxy)methane	Not Reported	0.75	USEPA 1996a	5.46	No
bis(2-Chloroethyl)ether	1.0 to 1.29	1.21	USEPA 1995a	15.5	No
bis(2-Ethylhexyl)phthalate	4.20 to 8.61	7.30	USEPA 1995a	15,003,065	Yes
Butylbenzylphthalate	3.57 to 5.02	4.84	USEPA 1995a	57,280	Yes
Diallate	3.79 to 5.23	4.49	USEPA 1995a	25,939	Yes
Dibenzofuran	Not Reported	4.20	USEPA 1996a	13,455	Yes
Diethylphthalate	1.40 to 3.00	2.50	USEPA 1995a	287	Yes
Dimethylphthalate	1.34 to 1.90	1.57	USEPA 1995a	35.0	No
Di-n-butylphthalate	3.74 to 4.79	4.61	USEPA 1995a	34,034	Yes
Di-n-octylphthalate	8.03 to 9.49	8.06	USEPA 1995a	83,803,084	Yes
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	Not Reported	3.69	USEPA 1996a	4,242	Yes
Ethyl methanesulfonate	0.01 to 0.05	0.05	USEPA 1995a	1.12	No
Hexachlorobenzene	5.00 to 7.42	5.89	USEPA 1995a	616,808	Yes
Hexachlorobutadiene	4.74 to 5.16	4.81	USEPA 1995a	53,519	Yes
Hexachlorocyclopentadiene	5.04 to 5.51	5.39	USEPA 1995a	198,907	Yes
Hexachloroethane	3.82 to 4.14	4.00	USEPA 1995a	8,556	Yes
Hexachlorophene	7.08 to 7.60	7.54	USEPA 1995a	25,828,548	Yes
Hexachloropropene	Not Reported	4.38	SRC 1998	20,222	Yes
Isophorone	1.67 to 1.90	1.70	USEPA 1995a	46.9	No
Isosafrole	Not Reported	3.37	SRC 1998	2,056	Yes
m-Cresol (3-Methylphenol)	1.92 to 2.05	1.97	USEPA 1995a	86.5	No
m-Dinitrobenzene (1,3-Dinitrobenzene)	1.49 to 1.63	1.50	USEPA 1995a	29.8	No
Methapyrilene	Not Reported	2.87	SRC 1998	663	No
Methyl methanesulfonate	Not Reported	-0.66	SRC 1998	0.22	No
n-Nitrosodiethylamine	0.29 to 0.56	0.48	USEPA 1995a	2.97	No
n-Nitrosodimethylamine	-0.77 to -0.48	-0.57	USEPA 1995a	0.28	No
n-Nitroso-di-n-butylamine	2.41 to 2.45	2.41	USEPA 1995a	234	No
n-Nitroso-di-n-propylamine	1.31 to 1.45	1.40	USEPA 1995a	23.8	No
n-Nitrosodiphenylamine	3.13 to 3.45	3.16	USEPA 1995a	1,278	Yes
n-Nitrosomethylethylamine	-0.24 to 1.35	-0.12	USEPA 1995a	0.76	No
n-Nitrosomorpholine	Not Reported	-0.44	SRC 1998	0.37	No
n-Nitrosopiperidine	0.25 to 0.63	0.63	USEPA 1995a	4.16	No
n-Nitrosopyrrolidine	-0.29 to -0.19	-0.19	USEPA 1995a	0.65	No
Nitrobenzene	Not Reported	1.84	USEPA 1996a	64.4	No
o-Cresol (2-Methylphenol)	1.90 to 2.04	1.99	USEPA 1995a	90.5	No
o-Toluidine	1.34 to 1.63	1.34	USEPA 1995a	20.8	No
p-Cresol (4-Methylphenol)	1.38 to 2.04	1.95	USEPA 1995a	82.6	No
p-Dimethylaminoazobenzene	Not Reported	4.58	SRC 1998	31,799	Yes
Pentachlorobenzene	4.88 to 6.12	5.26	USEPA 1995a	148,204	Yes
Pentachloronitrobenzene	4.18 to 4.64	4.64	USEPA 1995a	36,425	Yes

TABLE 4-4

LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} (1) (L/Kg)	Bioaccumulative Chemical (2)
Semi-Volatile Organics:					
Pentachlorophenol	3.29 to 5.24	5.09	USEPA 1995a	100,867	Yes
Phenacetin	Not Reported	1.58	SRC 1998	35.8	No
Phenol	0.79 to 1.55	1.48	USEPA 1995a	28.5	No
Pronamide	3.26 to 3.86	3.51	USEPA 1995a	2,822	Yes
Pryridine	0.62 to 1.28	0.67	USEPA 1995a	4.56	No
Safrole	2.66 to 2.88	2.66	USEPA 1995a	412	No
PAHs:					
1-Methylnaphthalene	Not Reported	3.87	SRC 1998	6,375	Yes
2-Methylnaphthalene	Not Reported	3.90	USEPA 1996a	6,823	Yes
Acenaphthene	3.77 to 4.49	3.92	USEPA 1995a	7,139	Yes
Acenaphthylene	Not Reported	4.10	USEPA 1996a	10,730	Yes
Anthracene	3.45 to 4.80	4.55	USEPA 1995a	29,712	Yes
Benzo(a)anthracene	4.00 to 5.79	5.70	USEPA 1995a	401,218	Yes
Benzo(a)pyrene	5.98 to 6.42	6.11	USEPA 1995a	1,014,869	Yes
Benzo(b)fluoranthene	5.79 to 6.40	6.20	USEPA 1995a	1,244,171	Yes
Benzo(g,h,i)perylene	6.63 to 7.05	6.70	USEPA 1995a	3,858,158	Yes
Benzo(k)fluoranthene	6.12 to 6.27	6.20	USEPA 1995a	1,244,171	Yes
Chrysene	5.41 to 5.79	5.70	USEPA 1995a	401,218	Yes
Dibenzo(a,h)anthracene	6.50 to 6.88	6.69	USEPA 1995a	3,771,812	Yes
Fluoranthene	4.31 to 5.39	5.12	USEPA 1995a	107,954	Yes
Fluorene	4.04 to 4.40	4.21	USEPA 1995a	13,763	Yes
Indeno(1,2,3-cd)pyrene	6.58 to 6.72	6.65	USEPA 1995a	3,445,323	Yes
Naphthalene	3.01 to 4.70	3.36	USEPA 1995a	2,010	Yes
Phenanthrene	4.28 to 4.57	4.55	USEPA 1995a	29,712	Yes
Pyrene	4.76 to 5.52	5.11	USEPA 1995a	105,538	Yes
PCBs:					
Aroclor-1016	Not Reported	5.62	SRC 1998	334,765	Yes
Aroclor-1221	Not Reported	4.53	SRC 1998	28,397	Yes
Aroclor-1232	Not Reported	4.53	SRC 1998	28,397	Yes
Aroclor-1242	Not Reported	6.29	SRC 1998	1,525,281	Yes
Aroclor-1248	Not Reported	6.34	SRC 1998	1,708,048	Yes
Aroclor-1254	Not Reported	6.79	SRC 1998	4,729,879	Yes
Aroclor-1260	Not Reported	8.27	SRC 1998	134,800,033	Yes

Notes:

K_{ow} = Ocatnol-Water Partitian Coefficient
K_{oc} = Organic Carbon Partition Coefficient
SRC = Syracuse Research Corporation
USEPA = United States Environmental Protection Agency

(1) K_{oc} values were estimated from the following equation: Log K_{oc} = 0.00028 + (0.983)(Log K_{ow}) (USEPA 1993a and 1996a).

(2) An organic chemical is considered a bioaccumulative chemical if its Log K_{ow} value is greater than or equal to 3.0. When a range of Log K_{ow} values is reported, the upper value within the range was conservatively used to identify bioaccumulative chemicals.

(3) The K_{ow} values shown are for o-xylene

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
Volatile Organics (ug/kg):			
1,1,1,2-Tetrachloroethane	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,1,1-Trichloroethane	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,1,2,2-Tetrachloroethane	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,1,2-Trichloroethane	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,1-Dichloroethane	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,1-Dichloroethene	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,2,3-Trichloropropane	NA	---	---
1,2-Dibromo-3-chloropropane	NA	---	---
1,2-Dibromoethane (EDB)	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,2-Dichloroethane	401 (1)	MHSPE 1994	---
1,2-Dichloropropane	700,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
2-Butanone (Methyl ethyl ketone)	NA	---	---
2-Hexanone	NA	---	---
3-Chloropropene (Allyl chloride)	NA	---	---
4-Methyl-2-pentanone (MIBK)	NA	---	---
Acetone	NA	---	---
Acetonitrile	NA	---	---
Acrolein (Propenal)	NA	---	---
Acrylonitrile	1,000,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Benzene	105 (2)	MHSPE 1994	---
Bromodichloromethane	NA	---	---
Bromoform	NA	---	---
Bromomethane (Methyl bromide)	NA	---	---
Carbon disulfide	NA	---	---
Carbon tetrachloride	1,000,000	Efroymson et al. 1997a	Toxicological threshold for microbial processes
Chlorobenzene	40,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Chloroethane	NA	---	---
Chloroform	1,000 (2)	MHSPE 1994	---
Chloromethane (Methyl chloride)	NA	---	---
Chloroprene	NA	---	---

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
Volatile Organics (ug/kg):			
cis-1,3-Dichloropropene	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
Dibromochloromethane	NA	---	---
Dibromomethane (Methylene bromide)	NA	---	---
Dichlorodifluoromethane	NA	---	---
Ethylbenzene	5,005 (2)	MHSPE 1994	---
Ethyl methacrylate	NA	---	---
Iodomethane (Methyl iodide)	NA	---	---
Isobutanol (Isobutyl alcohol)	NA	---	---
Methacrylonitrile	NA	---	---
Methylene chloride (Dichloromethane)	1,001 (2)	MHSPE 1994	---
Methyl methacrylate	NA	---	---
Pentachloroethane	NA	---	---
Propionitrile	NA	---	---
Styrene	10,010 (2)	MHSPE 1994	---
Tetrachloroethene	401 (2)	MHSPE 1994	---
Toluene	13,005 (2)	MHSPE 1994	---
1,2-Dichloroethene (total)	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
trans-1,2-Dichloroethene	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
trans-1,3-Dichloropropene	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
trans-1,4-Dichloro-2-butene	1,000,000	Efroymson et al. 1997a	Toxicological threshold for microbial processess
Trichloroethene	6,000 (2)	MHSPE 1994	---
Trichlorofluoromethane	NA	---	---
Vinyl acetate	NA	---	---
Vinyl chloride	11 (1)	MHSPE 1994	---
Xylene	2,505 (2)	MHSPE 1994	---
Semi-Volatile Organics (ug/kg):			
1,2,4,5-Tetrachlorobenzene	50.0	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,2,4-Trichlorobenzene	20,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
1,3,5-Trinitrobenzene	50.0	CCME 2002	Canadian soil quality guideline based on agricultural land uses
1,2-Dichlorobenzene (o-Dichlorobenzene)	3,001 (1)	MHSPE 1994	Value for total chlorobenzenes (3)

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
Semi-Volatile Organics (ug/kg):			
1,3-Dichlorobenzene (m-Dichlorobenzene)	3,001 (1)	MHSPE 1994	Value for total chlorobenzenes (3)
1,4-Dichlorobenzene (p-Dichlorobenzene)	20,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
1,4-Dioxane	NA	---	---
1,4-Naphthoquinone	NA	---	---
1,4-Phenylenediamine (p-phenylenediamine)	NA	---	---
1-Naphthylamine	NA	---	---
2,3,4,6-Tetrachlorophenol	1,001 (1)	MHSPE 1994	Value for total chlorophenols (4)
2,4,5-Trichlorophenol	4,000	Efroymson et al. 1997b	Toxicological threshold for plants
2,4,6-Trichlorophenol	10,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
2,2'-Oxybis(1-chloropropane)	NA	---	---
2,4-Dichlorophenol	1,001 (1)	MHSPE 1994	Value for total chlorophenols (4)
2,4-Dimethylphenol	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
2,4-Dinitrophenol	20,000	Efroymson et al. 1997b	Toxicological threshold for plants
2,4-Dinitrotoluene	NA	---	---
2,6-Dichlorophenol	1,001 (1)	MHSPE 1994	Value for total chlorophenols (4)
2,6-Dinitrotoluene	NA	---	---
2-Acetylaminofluorene	NA	---	---
2-Chloronaphthalene	NA	---	---
2-Chlorophenol	1,001 (1)	MHSPE 1994	Value for total chlorophenols (4)
2-Naphthylamine	NA	---	---
2-Nitroaniline (o-Nitroaniline)	NA	---	---
2-Nitrophenol (o-Nitrophenol)	7,000	---	Value for 4-nitrophenol used as a surrogate
2-Picoline	NA	---	---
3,3'-Dichlorobenzidine	NA	---	---
3,3'-Dimethylbenzidine	NA	---	---
3-Methylcholanthrene	NA	---	---
3-Nitroaniline (m-Nitroaniline)	NA	---	---
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	NA	---	---
4-Aminobiphenyl	NA	---	---
4-Bromophenylphenyl ether	NA	---	---

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
Semi-Volatile Organics (ug/kg):			
4-Chloro-3-methylphenol	NA	---	---
4-Chloroaniline	NA	---	---
4-Chlorophenylphenyl ether	NA	---	---
4-Nitroaniline (p-Nitroaniline)	NA	---	---
4-Nitrophenol (p-nitrophenol)	7,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
4-Nitroquinoline-1-oxide	NA	---	---
5-Nitro-o-toluidine	NA	---	---
7,12-Dimethylbenz(a)anthracene	NA	---	---
Acetophenone	NA	---	---
A,A-Dimethylphenethylamine	NA	---	---
Aniline	NA	---	---
Aramite	NA	---	---
Benzyl alcohol	NA	---	---
bis(2-Chloroethoxy)methane	NA	---	---
bis(2-Chloroethyl)ether	NA	---	---
bis(2-Ethylhexyl)phthalate	6,010 (2)	MHSPE 1994	Value for total phthalates (5)
Butylbenzylphthalate	6,010 (2)	MHSPE 1994	Value for total phthalates (5)
Diallate	NA	---	---
Dibenzofuran	NA	---	---
Diethylphthalate	100,000	Efroymson et al. 1997b	Toxicological threshold for plants
Dimethylphthalate	200,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Di-n-butylphthalate	200,000	Efroymson et al 1997b	Toxicological threshold for plants
Di-n-octylphthalate	6,010 (2)	MHSPE 1994	Value for total phthalates (5)
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	NA	---	---
Ethyl methanesulfonate	NA	---	---
Hexachlorobenzene	1,000,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Hexachlorobutadiene	NA	---	---
Hexachlorocyclopentadiene	10,000	Efroymson et al. 1997b	Toxicological threshold for plants
Hexachloroethane	NA	---	---
Hexachlorophene	NA	---	---

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
Semi-Volatile Organics (ug/kg):			
Hexachloropropene	NA	---	---
Isophorone	NA	---	---
Isosafrole	NA	---	---
m-Dinitrobenzene (1,3-Dinitrobenzene)	NA	---	---
m,p-Cresol (3,4-Methylphenol)	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
N-Nitrosodiethylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitrosodimethylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitroso-di-n-butylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitroso-di-n-propylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitrosodiphenylamine	20,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
N-Nitrosomethylethylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---
Nitrobenzene	NA	---	---
o-Cresol (2-Methylpheneol)	100	CCME 2002	Canadian soil quality guideline based on agricultural land uses
o-Toluidine	NA	---	---
p-(Dimethylamino)azobenzene	NA	---	---
Pentachlorobenzene	1,150	USEPA 1999a	Toxicological threshold for earthworms
Pentachloronitrobenzene	NA	---	---
Pentachlorophenol	1,730	USEPA 1999a	Toxicological threshold for plants
Phenacetin	NA	---	---
Phenol	30,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Pronamide	NA	---	---
Pryridine	NA	---	---
Safrole	NA	---	---
PAHs (ug/kg):			
1-Methylnaphthalene	1,200	---	Value for benzo(a)pyrene used as a surrogate

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
PAHs (ug/kg):			
2-Methylnaphthalene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Acenaphthene	20,000	Efroymson et al. 1997b	Toxicological Threshold for plants
Acenaphthylene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Anthracene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Benzo(a)anthracene	1,200	USEPA 1999a	Value for benzo(a)pyrene used as a surrogate
Benzo(a)pyrene	1,200	USEPA 1999a	Toxicological threshold for plants
Benzo(b)fluoranthene	1,200	USEPA 1999a	Toxicological threshold for plants
Benzo(g,h,i)perylene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Benzo(k)fluoranthene	1,200	USEPA 1999a	Value for benzo(a)pyrene used as a surrogate
Chrysene	1,200	USEPA 1999a	Value for benzo(a)pyrene used as a surrogate
Dibenzo(a,h)anthracene	1,200	USEPA 1999a	Value for benzo(a)pyrene used as a surrogate
Fluoranthene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Fluorene	30,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Indeno(1,2,3-cd)pyrene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Naphthalene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Phenanthrene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Pyrene	1,200	---	Value for benzo(a)pyrene used as a surrogate
PCBs (ug/kg):			
Aroclor-1016	2,510	USEPA 1999a	Toxicological threshold for earthworms
Aroclor-1221	2,510	---	Value for Aroclor-1016 and Aroclor-1254 used as a surrogate
Aroclor-1232	2,510	---	Value for Aroclor-1016 and Aroclor-1254 used as a surrogate
Aroclor-1242	2,510	---	Value for Aroclor-1016 and Aroclor-1254 used as a surrogate
Aroclor-1248	2,510	---	Value for Aroclor-1016 and Aroclor-1254 used as a surrogate
Aroclor-1254	2,510	USEPA 1999a	Toxicological threshold for earthworms
Aroclor-1260	2,510	---	Value for Aroclor-1016 and Aroclor-1254 used as a surrogate
Inorganics (mg/kg):			
Antimony	5.00	Efroymson et al. 1997b	Toxicological threshold for plants
Arsenic	10.0	Efroymson et al. 1997b	Toxicological threshold for plants
Barium	500	Efroymson et al. 1997b	Toxicological threshold for plants
Beryllium	10.0	Efroymson et al. 1997b	Toxicological threshold for plants

TABLE 4-5

SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Soil Screening Value	Reference	Comment
Inorganics (mg/kg):			
Cadmium	4.00	Efroymson et al. 1997b	Toxicological threshold for plants
Chromium (total)	0.40	Efroymson et al. 1997a	Toxicological threshold for earthworms
Cyanide	0.90	CCME 2002	Canadian soil quality guideline based on agricultural land uses
Cobalt	20.0	Efroymson et al. 1997b	Toxicological threshold for plants
Copper	50.0	Efroymson et al. 1997a	Toxicological threshold for earthworms
Lead	50.0	Efroymson et al. 1997b	Toxicological threshold for plants
Mercury	0.10	Efroymson et al. 1997a	Toxicological threshold for earthworms
Nickel	30.0	Efroymson et al. 1997b	Toxicological threshold for plants
Selenium	1.00	Efroymson et al. 1997b	Toxicological threshold for plants
Silver	2.00	Efroymson et al. 1997b	Toxicological threshold for plants
Thallium	1.00	Efroymson et al. 1997b	Toxicological threshold for plants
Tin	50.0	Efroymson et al. 1997b	Toxicological threshold for plants
Vanadium	2.00	Efroymson et al. 1997b	Toxicological threshold for plants
Zinc	50.0	Efroymson et al. 1997b	Toxicological threshold for plants

Notes:

NA = Not Available
MHSPE = Ministry of Housing, Spatial Planning and Environment
CCME = Canadian Council of Ministers of the Environment

(1) The screening value shown is an average of the detection limit and the intervention soil standards. The value is based on a default organic carbon content of 0.02 (2.0 percent), which represents a minimum value (adjustment range is 2 to 30 percent).

(2) The screening value shown is an average of the target and intervention soil standards. The value is based on a default organic carbon content of 0.02 (2.0 percent), which represents a minimum value (adjustment range is 2 to 30 percent).

(3) The value represents a total concentration for chlorobenzenes (mono, di, tri, tetra, penta, and hexachlorobenzene).

(4) The value represents a total concentration for all chlorophenols (mono, di, tri, tetra, and pentachlorophenol)

(5) The value represents a total concentration for all phthalates.

TABLE 4-6

SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value (1)	Reference	Comment
Volatile Organics (ug/L):			
1,1,1,2-Tetrachloroethane	902	Buchman 1999	Acute LOEL with a safety factor of 10
1,1,1-Trichloroethane	312	USEPA 2001a	EPA Region 4 chronic screening value
1,1,2,2-Tetrachloroethane	90.2	USEPA 2001a	EPA Region 4 chronic screening value
1,1,2-Trichloroethane	340	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Pleuronectes platessa* [sand dab]) with a safety factor of 100
1,1-Dichloroethane	47.0 (2)	USEPA 1996b	Tier II Value
1,1-Dichloroethene	2,240	USEPA 2001a	EPA Region 4 chronic screening value
1,2,3-Trichloropropane	274 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
1,2-Dibromo-3-chloropropane	100	USEPA 2003b	Minimum acute value (48-hr EC_{50} for *Mercenaria mercenaria* [hard clam]) with a safety factor of 100
1,2-Dibromoethane (EDB)	48.0	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 100
1,2-Dichloroethane	1,130	USEPA 2001a	EPA Region 4 chronic screening value
1,2-Dichloropropane	2,400	USEPA 2001a	EPA Region 4 chronic screening value
2-Butanone (Methyl ethyl ketone)	40,000	USEPA 2003b	Minimum acute value (96-hour NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 10
2-Hexanone	98.8 (2)	Suter II 1996	Tier II secondary chronic value
3-Chloropropene (Allyl chloride)	3.40 (2)	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Xenopus laevis* [clawed toad]) with a safety factor of 100
4-Methyl-2-pentanone (MIBK)	164	Suter II 1996	Tier II Secondary Chronic Value
Acetone	1,000	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Lumbriculus variegatus* [Oligochaete]) with a safety factor of 100
Acetonitrile	160,000 (2)	USEPA 2003b	Minimum chronic value (21-day NOEC for *daphnia magna* based on reproduction)
Acrolein (Propenal)	0.55	USEPA 2001a	EPA Region 4 chronic screening value
Acrylonitrile	58.1	USEPA 2003b	Minimum acute value (96-hr $LC_{50\ for}$ *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Benzene	109	USEPA 2001a	EPA Region 4 chronic screening value
Bromodichloromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Bromoform	640	USEPA 2001a	EPA Region 4 chronic screening value
Bromomethane (Methyl bromide)	120	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
Carbon disulfide	650 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Alburnus alburnus* [bleak]) with a safety factor of 100
Carbon tetrachloride	1,500	USEPA 2001a	EPA Region 4 chronic screening value
Chlorobenzene	105	USEPA 2001a	EPA Region 4 chronic screening value
Chloroethane	NA	---	---
Chloroform	815	USEPA 2001a	EPA Region 4 chronic screening value
Chloromethane (Methyl chloride)	2,700	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
Chloroprene	NA	---	---
cis-1,3-Dichloropropene	7.90	USEPA 2001a	EPA Region 4 chronic screening value (cis and trans)
Dibromochloromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Dibromomethane (Methyl bromide)	6,400	Buchman 1999	Chronic LOEL for chemical class
Dichlorodifluoromethane	6,400	Buchman 1999	Chronic LOEL for chemical class

TABLE 4-6

SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value (1)	Reference	Comment
Volatile Organics (ug/L):			
Ethylbenzene	4.30	USEPA 2001a	EPA Region 4 chronic screening value
Ethyl methacrylate	NA	---	---
Iodomethane (Methyl iodide)	NA	---	---
Isobutanol (Isobutyl alcohol)	10,000	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Alburnus alburnus* [bleak]) with a safety factor of 100
Methacrylonitrile	NA	---	---
Methylene chloride (Dichloromethane)	2,560	USEPA 2001a	EPA Region 4 chronic screening value
Methyl methacrylate	1,300 (2)	USEPA 2003b	Minumum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
Pentachloroethane	281	Buchman 1999	Chronic LOEL
Propionitrile	15,200 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
Styrene	510	USEPA 2003b	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 10
Tetrachloroethene	45.0	USEPA 2001a	EPA Region 4 chronic screening value
Toluene	37.0	USEPA 2001a	EPA Region 4 chronic screening value
trans-1,2-dichloroethene	22,400	Buchman 1999	Acute LOEL (summation of all isomers) with a safety factor of 10
trans-1,3-Dichloropropene	7.90	USEPA 2001a	EPA Region 4 chronic screening value (cis and trans)
trans-1,4-Dichloro-2-butene	NA	---	---
Trichloroethene	200	Buchman 1999	Acute LOEL with a safety factor of 10
Trichlorofluoromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Vinyl acetate	100	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Crangon crangon* [sand shrimp]) with a safety factor of 100
Vinyl chloride	87.8 (2)	Suter II 1996	Tier II secondary chronic value
Xylene	41.0 (3)	USEPA 2003b	Minimum acute value (96-hr EC_{50} for *Strongylocentrotus droebachiensis* [green sea urchin]) with a safety factor of 100
Semi-Volatile Organics (ug/L):			
1,2,4,5-Tetrachlorobenzene	30.0	USEPA 2003b	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 10
1,2,4-Trichlorobenzene	4.50	USEPA 2001a	EPA Region 4 chronic screening value
1,3,5-Trinitrobenzene	80.0 (2)	USEPA 2003b	Minimum chronic value (71-day NOEC for *Oncorhynchus mykiss* [rainbow trout] based on reproduction)
1,2-Dichlorobenzene (o-Dichlorobenzene)	19.7	USEPA 2001a	EPA Region 4 chronic screening value
1,3-Dichlorobenzene (m-Dichlorobenzene)	28.5	USEPA 2001a	EPA Region 4 chronic screening value
1,4-Dichlorobenzene (p-Dichlorobenzene)	19.9	USEPA 2001a	EPA Region 4 chronic screening value
1,4-Dioxane	67,000	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
1,4-Naphthoquinone	NA	---	---
1,4-Phenylenediamine (p-phenylenediamine)	200 (2)	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Oryzias latipes* [medaka]) with a safety factor of 100
1-Naphthylamine	NA	---	---
2,3,4,6-Tetrachlorophenol	44.0	Buchman 1999	Acute LOEL with a safety factor of 10
2,4,5-Trichlorophenol	11.0	Buchman 1999	Proposed CCC
2,4,6-Trichlorophenol	12.1	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Palaemonetes pugio* [daggerblade grass shrimp]) with a safety factor of 100
2,2'-Oxybis(1-chloropropane)	NA	---	---

TABLE 4-6

SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value (1)	Reference	Comment
Semi-Volatile Organics (ug/L):			
2,4-Dichlorophenol	5.00	USEPA 2003b	Minimum acute value (96-hr NOEC for *Allorchestes compressa* [scud]) with a safety factor of 10
2,4-Dimethylphenol	131	USEPA 2003b	Minimum chronic value (28-day NOEC for *Menidia beryllina* [inland silverside] based on survival)
2,4-Dinitrophenol	48.5	USEPA 2001a	EPA Region 4 chronic screening value
2,4-Dinitrotoluene	20.0 (2)	USEPA 2003b	Miimum chronic value (21-day NOEC for *Daphnia magna* based on reproduction)
2,6-Dichlorophenol	54.0	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Platichthys flesus* [european flounder]) with a safety factor of 100
2,6-Dinitrotoluene	60.0 (2)	USEPA 2003b	Minimum chronic value (21-day NOEC for *Daphnia magna* based on reproduction)
2-Acetylaminofluorene	100 (2)	USEPA 2003b	Minimum acute value (96-hr LOEC for *Xenopus laevis* [clawed toad]) with a safety factor of 10
2-Chloronaphthalene	0.75	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
2-Chlorophenol	53.0	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Crangon septemspinosa* [bay shrimp]) with a safety factor of 100
2-Naphthylamine	NA	---	---
2-Nitroaniline (o-Nitroaniline)	48.9 (2)	USEPA 2003b	Minumum acute value (48-hr EC_{50} for *daphnia magna*) with a safety factor of 100
2-Nitrophenol (o-Nitrophenol)	10,000	USEPA 2003b	Minimum chronic value (28-day MATC for *Cyprinodon variegatus* [sheepshead minnow] based on egg hatchability)
2-Picoline	8,979 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
3,3'-Dichlorobenzidine	10.5 (2)	USEPA 2003b	Minimum acute value (48-hr EC_{50} for *Daphnia magna*) with a safety factor of 100
3,3'-Dimethylbenzidine	160 (2)	USEPA 2003b	Minimum chronic value (21-day NOEC for *Daphnia magna* based on behavior [equilibrium])
3-Methylcholanthrene	NA	---	---
3-Nitroaniline (m-Nitroaniline)	9.80 (2)	USEPA 2003b	Minimum acute value (48-hr EC_{50} for *Daphnia magna*) with a safety factor of 100
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	10.0 (2)	USEPA 2003b	Minimum chronic value (21-day NOEC for *Daphnia magna* based on reproduction)
4-Aminobiphenyl	NA	---	---
4-Bromophenylphenyl ether	3.60 (2)	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Daphnia magna*) with a safety factor of 100
4-Chloro-3-methylphenol	1,300 (2)	USEPA 2003b	Minimum chronic value (21-day NOEC for *Daphnia magna* based on for reproduction)
4-Chloroaniline	129	Buchman 1999	Chronic LOEL for chemical class
4-Chlorophenylphenyl ether	7.30 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Salvelinus fontinalis* [brook trout]) with a safety factor of 100
4-Nitroaniline (p-Nitroaniline)	170 (2)	USEPA 2003b	Minimum acute value (48-hr EC_{50} for *Daphnia magna*) with a safety factor of 100)
4-Nitrophenol (p-nitrophenol)	71.7	USEPA 2001a	EPA Region 4 chronic screening value
4-Nitroquinoline-1-oxide	NA	---	---
5-Nitro-o-toluidine	190 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
7,12-Dimethylbenz(a)anthracene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Acetophenone	1,550 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
A,A-Dimethylphenethylamine	NA	---	---
Aniline	294	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Crangon septemspinosa* [sand shrimp]) with a safety factor of 100
Aramite	0.60 (2)	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Gammarus fasciatus* [scud]) with a safety factor of 100

TABLE 4-6

SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment
Semi-Volatile Organics (ug/L):			
Benzyl alcohol	150	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
bis(2-Chloroethoxy)methane	6,400	Buchman 1999	Chronic LOEL for the chemical class
bis(2-Chloroethyl)ether	910 [2]	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Oncorhynchus mykiss* [rainbow trout]) with a safety factor of 100
bis(2-Ethylhexyl)phthalate	360	Buchman 1999	Proposed CCC
Butylbenzylphthalate	29.4	USEPA 2001a	EPA Region 4 chronic screening value
Diallate	82.0 [2]	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Rasbora heteromorpha* [harlequinfish]) with a safety factor of 100
Dibenzofuran	100	USEPA 2003b	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 10
Diethylphthalate	75.9	USEPA 2001a	EPA Region 4 chronic screening value
Dimethylphthalate	580	USEPA 2001a	EPA Region 4 chronic screening value
Di-n-butylphthalate	3.40	USEPA 2001a	EPA Region 4 chronic screening value
Di-n-octylphthalate	3,450	USEPA 2003b	Minimum acute value (96-hr NOEC for *Americamysis bahia* [opossum shrimp]) with a safety factor of 10
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	1.70	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Ethyl methanesulfonate	NA	---	---
Hexachlorobenzene	10.0	USEPA 2003b	Minimum acute value (48-hr EC_{50} for *Crassostrea virginica* [Virginia oyster]) with a safety factor of 100
Hexachlorobutadiene	0.32	USEPA 2001a	EPA Region 4 chronic screening value
Hexachlorocyclopentadiene	0.07	USEPA 2001a	EPA Region 4 chronic screening value
Hexachloroethane	9.40	USEPA 2001a	EPA Region 4 chronic screening value
Hexachlorophene	8.80 [2]	USEPA 2003b	Minimum chronic value (34-day NOEC for *Pimephales promelas* [fathead minnow] based on survival and growth)
Hexachloropropene	NA	---	---
Isophorone	129	USEPA 2001a	EPA Region 4 chronic screening value
Isosafrole	NA	---	---
m-Dinitrobenzene (1,3-Dinitrobenzene)	500 [2]	USEPA 2003b	Minimum chronic value (69-day NOEC for *Oncorhynchus mykiss* [rainbow trout] based on reproduction)
m-Cresol (3-Methylphenol)	100	USEPA 2003b	Minimum acute value (48-hr LC_{50} for *Crangon crangon* [sand shrimp]) with a safety factor of 100
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
N-Nitrosodiethylamine	330,000	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
N-Nitrosodimethylamine	13,650 [2]	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Dugesia dorotocephala* [flatworm]) with a safety factor of 100
N-Nitroso-di-n-butylamine	330,000	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
N-Nitroso-di-n-propylamine	330,000	Assumed	Acute LOEL for chemical class with a safety factor of 10
N-Nitrosodiphenylamine	33,000	USEPA 2001a	EPA Region 4 chronic screening value
N-Nitrosomethylethylamine	330,000	Assumed	Acute LOEL for chemical class with a safety factor of 10
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---
Nitrobenzene	66.8	USEPA 2001a	EPA Region 4 chronic screening value

TABLE 4-6

SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value (1)	Reference	Comment
Semi-Volatile Organics (ug/L):			
o-Cresol (2-Methylpheneol)	102	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Elasmopus pectinicrus* [scud]) with a safety factor of 100
o-Toluidine	400	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Elasmopus pectinicrus* [scud]) with a safety factor of 100
p-Cresol (4-Methylphenol)	50.0	USEPA 2003b	Minimum acute value (96-hr EC_{50} for *Strongylocentrotus droebachiensis* [green sea urchin]) with a safety factor of 100
p-(Dimethylamino)azobenzene	NA	---	---
Pentachlorobenzene	129	USEPA 2001a	EPA Region 4 chronic screening value
Pentachloronitrobenzene	0.23	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Pentachlorophenol	7.90	USEPA 2002a	CCC
Phenacetin	NA	---	---
Phenol	58.0	USEPA 2001a	EPA Region 4 chronic screening value
PAHs (ug/L):			
Pronamide	35.0	USEPA 2003b	Minimum acute value (96-hr EC_{50} for *Crassostrea virginica* [Virginia oyster]) with a safety factor of 100
Pryridine	500	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Crangon septemspinosa* [sand shrimp]) with a safety factor of 100
Safrole	NA	---	---
1-Methylnaphthalene	19.0	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Cancer magister* [dungeness crab]) with a safety factor of 100
2-Methylnaphthalene	3.00	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Gadus morhua* [Atlantic cod]) with a safety factor of 100
Acenaphthene	9.70	USEPA 2001a	EPA Region 4 chronic screening value
Acenaphthylene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Anthracene	50.0	USEPA 1996a	Acute value (LC_{50}) with a safety factor of 100
Benzo(a)anthracene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Benzo(a)pyrene	10.0	USEPA 1996a	Acute value (LC_{50}) with a safety factor of 100
Benzo(b)fluoranthene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Benzo(g,h,i)perylene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Benzo(k)fluoranthene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Chrysene	10.0	USEPA 1996a	Acute value (LC_{50}) with a safety factor of 100
Dibenzo(a,h)anthracene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Fluoranthene	11.0	USEPA 1996b	Final Chronic Value
Fluorene	10.0	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Nereis arenaceodentata* [polychaete]) with a safety factor of 100
Indeno(1,2,3-cd)pyrene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Naphthalene	23.5	USEPA 2001a	EPA Region 4 chronic screening value
Phenanthrene	8.30	USEPA 1996b	Final Chronic Value
Pyrene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
PCBs (ug/L):			
Aroclor-1016	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs
Aroclor-1221	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs
Aroclor-1232	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs

TABLE 4-6

SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [(1)]	Reference	Comment
PCBs (ug/L):			
Aroclor-1242	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs
Aroclor-1248	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs
Aroclor-1254	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs
Aroclor-1260	0.03	USEPA 2002a	CCC based on Final Residual Value for total PCBs
Inorganics (ug/L):			
Antimony	500	Buchman 1999	Proposed CCC
Arsenic	36.0	USEPA 2002a	Total recoverable CCC for trivalent arsenic
Barium	50,000	USEPA 2003b	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 100
Beryllium	310	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Fundulus heteroclitus* [mummichog]) with a safety factor of 100
Cadmium	8.90	USEPA 2002a	Total recoverable CCC
Chromium (total)	50.4	USEPA 2002a	Total recoverable CCC for hexavalent chromium
Cobalt	45.0	USEPA 2003b	Minimum acute value (96-hr LC_{50} for *Nitocra spinipes* [Harpacticoid copepod]0 with a safety factor of 100
Copper	3.70	USEPA 2002a	Total recoverable CCC
Cyanide (total)	1.00	USEPA 1999	Total recoverable CCC for free cyanide
Lead	8.50	USEPA 2002a	Total recoverable CCC
Mercury	1.10	USEPA 2002a	Total recoverable CCC
Nickel	8.30	USEPA 2002a	Total recoverable CCC
Selenium	71.1	USEPA 2002a	Total recoverable CCC
Silver	0.23	USEPA 2001a	EPA Region 4 chronic screening value
Thallium	21.3	USEPA 2001a	EPA Region 4 chronic screening value
Tin	NA	---	---
Vanadium	120 [(2)]	USEPA 2003b	Minimum chronic value (28-day NOEC for *Pimephales promelas* [fathead minnow] based on growth)
Zinc	85.6	USEPA 2002a	Total recoverable CCC

Notes:

NA = Not Available
CCC = Criteria Continuous Concentration
LOEL = Lowest Observed Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NOEC = No Observed Effect Concentration
USEPA = United States Environmental Protection Agency
CCC = Criteria Continuoous Concentration
EC_{50} = Median Effective Concentration
LC_{50} = Median Lethal Concentration

(1) The values shown are marine/estuarine screening values unless otherwise noted
(2) The chemical lacks a marine/estuarine surface water screening value. The value shown is a freshwater screening value
(3) The value shown is for o-xylene.

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment [1] [2]
Volatile Organics (ug/kg):			
1,1,1,2-Tetrachloroethane	3,474	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,1,1-Trichloroethane	856	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,1,2,2-Tetrachloroethane	202	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,1,2-Trichloroethane	352	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,1-Dichloroethane	27.0	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,1-Dichloroethene	2,782	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2,3-Trichloropropane	446	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2-Dibromo-3-chloropropane	200	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2-Dibromoethane (EDB)	44.4	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2-Dichloroethane	315	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2-Dichloropropane	2,075	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Butanone (Methyl ethyl ketone)	754	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Hexanone	22.5	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
3-Chloropropene (Allyl chloride)	2.69	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
4-Methyl-2-pentanone (MIBK)	31.8	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Acetone	5.81	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Acetonitrile	742	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Acrolein (Propenal)	0.01	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Acrylonitrile	1.02	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Benzene	135	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Bromodichloromethane	7,426	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Bromoform	1,308	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Bromomethane (Methyl bromide)	17.8	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Carbon disulfide	601	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Carbon tetrachloride	7,244	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Chlorobenzene	681	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Chloroethane	2,890	Di Toro and McGrath 2000	EqP-based toxicological threshold
Chloroform	629	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Chloromethane (Methyl chloride)	212	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Chloroprene	NA	---	---

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment (1) (2)
Volatile Organics (ug/kg):			
cis-1,3-Dichloropropene	8.37	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Dibromochloromethane	8,701	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Dibromomethane (Methylene bromide)	2,039	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Dichlorodifluoromethane	5,864	Di Toro and McGrath 2000	EqP-based toxicological threshold
Ethylbenzene	4.00	Buchman 1999	Minimum AET (Echinoderm larvae and larval$_{max}$)
Ethyl methacrylate	NA	---	---
Iodomethane (Methyl iodide)	NA	---	---
Isobutanol (Isobutyl alcohol)	546	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Methacrylonitrile	NA	---	---
Methylene chloride (Dichloromethane)	434	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Methyl methacrylate	296	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Pentachloroethane	2,864	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Propionitrile	218	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Styrene	3,962	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Tetrachloroethene	57.0	Buchman 1999	Minimum AET (infaunal community impacts)
Toluene	187	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
trans-1,2-Dichloroethene	4,614	Di Toro and McGrath 2000	EqP-based toxicological threshold
trans-1,3-Dichloropropene	7.82	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
trans-1,4-Dichloro-2-butene	NA	---	---
Trichloroethene	41.0	Buchman 1999	Minimum AET (Neanthes bioassays)
Trichlorofluoromethane	6,786	Di Toro and McGrath 2000	EqP-based toxicological threshold
Vinyl acetate	5.22	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Vinyl chloride	26.2	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Xylene	4.00	Buchman 1999	AET screening value for total xylenes
Semi-Volatile Organics (ug/kg):			
1,2,4,5-Tetrachlorobenzene	10,928	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2,4-Trichlorobenzene	4.80	Buchman 1999	Minimum AET (Echinoderm larvae)
1,3,5-Trinitrobenzene	11.6	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,2-Dichlorobenzene (o-Dichlorobenzene)	13.0	Buchman 1999	Minimum AET (Neanthes bioassays)
1,3-Dichlorobenzene (m-Dichlorobenzene)	986	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment (1) (2)
Semi-Volatile Organics (ug/kg):			
1,4-Dichlorobenzene (p-Dichlorobenzene)	110	Buchman 1999	Minimum AET (infaunal community impacts and Microtox)
1,4-Dioxane	364	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1,4-Naphthoquinone	NA	---	---
1,4-Phenylenediamine (p-phenylenediamine)	1.01	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
1-Naphthylamine	NA	---	---
2,3,4,6-Tetrachlorophenol	10,425	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2,4,5-Trichlorophenol	3.00	Buchman 1999	Minimum AET (infaunal community impacts)
2,4,6-Trichlorophenol	6.00	Buchman 1999	Minimum AET (infaunal community impacts)
2,2'-Oxybis(1-chloropropane)	NA	---	---
2,4-Dichlorophenol	5.00	Buchman 1999	Minimum AET (amphipod)
2,4-Dimethylphenol	18.0	Buchman 1999	Minimum Aet (Neanthes biassays)
2,4-Dinitrophenol	16.2	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2,4-Dinitrotoluene	18.9	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2,6-Dichlorophenol	273	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2,6-Dinitrotoluene	41.4	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Acetylaminofluorene	1,167	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Chloronaphthalene	15.8	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Chlorophenol	8.00	Buchman 1999	Minimum AET (amphipod)
2-Naphthylamine	NA	---	---
2-Nitroaniline (o-Nitroaniline)	32.2	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Nitrophenol (o-Nitrophenol)	5,752	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Picoline	1,108	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
3,3'-Dichlorobenzidine	296	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
3,3'-Dimethylbenzidine	690	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
3-Methylcholanthrene	NA	---	---
3-Nitroaniline (m-Nitroaniline)	2.18	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	12.14	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
4-Aminobiphenyl	NA	---	---
4-Bromophenylphenyl ether	312	Di Toro and McGrath 2000	EqP-based toxicological threshold
4-Chloro-3-methylphenol	14,505	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment [(1) (2)]
Semi-Volatile Organics (ug/kg):			
4-Chloroaniline	85.0	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
4-Chlorophenylphenyl ether	287	Di Toro and McGrath 2000	EqP-based toxicological threshold
4-Nitroaniline (p-Nitroaniline)	39.5	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
4-Nitrophenol (p-nitrophenol)	54.1	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
4-Nitroquinoline-1-oxide	NA	---	---
5-Nitro-o-toluidine	131	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
7,12-Dimethylbenz(a)anthracene	965,742	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Acetophenone	635	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
A,A-Dimethylphenethylamine	NA	---	---
Aniline	27.0	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Aramite	328	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Benzyl alcohol	52.0	Buchman 1999	Minimum AET (bivalve)
bis(2-Chloroethoxy)methane	350	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
bis(2-Chloroethyl)ether	141	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
bis(2-Ethylhexyl)phthalate	182	MacDonald 1994	TEL
Butylbenzylphthalate	63.0	Buchman 1999	Minimum AET (Microtox)
Diallate	21,270	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Dibenzofuran	110	Buchman 1999	Minimum AET (Echinoderm larvae)
Diethylphthalate	6.00	Buchman 1999	Minimum AET (bivalve and $larval_{max}$)
Dimethylphthalate	6.00	Buchman 1999	Minimum AET (bivalve)
Di-n-butylphthalate	58.0	Buchman 1999	Minimum AET (bivalve and $larval_{max}$)
Di-n-octylphthalate	61.0	Buchman 1999	Minimum AET (bivalve and $larval_{max}$)
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	72.1	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Ethyl methanesulfonate	NA	---	---
Hexachlorobenzene	6.00	Buchman 1999	Minimum AET (bivalve)
Hexachlorobutadiene	1.3	Buchman 1999	Minimum AET (Echinoderm larvae)
Hexachlorocyclopentadiene	139	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Hexachloroethane	73.0	Buchman 1999	Minimum AET (bivalve and $larval_{max}$)
Hexachlorophene	2,272,912	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Hexachloropropene	NA	---	---

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment [(1) (2)]
Semi-Volatile Organics (ug/kg):			
Isophorone	60.5	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Isosafrole	NA	---	---
m-Dinitrobenzene (1,3-Dinitrobenzene)	149.2	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
m,p-Cresol (3,4-Methylphenol)	100	Buchman 1999	Minimum AET (bivalve)
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
N-Nitrosodiethylamine	9,787	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
N-Nitrosodimethylamine	37.6	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
N-Nitroso-di-n-butylamine	772,367	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
N-Nitroso-di-n-propylamine	78,522	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
N-Nitrosodiphenylamine	28.0	Buchman 1999	Minimum AET (infaunal community impacts)
N-Nitrosomethylethylamine	2,517	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---
Nitrobenzene	21.0	Buchman 1999	Minimum AET (Neanthes bioassays)
o-Cresol (2-Methylpheneol)	8.00	Buchman 1999	Minimum AET (bivalve)
o-Toluidine	83.1	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
p-(Dimethylamino)azobenzene	NA	---	---
Pentachlorobenzene	191,183	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Pentachloronitrobenzene	83.8	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Pentachlorophenol	17.0	Buchman 1999	Minimum AET (bivalve)
Phenacetin	NA	---	---
Phenol	130	Buchman 1999	Minimum AET (Echinoderm larvae)
Pronamide	988	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Pryridine	22.8	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
Safrole	NA	---	---
PAHs (ug/kg):			
1-Methylnaphthalene	1,211	USEPA 1993a	EqP-based screening value derived in accordance with USEPA 1993a
2-Methylnaphthalene	20.2	MacDonald 1994	TEL

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment [(1) (2)]
PAHs (ug/kg):			
Acenaphthene	6.71	MacDonald 1994	TEL
Acenaphthylene	5.87	MacDonald 1994	TEL
Anthracene	46.9	MacDonald 1994	TEL
Benzo(a)anthracene	74.8	MacDonald 1994	TEL
Benzo(a)pyrene	88.8	MacDonald 1994	TEL
Benzo(b)fluoranthene	1,800	Buchman 1999	Minimum AET (Echinoderm larvae and infaunal commuity impacts)
Benzo(g,h,i)perylene	670	Buchman 1999	Minimum AET (Microtox)
Benzo(k)fluoranthene	1,800	Buchman 1999	Minimum AET (Echinoderm larvae and infaunal commuity impacts)
Chrysene	108	MacDonald 1994	TEL
Dibenzo(a,h)anthracene	6.22	MacDonald 1994	TEL
Fluoranthene	113	MacDonald 1994	TEL
Fluorene	21.2	MacDonald 1994	TEL
Indeno(1,2,3-cd)pyrene	600	Buchman 1999	Minimum AET (Microtox)
Naphthalene	34.6	MacDonald 1994	TEL
Phenanthrene	86.7	MacDonald 1994	TEL
Pyrene	153	MacDonald 1994	TEL
PCBs (ug/kg):			
Aroclor-1016	21.6	MacDonald 1994	TEL
Aroclor-1221	21.6	MacDonald 1994	TEL
Aroclor-1232	21.6	MacDonald 1994	TEL
Aroclor-1242	21.6	MacDonald 1994	TEL
Aroclor-1248	21.6	MacDonald 1994	TEL
Aroclor-1254	21.6	MacDonald 1994	TEL
Aroclor-1260	21.6	MacDonald 1994	TEL
Inorganics (mg/kg):			
Antimony	2.00	Long and Morgan 1991	ER-L
Arsenic	7.24	MacDonald 1994	TEL
Barium	48.0	Buchman 1999	Minimum AET (amphipod)
Beryllium	NA	---	---
Cadmium	0.68	MacDonald 1994	TEL

TABLE 4-7

MARINE SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value	Reference	Comment (1) (2)
Inorganics (mg/kg):			
Chromium (total)	52.3	MacDonald 1994	TEL
Cobalt	10.0	Buchman 1999	Minimum AET (Neanthes bioassay)
Copper	18.7	MacDonald 1994	TEL
Lead	30.2	MacDonald 1994	TEL
Mercury	0.13	MacDonald 1994	TEL
Nickel	15.9	MacDonald 1994	TEL
Selenium	1.00	Buchman 1999	Minimum AET (amphipod)
Silver	0.73	MacDonald 1994	TEL
Thallium	NA	---	---
Tin	3.40	Buchman 1999	Minimum AET (Neanthes bioassay)
Vanadium	57.0	Buchman 1999	Minimum AET (infaunal community impacts)
Zinc	124	MacDonald 1994	TEL

Notes:

NA = Not Available
EqP = Equilibrium Partitioning
ER-L = Effects Range-Low
AET = Apparent Effects Threshold
TEL Threshold Effects Level

(1) EqP-based sediment screening values from USEPA (1993a) were calculated from the following equation: $SV_{sed} = (K_{oc})(f_{oc})(SV_{sw})$ where K_{oc} is the organic carbon partition coefficient (L/kg), f_{oc} is the fraction of organic carbon (unitless), and SV_{sw} is the surface water screening value (ug/L). An f_{oc} of 0.01 was assumed.

(2) Eqp-based sediment screening values from Di Toro and McGrath (2000) are based on an f_{oc} of 0.01.

INGESTION-BASED SCREENING VALUES FOR BIRDS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Wt (kg)	Duration	Exposure Route	Effect/ Endpoint	Test Material	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference	Ecological Receptors
Volatile Organics:										
1,1,1,2-Tetrachloroethane	---	---	---	---	---	---	NA	NA	---	---
Carbon tetrachloride	---	---	---	---	---	---	NA	NA	---	---
Chlorobenzene	---	---	---	---	---	---	NA	NA	---	---
Chloroform	---	---	---	---	---	---	NA	NA	---	---
Ethylbenzene	---	---	---	---	---	---	NA	NA	---	---
Pentachloroethane	---	---	---	---	---	---	NA	NA	---	---
Styrene	---	---	---	---	---	---	NA	NA	---	---
Toluene	---	---	---	---	---	---	NA	NA	---	---
Trichloroethene	---	---	---	---	---	---	NA	NA	---	---
Xylene	Quail	0.191	Subacute	?	"Toxicity"	---	405	40.5	Hill and Camardese 1986	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Semi-Volatile Organics:										
1,2,4,5-Tetrachlorobenzene	---	---	---	---	---	---	NA	NA	---	---
1,2,4-Trichlorobenzene	---	---	---	---	---	---	NA	NA	---	---
1,2-Dichlorobenzene (o-Dichlorobenzene)	Northern bobwhite	0.157	14 days	Oral (gavage)	Growth /mortality	?	2,500	250	Grimes and Jaber 1989	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
1,3-Dichlorobenzene (m-Dichlorobenzne)	Northern bobwhite	0.157	14 days	Oral (gavage)	Growth /mortality	?	2,500	250	Grimes and Jaber 1989	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
1,4-Dichlorobenzene (p-Dichlorobenzne)	Northern bobwhite	0.157	14 days	Oral (gavage)	Growth /mortality	?	2,500	250	Grimes and Jaber 1989	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
2,3,4,6-Tetrachlorophenol	---	---	---	---	---	---	NA	NA	---	---
2,4,5-Trichlorophenol	---	---	---	---	---	---	NA	NA	---	---
2,4,6-Trichlorophenol	---	---	---	---	---	---	NA	NA	---	---
2,4-Dichlorophenol	---	---	---	---	---	---	NA	NA	---	---
2-Acetylaminofluorene	---	---	---	---	---	---	NA	NA	---	---
2-Chloronaphthalene	---	---	---	---	---	---	NA	NA	---	---
3,3'-Dichlorobenzidine	---	---	---	---	---	---	NA	NA	---	---
3,3-Dimethylbenzidine	---	---	---	---	---	---	NA	NA	---	---
3-Methylcholanthrene	---	---	---	---	---	---	NA	NA	---	---
4-Bromophenylphenyl ether	---	---	---	---	---	---	NA	NA	---	---
4-Chloro-3-methylphenol	---	---	---	---	---	---	NA	NA	---	---
4-Chlorophenylphenyl ether	---	---	---	---	---	---	NA	NA	---	---
7-12-Dimethyl benz(a)anthracene	---	---	---	---	---	---	NA	NA	---	---
Aramite	---	---	---	---	---	---	NA	NA	---	---
bis(2-Ethylhexyl)phthalate	Ringed dove	0.155	4 weeks	Oral in diet	Reproduction	Not Applicable	11.0	1.10	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Butylbenzylphthalate	---	---	---	---	---	---	NA	NA	---	---
Diallate	---	---	---	---	---	---	NA	NA	---	---
Dibenzofuran	---	---	---	---	---	---	NA	NA	---	---
Diethylphthalate	---	---	---	---	---	---	NA	NA	---	---
Di-n-butylphthalate	Ringed dove	0.155	4 weeks	Oral in diet	Reproduction	Not Applicable	1.10	0.11	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Di-n-octylphthalate	Ring-necked pheasant	1.00	?	?	Mortality	Not Applicable	500	50.0	TERRTOX 1998	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Dinoseb (2-sec-butyl-4,6-Dintrophenol)	---	---	---	---	---	---	NA	NA	---	---
Hexachlorobenzene	Japanese Quail	0.19	90 days	Oral	Reproduction	Not Applicable	0.80	0.08	Coulston and Kolbye 1994	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
	Coturnix quail	?	5 days	Oral	?	Not Applicable	2,250	225	USEPA 1999a	---
Hexachlorobutadiene	Japanese Quail	0.19	?	Oral	Reproduction	Not Applicable	8.00	2.50	Coulston and Kolbye 1994	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
	Japanese quail	?	3 months	Oral	?	Not Applicable	31,850	3,185	USEPA 1999a	---
Hexachlorocyclopentadiene	---	---	---	---	---	---	NA	NA	---	---
Hexachloroethane	---	---	---	---	---	---	NA	NA	---	---

TABLE 4-8

INGESTION-BASED SCREENING VALUES FOR BIRDS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Wt (kg)	Duration	Exposure Route	Effect/ Endpoint	Test Material	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference	Ecological Receptors
Semi-Volatile Organics:										
Hexachlorophene	---	---	---	---	---	---	NA	NA	---	---
Hexachloropropene	---	---	---	---	---	---	NA	NA	---	---
Isosafrole	---	---	---	---	---	---	---	---	---	---
N-Nitrosodiphenylamine	---	---	---	---	---	---	NA	NA	---	---
p-Dimethylaminoazobenzene	---	---	---	---	---	---	NA	NA	---	---
Pentachlorobenzene	---	---	---	---	---	---	NA	NA	---	---
Pentachloronitrobenzene	Chicken	1.50	35 weeks	Oral in diet	Reproduction	Not Applicable	70.7	7.07	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Pentachlorophenol	Chicken	1.50	8 weeks	Oral	Growth	Not Applicable	200	100	Eisler 1989	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
	Quail	?	5 days	Oral	?	Not Applicable	40,300	4,030	USEPA 1999a	---
Pronamide	---	---	---	---	---	---	NA	NA	---	---
PAHs:										
1-Methylnaphthalene	---	---	---	---	---	---	NA	NA	---	---
2-Methylnaphthalene	---	---	---	---	---	---	NA	NA	---	---
Acenaphthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Acenaphthylene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Anthracene	Mallard duck	1.043	7 months	Oral in diet	Hepatic	Not Applicable	228	22.8	Patton and Dieter 1980	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Benzo(a)anthracene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Benzo(a)pyrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Benzo(b)fluoranthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Benzo(g,h,i)perylene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Benzo(k)fluoranthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Chrysene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Dibenz(a,h)anthracene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Fluoranthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Fluorene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Indeno(1,2,3-cd)pyrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Naphthalene	Mallard duck	1.04	7 months	Oral in diet	Hepatic	Not Applicable	228	22.8	Patton and Dieter 1980	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Phenanthrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Pyrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
PCBs:										
Aroclor-1016	Screech owl	0.181	2 generations	Oral in diet	Reproduction	Not Applicable	4.10	0.41	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Aroclor-1221	Screech owl	0.181	2 generations	Oral in diet	Reproduction	Not Applicable	4.10	0.41	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Aroclor-1232	Screech owl	0.181	2 generations	Oral in diet	Reproduction	Not Applicable	4.10	0.41	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant

INGESTION-BASED SCREENING VALUES FOR BIRDS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Wt (kg)	Duration	Exposure Route	Effect/ Endpoint	Test Material	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference	Ecological Receptors
PCBs:										
Aroclor-1242	Screech owl	0.181	2 generations	Oral in diet	Reproduction	Not Applicable	4.10	0.41	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Aroclor-1248	Ring-necked pheasant	1.00	17 weeks	Oral	Reproduction	Not Applicable	1.80	0.18	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Aroclor-1254	Ring-necked pheasant	1.00	17 weeks	Oral	Reproduction	Not Applicable	1.80	0.18	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Aroclor-1260	Ring-necked pheasant	1.00	17 weeks	Oral	Reproduction	Not Applicable	1.80	0.18	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Inorganics:										
Antimony	---	---	---	---	---	---	NA	NA	---	---
Arsenic	Brown-headed cowbird	0.049	7 months	Oral in diet	Mortality	Copper acetoarsenite	7.38	2.46	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
	Mallard duck	1.00	128 days	Oral in diet	Mortality	Sodium arsenite	12.84	5.14	Sample et al. 1996	---
Barium	One-day old chicks	0.121	4 weeks	Oral in diet	Mortality	Barium hydroxide	41.7	20.8	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Beryllium	---	---	---	---	---	---	NA	NA	---	---
Cadmium	Mallard duck	1.153	90 days	Oral in diet	Reproduction	Cadmium chloride	20	1.45	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Chromium	American black duck	1.25	10 months	Oral in diet	Reproduction	Cr^{+3} as $CrK(SO_4)_2$	5.00	1.00	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Cobalt	Chicken	1.80	14 Days	Oral in diet	Growth	?	14.7	1.47	Diaz et al. 1994	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Copper	One-day old chicks	0.534	10 weeks	Oral in diet	Growth /mortality	Copper oxide	61.7	47.0	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Lead	Japanese Quail	0.15	12 weeks	Oral in diet	Reproduction	Lead acetate	11.3	1.13	Sample et al. 1996	American robin, mourning dove, belted kingfisher, and double-crested cormorant
	American kestrel	0.13	7 months	Oral in diet	Reproduction	Metallic lead	38.5	3.85	Sample et al. 1996	Red-tailed hawk
Mercury	Japanese quail	0.15	1 year	Oral in diet	Reproduction	Mercuric chloride	0.90	0.45	Sample et al. 1996	---
	Coturnix quail	?	5 days	Oral	Mortality	Mercuric chloride	0.90	0.45	USEPA 1999a	---
	Mallard duck	1.00	3 generations	Oral in diet	Reproduction	Methyl mercury dicyandiamide	0.064	0.0064	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Nickel	Mallard duckling	0.782	90 days	Oral in diet	Growth /mortality	Nickel sulfate	107	77.4	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
	Coturnix quail	?	5 days	Oral	?	?	650	65	USEPA 1999a	---
Selenium	Mallard duck	1.00	100 days	Oral in diet	Reproduction	Selanomethionine	0.80	0.40	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
	Mallard duck	1.00	78 days	Oral in diet	Reproduction	Sodium Selenite	1.00	0.50	Sample et al. 1996	---
	Screech owl	0.20	13.7 weeks	Oral in diet	Reproduction	Selanomethionine	1.50	0.44	Sample et al. 1996	---
	Black-crowned night heron	0.883	94 days	Oral in diet	Reproduction	Selanomethionine	11.8	1.80	Sample et al. 1996	---
Silver	Mallard duck	?	14 days	Oral	?	?	1780	178	USEPA 1999a	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Thallium	European starling	?	acute	Oral	?	?	3.50	0.35	USEPA 1999a	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Tin	Japanese quail	0.15	6 weeks	Oral in diet	Reproduction	bis(Tributyltin)-oxide	16.9	6.80	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Vanadium	Mallard duck	1.17	12 weeks	Oral in diet	Growth /mortality	Vanadyl sulfate	114	11.4	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant
Zinc	White leghorn hen	1.935	44 weeks	Oral in diet	Reproduction	Zinc sulfate	131	14.5	Sample et al. 1996	American robin, mourning dove, red-tailed hawk, belted kingfisher, and double-crested cormorant

Notes:

NA = Not Available
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level

TABLE 4-9

INGESTION-BASED SCREENING VALUES FOR MAMMALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Wt (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	Test Species LOAEL (mg/kg/d)	Test Species NOAEL (mg/kg/d)	Reference	Ecological Receptor (1)	Receptor Species (2)(3) LOAEL (mg/kg/d)	Receptor Species (2)(3) NOAEL (mg/kg/d)
Volatile Organics:												
1,1,1,2-Tetrachloroethane	Rat	0.35	103 weeks	Oral (gavage)	Mortality/weight loss/histopathology	Not Applicable	125	12.5	IRIS 2004	West Indian manatee	17.1	1.71
Carbon tetrachloride	Rat	0.35	2 years	Oral in diet	Reproduction	Not Applicable	160	16	Sample et al. 1996	West Indian manatee	21.9	2.19
Chlorobenzene	Dog	12.7	13 weeks	Oral	Liver	Not Applicable	5.45	2.725	IRIS 2004	West Indian manatee	1.83	0.915
Chloroform	Rat	0.35	13 weeks	Oral (intubation)	Systemic	Not Applicable	41	15	Sample et al. 1996	West Indian manatee	5.61	2.05
	Mouse	0.03	80 weeks	Oral in diet	?	Not Applicable	600	60	USEPA 1999a	---	---	---
Ethylbenzene	Rat	0.35	chronic	?	Liver/kidney	Not Applicable	971	97.1	Wolf et al. 1956	West Indian manatee	133	13.3
Pentachloroethane	---	---	---	---	---	---	NA	NA	---	---	NA	NA
Styrene	Rat	0.35	90 days	Oral	Reproduction	Not Applicable	350	35	Beliles et al. 1985	West Indian manatee	47.9	4.79
Toluene	Mouse	0.03	GD 6-12	Oral (gavage)	Reproduction	Not Applicable	260	26	Sample et al. 1996	West Indian manatee	19.2	1.92
Trichloroethene	Mouse	0.03	6 weeks	Oral (gavage)	hepatotoxicity	Not Applicable	7	0.7	Sample et al. 1996	West Indian manatee	0.518	0.0518
Xylene	Mouse	0.03	GD 6-15	Oral (gavage)	Reproduction	Not Applicable	2.6	2.1	Sample et al. 1996	West Indian manatee	0.192	0.155
Semi-Volatile Organics:												
1,2,4,5-Tetrachlorobenzene	Rat	0.35	13 weeks	Oral in diet	Hepatic/renal	Not Applicable	0.34	0.034	IRIS 2004	West Indian manatee	0.047	0.0047
1,2,4-Trichlorobenzene	Rat	0.35	3 generations	Oral in water	Reproduction	Not Applicable	106	53	Coulston and Kolbye 1994	West Indian manatee	14.5	7.25
	Rat	0.35	2 generations	Oral in water	Reproduction	Not Applicable	400	40	IRIS 2004	---	---	---
1,2-Dichlorobenzene (o-Dichlorobenzene)	Rat	0.35	chronic	Oral (gavage)	Liver/kidney	Not Applicable	857	85.7	Coulston and Kolbye 1994	West Indian manatee	117	11.72
1,3-Dichlorobenzene (m-Dichlorobenzene)	Rat	0.35	chronic	Oral (gavage)	Liver/kidney	Not Applicable	857	85.7	Coulston and Kolbye 1994	West Indian manatee	117	11.72
1,4-Dichlorobenzene (p-Dichlorobenzene)	Rat	0.35	GD 6-15	Oral (gavage)	Reproduction	Not Applicable	500	250	Coulston and Kolbye 1994	West Indian manatee	68.4	34.2
2,3,4,6-Tetrachlorophenol	Rat	0.35	90 days	Oral (gavage)	Mortality/body weight gain/histopathology	Not Applicable	10	2.5	IRIS 2004	West Indian manatee	1.37	0.342
	Rat	0.35	GD 6-15	Oral (gavage)	Reproduction/maternal weight gain	Not Applicable	200	100	IRIS 2004	---	---	---
2,4,5-Trichlorophenol	Rat	0.35	98 days	Oral in diet	Hepatic/renal	Not Applicable	800	80	McCollister et al. 1961	West Indian manatee	109	10.9
2,4,6-Trichlorophenol	Rat	0.35	98 days	Oral in diet	Hepatic/renal	Not Applicable	800	80	McCollister et al. 1961	West Indian manatee	109	10.9
2,4-Dichlorophenol	Rat	0.35	103 weeks	Oral in diet	Reproduction	Not Applicable	4,400	440	NTP 1989	West Indian manatee	602	60.2
2-Acetylaminofluorene	---	---	---	---	---	---	NA	NA	---	---	NA	NA
2-Chloronaphthalene	Mouse	0.03	13 weeks	Oral (gavage)	Mortality/systemic	Not Applicable	60	25	IRIS 2004	West Indian manatee	4.44	1.85
3,3'-Dichlorobenzidine	---	---	---	---	---	---	NA	NA	---	---	NA	NA
3,3'-Dimethylbenzidine	---	---	---	---	---	---	NA	NA	---	---	NA	NA
3-Methylcholanthrene	---	---	---	---	---	---	NA	NA	---	---	NA	NA
4-Bromophenylphenyl ether	---	---	---	---	---	---	NA	NA	---	---	NA	NA
4-Chloro-3-methylphenol	---	---	---	---	---	---	NA	NA	---	---	NA	NA
4-Chlorophenylphenyl ether	---	---	---	---	---	---	NA	NA	---	---	NA	NA
7,12-Dimethylbenz(a)anthracene	---	---	---	---	---	---	NA	NA	---	---	NA	NA
Aramite	---	---	---	---	---	---	NA	NA	---	---	NA	NA
bis(2-Ethylhexyl)phthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	183.3	18.3	Sample et al. 1996	West Indian manatee	13.6	1.35
	Rat	0.35	2 years	Oral	?	Not Applicable	600	60	USEPA 1999a	---	---	---
Butylbenzylphthalate	Rat	0.35	2 years	Oral in diet	Hepatic	Not Applicable	2,400	240	NTP 1997	West Indian manatee	328	32.8
Diallate	---	---	---	---	---	---	NA	NA	---	---	NA	NA
Dibenzofuran	Mouse	0.03	19 to 29 days	Oral in diet	Reproduction	Not Applicable	1,330	133	ATSDR 1995a	West Indian manatee	98.4	9.84
Diethylphthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	45,830	4,583	Sample et al. 1996	West Indian manatee	3,392	339
Di-n-butylphthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	1,833	550	Sample et al. 1996	West Indian manatee	136	40.7
Di-n-octylphthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	550	55	Sample et al. 1996	West Indian manatee	40.7	4.07
Dinoseb (2-sec-butyl-4, 6-dinitrophenol)	Rat	0.35	29 weeks	oral in diet	Reproduction	Not Applicable	1	0.1	IRIS 2004	West Indian manatee	NA	NA
Hexachlorobenzene	Rat	0.35	2 years	Oral	Reproduction	Not Applicable	16	1.6	ATSDR 1989	West Indian manatee	2.19	0.219
Hexachlorobutadiene	Rat	0.35	90 days +	Oral	Reproduction	Not Applicable	20	2	IPCS 1994	West Indian manatee	2.74	0.274
Hexachlorocyclopentadiene	Rat	0.35	GD 6-15	Oral	Reproduction	Not Applicable	30	10	USEPA 1984	West Indian manatee	4.10	1.37
	Rat	0.35	13 weeks	Oral (gavage)	?	Not Applicable	38	3.80	USEPA 1999a	---	---	---
Hexachloroethane	Rat	0.35	16 weeks	Oral (gavage)	Systemic	Not Applicable	1.0	0.1	IRIS 2004	West Indian manatee	NA	NA
Hexachlorophene	Rat	0.35	?	Oral	Mortality	Not Applicable	56	5.6	USEPA 1999a	West Indian manatee	7.66	0.766
Hexachloropropene	---	---	---	---	---	---	NA	NA	---	---	NA	NA

TABLE 4-9

INGESTION-BASED SCREENING VALUES FOR MAMMALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Wt (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	Test Species LOAEL (mg/kg/d)	Test Species NOAEL (mg/kg/d)	Reference	Ecological Receptor (1)	Receptor Species (2)(3) LOAEL (mg/kg/d)	Receptor Species (2)(3) NOAEL (mg/kg/d)
Semi-Volatile Organics:												
Isosafrole	---	---	---	---	---	---	NA	NA	---	---	NA	NA
N-Nitrosodiphenylamine	Rat	0.35	8 to 11 weeks	Oral in diet	Systemic	Not Applicable	1,500	150	ATSDR 1993a	West Indian manatee	205	20.5
p-Dimethylaminoazobenzene	---	---	---	---	---	---	NA	NA	---	---	NA	NA
Pentachlorobenzene	Rat	0.35	180 days	Oral	?	Not Applicable	72.5	7.25	USEPA 1999a	West Indian manatee	9.92	0.992
Pentachloronitrobenzene	Mouse	0.35	2 years	Oral	?	Not Applicable	4,583.3	458.3	USEPA 1999a	West Indian manatee	627	62.7
Pentachlorophenol	Rat	0.35	up to 24 months	Oral in diet	Reproduction	Not Applicable	30	3	Coulston and Kolbye 1994	West Indian manatee	4.10	0.41
Pronamide	Rat	0.35	3 generations	Oral	Reproduction	Not Applicable	150	15	IRIS 2004	West Indian manatee	20.5	2.05
PAHs:												
1-Methylnaphthalene	Mouse	0.03	81 weeks	Oral in diet	Systemic	Not Applicable	1,437	143.7	ATSDR 1995a	West Indian manatee	106	10.6
2-Methylnaphthalene	Mouse	0.03	81 weeks	Oral in diet	Systemic	Not Applicable	1,437	143.7	ATSDR 1995a	West Indian manatee	106	10.6
Acenaphthene	Mouse	0.03	13 weeks	Oral (gavage)	Reproduction	Not Applicable	3,500	350	ATSDR 1995a	West Indian manatee	259	25.9
Acenaphthylene	Mouse	0.03	13 weeks	Oral (gavage)	Reproduction	Not Applicable	2,500	350	ATSDR 1995a	West Indian manatee	185	25.9
Anthracene	Mouse	0.03	13 weeks	Oral (gavage)	Reproduction	Not Applicable	10,000	1,000	ATSDR 1995a	West Indian manatee	740	74.0
Benzo(a)anthracene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Benzo(a)pyrene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Benzo(b)fluoranthene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Benzo(g,h,i)perylene	Mouse	0.03	19 to 29 days	Oral in diet	Reproduction	Not Applicable	1330	133	ATSDR 1995a	West Indian manatee	98.4	9.84
Benzo(k)fluoranthene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Chrysene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Dibenz(a,h)anthracene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Fluoranthene	Mouse	0.03	13 weeks	Oral (gavage)	Hepatic	Not Applicable	1,250	125	ATSDR 1995a	West Indian manatee	92.5	9.25
Fluorene	Mouse	0.03	13 weeks	Oral (gavage)	Hematological	Not Applicable	1,250	125	ATSDR 1995a	West Indian manatee	92.5	9.25
Indeno(1,2,3-cd)pyrene	Mouse	0.03	GD 7-16	Oral (intubation)	Reproduction	Not Applicable	10	1	Sample et al. 1996	West Indian manatee	0.740	0.074
Naphthalene	Mouse	0.03	13 weeks	Oral (gavage)	Reproduction	Not Applicable	1,400	140	ATSDR 1995b	West Indian manatee	104	10.4
Phenanthrene	Mouse	0.03	19 to 29 days	Oral in diet	Reproduction	Not Applicable	1,330	133	ATSDR 1995a	West Indian manatee	98.4	9.84
Pyrene	Mouse	0.03	19 to 29 days	Oral in diet	Reproduction	Not Applicable	1,330	133	ATSDR 1995a	West Indian manatee	98.4	9.84
PCBs:												
Aroclor-1016	Mink	1.00	18 months	Oral in diet	Reproduction	Not Applicable	3.43	1.37	Sample et al. 1996	West Indian manatee	0.610	0.244
Aroclor-1221	Mink	1.00	7 months	Oral in diet	Reproduction	Not Applicable	0.69	0.069	Sample et al. 1996	West Indian manatee	0.123	0.0123
Aroclor-1232	Mink	1.00	7 months	Oral in diet	Reproduction	Not Applicable	0.69	0.069	Sample et al. 1996	West Indian manatee	0.123	0.0123
Aroclor-1242	Mink	1.00	7 months	Oral in diet	Reproduction	Not Applicable	0.69	0.069	Sample et al. 1996	West Indian manatee	0.123	0.0123
Aroclor-1248	Rhesus monkey	5.00	14 months	Oral in diet	Reproduction	Not Applicable	0.1	0.01	Sample et al. 1996	West Indian manatee	0.027	0.0027
	Mouse	0.03	5 weeks	Oral in diet	Immunological	Not Applicable	13	1.3	ATSDR 1995c	West Indian manatee	0.962	0.0962
Aroclor-1254	Oldfield mouse	0.014	12 months	Oral in diet	Reproduction	Not Applicable	0.68	0.068	Sample et al. 1996	West Indian manatee	0.042	0.0042
Aroclor-1254	Mink	1.00	4.5 months	Oral in diet	Reproduction	Not Applicable	0.69	0.14	Sample et al. 1996	West Indian manatee	0.123	0.025
Aroclor-1260	Oldfield mouse	0.014	12 months	Oral in diet	Reproduction	Not Applicable	0.68	0.068	Sample et al. 1996	West Indian manatee	0.042	0.0042
Aroclor-1260	Mink	1.00	4.5 months	Oral in diet	Reproduction	Not Applicable	0.69	0.14	Sample et al. 1996	West Indian manatee	0.123	0.025
Inorganics:												
Antimony	Mouse	0.03	lifetime	Oral in water	Lifespan/longevity	Antimony Potassium Tartrate	1.25	0.125	Sample et al. 1996	---	---	---
	Rat	0.35	lifetime	Oral in water	Lifespan/longevity	?	0.66	0.066	USEPA 1999a	West Indian manatee	0.090	0.009
Arsenic	Mouse	0.03	3 generations	Oral in water	Reproduction	Arsentie (As^{+3})	1.26	0.126	Sample et al. 1996	West Indian manatee	0.093	0.0093
	Dog	?	2 years	Oral	?	?	12.5	1.25	USEPA 1999a	---	---	---
Barium	Rat	0.435	16 months	Oral in water	Growth/hypertension	Barium Chloride	51	5.1	Sample et al. 1996	---	---	---
	Rat	0.35	10 days	Oral in water	Mortality	Barium Chloride	19.8	1.98	Sample et al. 1996	West Indian manatee	2.71	0.271
Beryllium	Rat	0.35	lifetime	Oral in water	Longevity/weight loss	Beryllium Sulfate	6.60	0.66	Sample et al. 1996	West Indian manatee	0.903	0.0903
Cadmium	Rat	0.303	6 weeks	Oral (gavage)	Reproduction	Cadmium Chloride ($CdCl_2$)	10	1	Sample et al. 1996	---	---	---
	Dog	10.0	3 months	Oral (gavage)	Reproduction	?	7.50	0.75	ATSDR 1993b	---	---	---
	Mouse	0.03	2 generations	Oral in water	Reproduction	? (soluble salt)	2.52	0.252		West Indian manatee	0.187	0.0187
Chromium	Rat	0.35	2 years	Oral in diet	Reproduction and longevity	Cr^{+3} as Cr_2O_3	27,370	2,737	Sample et al. 1996	---	---	---

TABLE 4-9

INGESTION-BASED SCREENING VALUES FOR MAMMALS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Wt (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	Test Species LOAEL (mg/kg/d)	Test Species NOAEL (mg/kg/d)	Reference	Ecological Receptor [1]	Receptor Species [2][3] LOAEL (mg/kg/d)	Receptor Species [2][3] NOAEL (mg/kg/d)
Inorganics:												
Chromium	Rat	0.35	1 year	Oral in water	Body weight and food consumption	Cr^{+6} as $K2Cr_2O_4$	32.8	3.28	Sample et al. 1996	---	---	---
	Rat	0.35	3 months	Oral in water	Mortality	Cr^{+6}	13.14	1.314	Sample et al. 1996	West Indian manatee	1.80	0.180
Cobalt	Rat	0.35	69 days	Oral in diet	Reproduction	?	50	5	ATSDR 1992a	West Indian manatee	6.84	0.684
Copper	Mink	1.00	357 days	Oral in diet	Reproduction	Copper Sulfate	15.14	11.7	Sample et al. 1996	West Indian manatee	2.69	2.08
Lead	Rat	0.35	3 generations	Oral in diet	Reproduction	Lead Acetate	80	8	Sample et al. 1996	West Indian manatee	10.9	1.09
Mercury	Mink	1.00	6 months	Oral in diet	Reproduction	Mercuric Chloride	10	1	Sample et al. 1996	---	---	---
	Mouse	0.03	20 months	Oral in diet	Reproduction	Mercuric Sulfide	132	13.2	Sample et al. 1996	---	---	---
	Mink	1.00	93 days	Oral in diet	Mortality/weight loss	Methyl Mercury Chloride (CH3HgCl)	0.025	0.015	Sample et al. 1996	West Indian manatee	0.004	0.003
	Rat	0.35	3 generations	Oral in diet	Reproduction	Methyl Mercury Chloride (CH_3HgCl)	0.16	0.032	Sample et al. 1996	---	---	---
Nickel	Rat	0.35	3 generations	Oral in diet	Reproduction	Nickel Sulfate Hexahydrate	80	40	Sample et al. 1996	West Indian manatee	10.9	5.47
Selenium	Rat	0.35	1 year	Oral in water	Reproduction	Potassium Selenate (SeO_4)	0.33	0.2	Sample et al. 1996	West Indian manatee	0.045	0.027
	Mouse	0.03	3 generations	Oral in water	Mortality	Selenate (SeO_4)	0.76	0.076	USEPA 1999a	---	---	---
Silver	Rat	0.35	2 weeks	Oral in water	Mortality	?	181	18.1	ATSDR 1990	West Indian manatee	24.8	2.48
	Mouse	0.03	125 days	Oral	Hypoactivity	?	3.75	0.375	USEPA 1999a	---	---	---
Thallium	Rat	0.365	60 days	Oral in water	Reproduction	Thallium Sulfate	0.74	0.074	Sample et al. 1996	West Indian manatee	0.102	0.0102
Tin	Mouse	0.03	6-15 days	Oral intubation	Reproduction	bis(Tributyltin)oxide	35	23.4	Sample et al. 1996	West Indian manatee	2.59	1.73
Vanadium	Rat	0.26	>60 days	Oral intubation	Reproduction	Sodium Metavanadate ($NaVO_3$)	2.10	0.21	Sample et al. 1996	West Indian manatee	0.267	0.0267
Zinc	Rat	0.35	GD 1-16	Oral in diet	Reproduction	Zinc Oxide	320	160	Sample et al. 1996	---	---	---
	Mink	1.00	25 weeks	Oral	Reproduction	?	208	20.8	ATSDR 1992b	West Indian manatee	37.0	3.70
	Mouse	0.03	13 weeks	Oral	?	?	100.4	10.04	USEPA 1999a	---	---	---

Notes:

NA = Not Available
NOAEL = No Observed Effect Level
LOAEL = Lowest Observed Effect Level

[1] The West Indian manatee was asssigned to a given chemical-test organism screening value combination based on a number of factors, including study design, study methodology, study duration, study endpoint, and test species.

[2] Receptor species NOAEL and LOAEL values reflect differences in body weights between the test organisms and receptor species. Test species NOAEL and LOAEL values were converted to receptor-based values using Equation 4-1.

[3] Receptor NOAEL and LOAEL screening values are shown only for those chemical-test organism screening value combinations with an assigned receptor.

TABLE 4-10

SOIL BIOCONCENTRATION FACTORS USED FOR TERRESTRIAL PLANTS AND SOIL BIOACCUMULATION FACTORS USED FOR TERRESTRIAL INVERTEBRATES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference	Value	Reference
Volatile Organics:				
1,1,1,2-Tetrachloroethane	1.1691	Travis and Arms 1988	1.00	Assumed
Carbon Tetrachloride	1.0234	Travis and Arms 1988	1.00	Assumed
Chlorobenzene	0.8608	Travis and Arms 1988	1.00	Assumed
Chloroform	3.0077	Travis and Arms 1988	1.00	Assumed
Ethylbenzene	0.5930	Travis and Arms 1988	1.00	Assumed
Pentachloroethane	0.6597	Travis and Arms 1988	1.00	Assumed
Styrene	0.7739	Travis and Arms 1988	1.00	Assumed
Toluene	0.9966	Travis and Arms 1988	1.00	Assumed
Trichloroethene	1.0510	Travis and Arms 1988	1.00	Assumed
Xylene	0.6010	Travis and Arms 1988	1.00	Assumed
Semi-Volatile Organics:				
1,2,4,5-Tetrachlorobenzene	0.0806	Travis and Arms 1988	1.00	Assumed
1,2,4-Trichlorobenzene	0.1863	Travis and Arms 1988	0.56	Beyer 1996
1,2-Dichlorobenzene (o-Dichlorobenzene)	0.4031	Travis and Arms 1988	1.00	Assumed
1,3-Dichlorobenzene (m-Dichlorobenzene)	0.3215	Travis and Arms 1988	1.00	Assumed
1,4,-Dichlorobenzene (p-Dichlorobenzne)	0.4085	Travis and Arms 1988	1.00	Assumed
2,3,4,6-Tetrachlorophenol	0.1051	Travis and Arms 1988	1.00	Assumed
2,4,5-Trichlorophenol	0.2157	Travis and Arms 1988	8.40	van Gestel and Ma 1988
2,4,6-Trichlorophenol	0.2814	Travis and Arms 1988	1.00	Assumed
2,4-Dichlorophenol	0.6423	Travis and Arms 1988	1.00	Assumed
2-Acetylaminofluorene	0.6090	Travis and Arms 1988	1.00	Assumed
2-Chloronaphthalene	0.1567	Travis and Arms 1988	1.00	Assumed
3,3'-Dichlorobenzidine	0.3624	Travis and Arms 1988	1.00	Assumed
3,3'-Dimethylbenzidine	1.0939	Travis and Arms 1988	1.00	Assumed
3-Methylcholanthrene	0.0075	Travis and Arms 1988	1.00	Assumed
4-Bromophenylphenyl ether	0.0499	Travis and Arms 1988	1.00	Assumed
4-Chloro-3-methylphenol	0.6255	Travis and Arms 1988	1.00	Assumed
4-Chlorophenylphenyl ether	0.0533	Travis and Arms 1988	1.00	Assumed
7,12-Dimethylbenz(a)anthracene	0.0058	Travis and Arms 1988	1.00	Assumed
Aramite	0.0634	Travis and Arms 1988	1.00	Assumed
Bis(2-ethylhexyl)phthalate	0.0023	Travis and Arms 1988	1.00	Assumed
Butylbenzylphthalate	0.0617	Travis and Arms 1988	1.00	Assumed
Diallate	0.0984	Travis and Arms 1988	1.00	Assumed
Dibenzofuran	0.1447	Travis and Arms 1988	1.00	Assumed
Diethylphthalate	1.3900	Travis and Arms 1988	1.00	Assumed
Di-n-butylphthalate	0.0838	Travis and Arms 1988	1.00	Assumed
Di-n-octylphthalate	0.0008	Travis and Arms 1988	1.00	Assumed
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	0.2852	Travis and Arms 1989	1.00	Assumed
Hexachlorobenzene	0.0153	Travis and Arms 1988	1.69	Beyer 1996
Hexachlorobutadiene	0.0642	Travis and Arms 1988	1.00	Assumed
Hexachlorocyclopentadiene	0.0297	Travis and Arms 1988	1.00	Assumed
Hexachloroethane	0.1888	Travis and Arms 1988	1.00	Assumed
Hexachlorophene	0.0017	Travis and Arms 1988	1.00	Assumed
Hexachloropropene	0.1139	Travis and Arms 1988	1.00	Assumed

TABLE 4-10

SOIL BIOCONCENTRATION FACTORS USED FOR TERRESTRIAL PLANTS AND SOIL BIOACCUMULATION FACTORS USED FOR TERRESTRIAL INVERTEBRATES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference	Value	Reference
Semi-Volatile Organics:				
Isosafrole	0.4367	Travis and Arms 1988	1.00	Assumed
n-Nitrosodiphenylamine	0.5775	Travis and Arms 1988	1.00	Assumed
p-Dimethylaminoazobenzene	0.0872	Travis and Arms 1988	1.00	Assumed
Pentachlorobenzene	0.0353	Travis and Arms 1988	1.00	Assumed
Pentachloronitrobenzene	0.0806	Travis and Arms 1988	1.00	Assumed
Pentachlorophenol	0.0443	Travis and Arms 1988	8.00	van Gestel and Ma 1988
Pronamide	0.3624	Travis and Arms 1988	1.00	Assumed
PAHs:				
1-Methylnaphthalene	0.2245	Travis and Arms 1988	0.23	Beyer and Stafford 1993
2-Methylnaphthalene	0.2157	Travis and Arms 1988	0.20	Beyer and Stafford 1993
Acenaphthene	0.21	Travis and Arms 1988	0.30	Beyer and Stafford 1993
Acenaphthylene	0.1653	Travis and Arms 1988	0.22	Beyer and Stafford 1993
Anthracene	0.0908	Travis and Arms 1988	0.32	Beyer and Stafford 1993
Benzo(a)anthracene	0.0197	Travis and Arms 1988	0.27	Beyer and Stafford 1993
Benzo(a)pyrene	0.0114	Travis and Arms 1988	0.34	Beyer and Stafford 1993
Benzo(b)fluoranthene	0.0101	Travis and Arms 1988	0.21	Beyer and Stafford 1993
Benzo(g,h,i)perylene	0.0052	Travis and Arms 1988	0.15	Beyer and Stafford 1993
Benzo(k)fluoranthene	0.0101	Travis and Arms 1988	0.21	Beyer and Stafford 1993
Chrysene	0.0197	Travis and Arms 1988	0.44	Beyer and Stafford 1993
Dibenzo(a,h)anthracene	0.0053	Travis and Arms 1988	0.49	Beyer and Stafford 1993
Fluoranthene	0.0425	Travis and Arms 1988	0.37	Beyer and Stafford 1993
Fluorene	0.1428	Travis and Arms 1988	0.20	Beyer and Stafford 1993
Indeno(1,2,3-cd)pyrene	0.0056	Travis and Arms 1988	0.41	Beyer and Stafford 1993
Naphthalene	0.4425	Travis and Arms 1988	0.21	Beyer and Stafford 1993
Phenanthrene	0.0908	Travis and Arms 1988	0.28	Beyer and Stafford 1993
Pyrene	0.0056	Travis and Arms 1988	0.39	Beyer and Stafford 1993
PCBs:				
Aroclor-1016	0.0219	Travis and Arms 1988	15.91	Sample et al. 1998a
Aroclor-1221	0.0933	Travis and Arms 1988	15.91	Sample et al. 1998a
Aroclor-1232	0.0933	Travis and Arms 1988	15.91	Sample et al. 1998a
Aroclor-1242	0.0090	Travis and Arms 1988	15.91	Sample et al. 1998a
Aroclor-1248	0.0084	Travis and Arms 1988	15.91	Sample et al. 1998a
Aroclor-1254	0.0046	Travis and Arms 1988	15.91	Sample et al. 1998a
Aroclor-1260	0.0006	Travis and Arms 1988	15.91	Sample et al. 1998a
Inorganics:				
Antimony	0.2	Baes et al. 1984	1.00	Assumed
Arsenic	1.103	Bechtel Jacobs 1998a	0.523	Sample et al. 1998a
Barium	0.15	Baes et al. 1984	0.36	Beyer and Stafford 1993
Beryllium	0.01	Baes et al. 1984	1.00	Assumed
Cadmium	3.25	Bechtel Jacobs 1998a	40.69	Sample et al. 1998a
Chromium (total)	0.0075	Baes et al. 1984	3.162	Sample et al. 1998a
Cobalt	0.02	Baes et al. 1984	1.00	Assumed

TABLE 4-10

SOIL BIOCONCENTRATION FACTORS USED FOR TERRESTRIAL PLANTS AND SOIL BIOACCUMULATION FACTORS USED FOR TERRESTRIAL INVERTEBRATES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference	Value	Reference
Inorganics:				
Copper	0.625	Bechtel Jacobs 1998a	1.531	Sample et al. 1998a
Lead	0.468	Bechtel Jacobs 1998a	1.522	Sample et al. 1998a
Mercury	5.00	Bechtel Jacobs 1998a	20.63	Sample et al. 1998a
Nickel	1.411	Bechtel Jacobs 1998a	4.73	Sample et al. 1998a
Selenium	3.012	Bechtel Jacobs 1998a	1.34	Sample et al. 1998a
Silver	0.40	Baes et al. 1984	1.00	Assumed
Thallium	0.004	Baes et al. 1984	1.00	Assumed
Tin	0.03	Baes et al. 1984	1.00	Assumed
Vanadium	0.0055	Baes et al. 1984	0.088	Sample et al. 1998a
Zinc	1.82	Bechtel Jacobs 1998a	12.89	Sample et al. 1998a

Notes:

BCF = Bioconcentration Factor
BAF = Bioaccumulation Factor

TABLE 4-11

SOIL BIOACCUMULATION FACTORS USED FOR SMALL MAMMAL PREY ITEMS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Omnivore BAF (dry weight)	
	Value	Reference
Volatile Organics:		
1,1,1,2-Tetrachloroethane	---	see text
Carbon Tetrachloride	---	see text
Chlorobenzene	---	see text
Chloroform	---	see text
Ethylbenzene	---	see text
Pentachloroethane	---	see text
Styrene	---	see text
Toluene	---	see text
Trichloroethene	---	see text
Xylene	---	see text
Semi-Volatile Organics:		
1,2,4,5-Tetrachlorobenzene	---	see text
1,2,4-Trichlorobenzene	---	see text
1,2-Dichlorobenzene (o-Dichlorobenzene)	---	see text
1,3-Dichlorobenzene (m-Dichlorobenzene)	---	see text
1,4,-Dichlorobenzene (p-Dichlorobenzne)	---	see text
2,3,4,6-Tetrachlorophenol	---	see text
2,4,5-Trichlorophenol	---	see text
2,4,6-Trichlorophenol	---	see text
2,4-Dichlorophenol	---	see text
2-Acetylaminofluorene	---	see text
2-Chloronaphthalene	---	see text
3,3'-Dichlorobenzidine	---	see text
3,3'-Dimethylbenzidine	---	see text
3-Methylcholanthrene	---	see text
4-Bromophenylphenyl ether	---	see text
4-Chloro-3-methylphenol	---	see text
4-Chlorophenylphenyl ether	---	see text
7,12-Dimethylbenz(a)anthracene	---	see text
Aramite	---	see text
Bis(2-ethylhexyl)phthalate	---	see text
Butylbenzylphthalate	---	see text
Diallate	---	see text
Dibenzofuran	---	see text
Diethylphthalate	---	see text
Di-n-butylphthalate	---	see text
Di-n-octylphthalate	---	see text
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	---	see text
Hexachlorobenzene	---	see text
Hexachlorobutadiene	---	see text
Hexachlorocyclopentadiene	---	see text
Hexachloroethane	---	see text
Hexachlorophene	---	see text

TABLE 4-11

**SOIL BIOACCUMULATION FACTORS USED FOR SMALL MAMMAL PREY ITEMS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO**

Chemical	Soil-Omnivore BAF (dry weight)	
	Value	Reference
Semi-Volatile Organics:		
Hexachloropropene	---	see text
Isosafrole	---	see text
n-Nitrosodiphenylamine	---	see text
p-Dimethylaminoazobenzene	---	see text
Pentachlorobenzene	---	see text
Pentachloronitrobenzene	---	see text
Pentachlorophenol	---	see text
Pronamide	---	see text
PAHs:		
1-Methylnaphthalene	---	see text
2-Methylnaphthalene	---	see text
Acenaphthene	---	see text
Acenaphthylene	---	see text
Anthracene	---	see text
Benzo(a)anthracene	---	see text
Benzo(a)pyrene	---	see text
Benzo(b)fluoranthene	---	see text
Benzo(g,h,i)perylene	---	see text
Benzo(k)fluoranthene	---	see text
Chrysene	---	see text
Dibenzo(a,h)anthracene	---	see text
Fluoranthene	---	see text
Fluorene	---	see text
Indeno(1,2,3-cd)pyrene	---	see text
Naphthalene	---	see text
Phenanthrene	---	see text
Pyrene	---	see text
PCBs:		
Aroclor-1016	---	see text
Aroclor-1221	---	see text
Aroclor-1232	---	see text
Aroclor-1242	---	see text
Aroclor-1248	---	see text
Aroclor-1254	---	see text
Aroclor-1260	---	see text
Inorganics:		
Antimony	---	see text
Arsenic	0.014	Sample et al. 1998b
Barium	0.069	Sample et al. 1998b
Beryllium	---	see text
Cadmium	0.462	Sample et al. 1998b
Chromium (total)	0.349	Sample et al. 1998b

TABLE 4-11

SOIL BIOACCUMULATION FACTORS USED FOR SMALL MAMMAL PREY ITEMS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Omnivore BAF (dry weight)	
	Value	Reference
Inorganics:		
Cobalt	0.025	Sample et al. 1998b
Copper	0.554	Sample et al. 1998b
Lead	0.286	Sample et al. 1998b
Mercury	0.13	Sample et al. 1998b
Nickel	0.589	Sample et al. 1998b
Selenium	1.263	Sample et al. 1998b
Silver	---	see text
Thallium	0.1227	Sample et al. 1998b
Tin	---	see text
Vanadium	---	see text
Zinc	2.7822	Sample et al. 1998b

Notes:

BAF = Bioaccumulation Factor

TABLE 4-12

SEDIMENT BIOACCUMULATION FACTORS USED FOR AQUATIC INVERTEBRATES AND FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference
Volatile Organics:				
1,1,1,2-Tetrachloroethane	1.00	Assumed	1.00	Assumed
Carbon Tetrachloride	1.00	Assumed	1.00	Assumed
Chlorobenzene	1.00	Assumed	1.00	Assumed
Chloroform	1.00	Assumed	1.00	Assumed
Ethylbenzene	1.00	Assumed	1.00	Assumed
Pentachloroethane	1.00	Assumed	1.00	Assumed
Styrene	1.00	Assumed	1.00	Assumed
Toluene	1.00	Assumed	1.00	Assumed
Trichloroethene	1.00	Assumed	1.00	Assumed
Xylene	1.00	Assumed	1.00	Assumed
Semi-Volatile Organics:				
1,2,4,5-Tetrachlorobenzene	1.00	Assumed	1.00	Assumed
1,2,4-Trichlorobenzene	1.00	Assumed	1.00	Assumed
1,2-Dichlorobenzene (o-Dichlorobenzene)	1.00	Assumed	1.00	Assumed
1,3-Dichlorobenzene (m-Dichlorobenzene)	1.00	Assumed	1.00	Assumed
1,4,-Dichlorobenzene (p-Dichlorobenzne)	1.00	Assumed	1.00	Assumed
2,3,4,6-Tetrachlorophenol	1.00	Assumed	1.00	Assumed
2,4,5-Trichlorophenol	1.00	Assumed	1.00	Assumed
2,4,6-Trichlorophenol	1.00	Assumed	1.00	Assumed
2,4-Dichlorophenol	1.00	Assumed	1.00	Assumed
2-Acetylaminofluorene	1.00	Assumed	1.00	Assumed
2-Chloronaphthalene	1.00	Assumed	1.00	Assumed
3,3'-Dichlorobenzidine	1.00	Assumed	1.00	Assumed
3,3'-Dimethylbenzidine	1.00	Assumed	1.00	Assumed
3-Methylcholanthrene	1.00	Assumed	1.00	Assumed
4-Bromophenylphenyl ether	1.00	Assumed	1.00	Assumed
4-Chloro-3-methylphenol	1.00	Assumed	1.00	Assumed
4-Chlorophenylphenyl ether	1.00	Assumed	1.00	Assumed
7,12-Dimethylbenz(a)anthracene	1.00	Assumed	1.00	Assumed
Aramite	1.00	Assumed	1.00	Assumed
Bis(2-ethylhexyl)phthalate	1.00	Assumed	1.00	Assumed
Butylbenzylphthalate	1.00	Assumed	1.00	Assumed
Diallate	1.00	Assumed	1.00	Assumed
Dibenzofuran	1.00	Assumed	1.00	Assumed
Diethylphthalate	1.00	Assumed	1.00	Assumed
Di-n-butylphthalate	1.00	Assumed	1.00	Assumed
Di-n-octylphthalate	1.00	Assumed	1.00	Assumed
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	1.00	Assumed	1.00	Assumed
Hexachlorobenzene	1.00	Assumed	1.00	Assumed
Hexachlorobutadiene	1.00	Assumed	1.00	Assumed
Hexachlorocyclopentadiene	1.00	Assumed	1.00	Assumed
Hexachloroethane	1.00	Assumed	1.00	Assumed
Hexachlorophene	1.00	Assumed	1.00	Assumed

TABLE 4-12

SEDIMENT BIOACCUMULATION FACTORS USED FOR AQUATIC INVERTEBRATES AND FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference
Semi-Volatile Organics:				
Hexachloropropene	1.00	Assumed	1.00	Assumed
Isosafrole	1.00	Assumed	1.00	Assumed
n-Nitrosodiphenylamine	1.00	Assumed	1.00	Assumed
p-Dimethylaminoazobenzene	1.00	Assumed	1.00	Assumed
Pentachlorobenzene	1.00	Assumed	1.00	Assumed
Pentachloronitrobenzene	1.00	Assumed	1.00	Assumed
Pentachlorophenol	1.00	Assumed	1.00	Assumed
Pronamide	1.00	Assumed	1.00	Assumed
PAHs:				
1-Methylnaphthalene	1.00	Assumed	1.00	Assumed
2-Methylnaphthalene	1.00	Assumed	1.00	Assumed
Acenaphthene	2.04	Maruya et al. 1997	1.00	Assumed
Acenaphthylene	1.00	Assumed	1.00	Assumed
Anthracene	10.271	Maruya et al. 1997	1.00	Assumed
Benzo(a)anthracene	1.40	Travis and Arms 1988	1.00	Assumed
Benzo(a)pyrene	0.191	Maruya et al. 1997	1.00	Assumed
Benzo(b)fluoranthene	0.16	Maruya et al. 1997	1.00	Assumed
Benzo(g,h,i)perylene	0.295	Maruya et al. 1997	1.00	Assumed
Benzo(k)fluoranthene	0.421	Maruya et al. 1997	1.00	Assumed
Chrysene	0.335	Maruya et al. 1997	1.00	Assumed
Dibenzo(a,h)anthracene	1.00	Assumed	1.00	Assumed
Fluoranthene	0.312	Maruya et al. 1997	1.00	Assumed
Fluorene	1.13	Maruya et al. 1997	1.00	Assumed
Indeno(1,2,3-cd)pyrene	0.355	Maruya et al. 1997	1.00	Assumed
Naphthalene	1.00	Assumed	1.00	Assumed
Phenanthrene	0.652	Maruya et al. 1997	1.00	Assumed
Pyrene	0.803	Maruya et al. 1997	1.00	Assumed
PCBs:				
Aroclor-1016	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Aroclor-1221	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Aroclor-1232	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Aroclor-1242	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Aroclor-1248	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Aroclor-1254	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Aroclor-1260	21.89	Bechtel Jacobs 1998b	11.24	Oliver and Niimi 1988
Inorganics:				
Antimony	1.00	Assumed	1.00	Assumed
Arsenic	0.675	Bechtel Jacobs 1998b	0.126	Pascoe et al. 1996
Barium	1.00	Assumed	1.00	Assumed
Beryllium	1.00	Assumed	1.00	Assumed
Cadmium	3.073	Bechtel Jacobs 1998b	0.164	Pascoe et al. 1996
Chromium (total)	0.186	Bechtel Jacobs 1998b	0.038	Krantzberg and Boyd 1992

TABLE 4-12

SEDIMENT BIOACCUMULATION FACTORS USED FOR AQUATIC INVERTEBRATES AND FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE
BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference
Inorganics:				
Cobalt	1.00	Assumed	1.00	Assumed
Copper	7.957	Bechtel Jacobs 1998b	0.10	Krantzberg and Boyd 1992
Lead	0.326	Bechtel Jacobs 1998b	0.07	Krantzberg and Boyd 1992
Mercury	1.735	Bechtel Jacobs 1998b	4.58	Cope et al. 1990
Nickel	0.214	Bechtel Jacobs 1998b	1.00	Assumed
Selenium	1.00	Assumed	1.00	Assumed
Silver	0.18	Hirsch 1998	1.00	Assumed
Thallium	1.00	Assumed	1.00	Assumed
Tin	1.00	Assumed	1.00	Assumed
Vanadium	1.00	Assumed	1.00	Assumed
Zinc	4.759	Bechtel Jacobs 1998b	0.147	Pascoe et al. 1996

Notes:

BAF = Bioaccumulation Factor

TABLE 4-13

SURFACE WATER BIOACCUMULATION FACTORS USED FOR FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1][2]	Surface Water to Fish BCF (dry weight)		Food Chain Multiplier [3]		Surface Water-Fish BAF (dry weight) [4]	
	Value	Reference	Value	Reference	Value [1]	Reference
Volatile Organics:						
Ethylbenzene	15.1	SRC 2003	1.034	USEPA 1995b	15.6	estimated
Styrene	13.5	SRC 2003	1.028	USEPA 1995b	13.9	estimated
Toluene	37.2	SRC 2003	1.028	USEPA 1995b	38.2	estimated
Semi-Volatile Organics:						
Butylbenzylphthalate	661	SRC 2003	1.95	USEPA 1995b	1,289	estimated
Di-n-butylphthalate	11.7	SRC 2003	1.95	USEPA 1995b	22.8	estimated
Di-n-octylphthalate	5,495	SRC 2003	8.22	USEPA 1995b	45,180	estimated
PAHs:						
2-Methylnaphthalene	97.7	SRC 2003	1.00	assumed	97.7	estimated
Benzo(b)fluoranthene	2,500 [5]	USEPA 1999a	1.00	assumed	2,500	estimated
Naphthalene	427	SRC 2003	1.00	assumed	427	estimated
Inorganics:						
Antimony	1.00	Sample et al. 1996	1.00	Sample et al. 1996	1.00	estimated
Arsenic	4.00	USEPA 1985a	1.00	Sample et al. 1996	4.00	estimated
Barium	95.0	SRC 2000	1.00	Sample et al. 1996	95.0	estimated
Chromium	3.00	Sample et al. 1996	1.00	Sample et al. 1996	3.00	estimated
Cobalt	190	USEPA 2003	1.00	Sample et al. 1996	190	estimated
Copper	290	Sample et al. 1996	1.00	Sample et al. 1996	290	estimated
Lead	45.0	Sample et al. 1996	1.00	Sample et al. 1996	45.0	estimated
Nickel	106	Sample et al. 1996	1.00	Sample et al. 1996	106	estimated
Selenium	---	---	---	---	2,600	Sample et al. 1996
Tin	85.0	SRC 2000	1.00	Sample et al. 1996	85.0	estimated
Vanadium	153	SRC 2000	1.00	Sample et al. 1996	153	estimated
Zinc	966	Sample et al. 1996	1.00	Sample et al. 1996	966	estimated

TABLE 4-13

SURFACE WATER BIOACCUMULATION FACTORS USED FOR FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Notes:

BAF = Bioaccumulation Factor.
BCF = Bioconcentration Factor
SRC = Syracuse Research Corporation
USEPA = United States Environmental Protection Agency

(1) The organics shown are limited to those detected in surface water.

(2) The metals shown are limited to those detected in the dissolved (filtered) fraction.

(3) The food chain multipliers shown are for trophic level 3 fish.

(4) Estimated BAF values were derived using the following equation (USEPA 1995b and Sample et al. 1996): BAF = (BCF)(FCM) where BAF is the bioaccumulation factor, BCF is the bioconcentration factor, and FCM is the food chain multiplier.

(5) The value shown is a BAF for benzo(a)pyrene.

TABLE 4-14

CONSERVATIVE EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Receptor	Habitat	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Area Use Factor
		Value	Reference	Value	Reference	
Birds:						
American robin	Terrestrial	0.0635	USEPA 1993b	0.00567	Levey and Karasov 1989	1.00
Belted kingfisher	Aquatic (estuarine wetland)	0.125	Dunning 1993	0.02666	USEPA 1993b	1.00
Mourning dove	Terrestrial	0.105	Tomlinson et al. 1994	0.01787	Allometric equation from Nagy 1987 for all birds	1.00
Red-tailed hawk	Terrestrial	0.957	USEPA 1993b	0.03952	Sample and Suter II 1994	1.00
Double-crested cormorant	Aquatic	1.825	Glahn amd McCoy 1995	0.09250	Bivings et al. 1989	1.00
Mammal:						
West Indian manatee	Aquatic	800 kg	USGS 2000	21.87	Etheridge et al. 1985	1.00
Small mammal omnivore (prey item)	Terrestrial	0.375	Jackson 1992	0.0176	Allometric equation from Nagy 1987 for rodents	1.00

TABLE 4-15

DIETARY COMPOSITION FOR UPPER TROPHIC LEVEL RECEPTORS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Receptor	Dietary Composition (percent)							Soil/ Sediment Ingestion (percent)	
	Terr. Plants	Soil Invert.	Small Mammals	Fish	Aquatic Plants	Aquatic Invert.	Reference	Value	Reference
Birds:									
American robin	12.0	78.9 [1]	0	0	0	0	Martin et al. 1951	9.10	Sample and Suter II 1994
Belted kingfisher	0	0	0	92.6	0	4.90	USEPA 1993b	2.50	Assumed
Double-crested cormorant	0	0	0	100	0	0	Bivings et al. 1989	0	Assumed
Great blue heron	0	0	0	93.6	0	3.90	USEPA 1993b	2.50	Assumed
Mourning dove	95.0	0	0	0	0	0	Tomlinson et al. 1994	5.00	Assumed
Red-tailed hawk	0	0	97.5	0	0	0	USEPA 1993b; Sample and Suter II 1994	2.50	Assumed
Spotted sandpiper	0	0	0	0	0	81.9	USEPA 1993b	18.1	Beyer et al. 1994
Mammals:									
West indian Manatee	0	0	0	0	99.0	0	USFWS 1986 and Odell 1992	1.00	USGS 2000
Small Mammal Omnivore (prey item)	49.0	49.0	0	0	0	0	Assumed	2.00	Assumed

Notes:

(1) Dietary compositions were available for spring, summer, winter, and fall. For conservatism, the percentage of soil invertebrates shown represents the highest percentage of terrestrial insects reported for a given season (spring).

TABLE 4-16

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Surface Soil Screening Values (SSSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Volatile Organics (ug/kg)										
1,1,1,2-Tetrachloroethane	0/4	NA	11U - 12U	5.63	12.0	100	CCME 2002	0.12	No	Below SSSV
1,1,1-Trichloroethane	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
1,1,2,2-Tetrachloroethane	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
1,1,2-Trichloroethane	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
1,1-Dichloroethane	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
1,1-Dichloroethene	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
1,2,3-Trichloropropane	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
1,2-Dibromo-3-chloropropane	0/4	NA	22U - 23U	11.3	23.0	NE	---	NA	Yes	Not Detected
1,2-Dibromoethane (EDB)	0/4	NA	22U - 23U	11.3	23.0	100	CCME 2002	0.23	No	Below SSSV
1,2-Dichloroethane	0/4	NA	5U - 6U	2.88	6.00	401	MHSPE 1994	0.01	No	Below SSSV
1,2-Dichloroethene (Total)	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
1,2-Dichloropropane	0/4	NA	5U - 6U	2.88	6.00	700,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
2-Butanone (Methyl ethyl ketone)	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
2-Hexanone	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
3-Chloropropene (Allyl chloride)	0/4	NA	22UJ - 23UJ	11.3	23.0	NE	---	NA	Yes	Not Detected
4-Methyl-2-pentanone (MIBK)	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
Acetone	0/4	NA	11UJ - 12UJ	5.63	12.0	NE	---	NA	Yes	Not Detected
Acetonitrile	0/4	NA	110UJ - 120UJ	56.3	120	NE	---	NA	Yes	Not Detected
Acrolein (Propenal)	0/4	NA	550UJ - 580U	283	580	NE	---	NA	Yes	Not Detected
Acrylonitrile	0/4	NA	110UJ - 120UJ	56.3	120	1,000,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
Benzene	0/4	NA	5U - 6U	2.88	6.00	105	MHSPE 1994	0.06	No	Below SSSV
Bromodichloromethane	0/4	NA	5U - 6U	2.88	6.00	NE	---	NA	Yes	Not Detected
Bromoform	0/4	NA	5UJ - 6UJ	2.88	6.00	NE	---	NA	Yes	Not Detected
Bromomethane (Methyl bromide)	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
Carbon disulfide	0/4	NA	5U - 6UJ	2.88	6.00	NE	---	NA	Yes	Not Detected
Carbon tetrachloride	0/4	NA	5U - 6U	2.88	6.00	1,000,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
Chlorobenzene	0/4	NA	5U - 6U	2.88	6.00	40,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
Chloroethane	0/4	NA	11UJ - 12UJ	5.63	12.0	NE	---	NA	Yes	Not Detected
Chloroform	0/4	NA	5U - 6U	2.88	6.00	1,000	MHSPE 1994	<0.01	No	Below SSSV
Chloromethane (Methyl chloride)	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
Cis-1,3-Dichloropropene	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
Dibromochloromethane	0/4	NA	5UJ - 6U	2.88	6.00	NE	---	NA	Yes	Not Detected
Dibromomethane (Methylene bromide)	0/4	NA	11U - 12UJ	5.63	12.0	NE	---	NA	Yes	Not Detected
Dichlorodifluoromethane	0/4	NA	22U - 23U	11.3	23.0	NE	---	NA	Yes	Not Detected
Ethyl methacrylate	0/4	NA	22UJ - 23UJ	11.3	23.0	NE	---	NA	Yes	Not Detected
Ethylbenzene	0/4	NA	5U - 6U	2.88	6.00	5,005	MHSPE 1994	<0.01	No	Below SSSV
Iodomethane (Methyl iodide)	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
Methacrylonitrile	0/4	NA	22UJ - 23UJ	11.3	23.0	NE	---	NA	Yes	Not Detected
Methyl methacrylate	0/4	NA	22UJ - 23U	11.3	23.0	NE	---	NA	Yes	Not Detected
Methylene chloride (Dichloromethane)	0/4	NA	5U - 6U	2.88	6.00	1,001	MHSPE 1994	<0.01	No	Below SSSV
Pentachloroethane	0/4	NA	22UJ - 23UJ	11.3	23.0	NE	---	NA	Yes	Not Detected
Propionitrile	0/4	NA	55U - 58U	28.3	58.0	NE	---	NA	Yes	Not Detected
Styrene	0/4	NA	5U - 6U	2.88	6.00	10,010	MHSPE 1994	<0.01	No	Below SSSV
Tetrachloroethene	0/4	NA	5UJ - 6UJ	2.88	6.00	401	MHSPE 1994	0.01	No	Below SSSV

TABLE 4-16

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Soil Screening Values (SSSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)					
Volatile Organics (ug/kg)										
Toluene	0/4	NA	5U - 6U	2.88	6.00	13,005	MHSPE 1994	<0.01	No	Below SSSV
Trans-1,3-dichloropropene	0/4	NA	5U - 6U	2.88	6.00	100	CCME 2002	0.06	No	Below SSSV
Trans-1,4-dichloro-2-butene	0/4	NA	22UJ - 23UJ	11.3	23.0	1,000,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
Trichloroethene	0/4	NA	5UJ - 6UJ	2.88	6.00	6,000	MHSPE 1994	<0.01	No	Below SSSV
Trichlorofluoromethane	0/4	NA	11U - 12U	5.63	12.0	NE	---	NA	Yes	Not Detected
Vinyl acetate	0/4	NA	11UJ - 12UJ	5.63	12.0	NE	---	NA	Yes	Not Detected
Vinyl chloride	0/4	NA	11U - 12U	5.63	12.0	11.1	MHSPE 1994	1.08	Yes	Not Detected
Xylenes, Total	0/4	NA	5U - 6U	2.88	6.00	2,505	MHSPE 1994	<0.01	No	Below SSSV
Semi-Volatile Organics (ug/kg)										
1,2,4,5-Tetrachlorobenzene	0/4	NA	360U - 380U	186	380	50.0	CCME 2002	7.60	Yes	Not Detected
1,2,4-Trichlorobenzene	0/4	NA	360U - 380U	186	380	20,000	Efroymson et al. 1997a	0.02	No	Below SSSV
1,2-Dichlorobenzene (o-Dichlorobenzene)	0/4	NA	360U - 380U	186	380	3,001	MHSPE 1994	0.13	No	Below SSSV
1,3,5-Trinitrobenzene	0/2	NA	3700UJ - 3800UJ	1,875	3,800	50.0	CCME 2002	76.0	Yes	Not Detected
1,3-Dichlorobenzene (m-Dichlorobenzene)	0/4	NA	360U - 380U	186	380	3,001	MHSPE 1994	0.13	No	Below SSSV
1,4-Dichlorobenzene (p-Dichlorobenzene)	0/4	NA	360U - 380U	186	380	20,000	Efroymson et al. 1997a	0.02	No	Below SSSV
1,4-Dioxane	0/4	NA	730U - 760UJ	374	760	NE	---	NA	Yes	Not Detected
1,4-Naphthoquinone	0/4	NA	1800U - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
1-Naphthylamine	0/4	NA	730U - 760UJ	374	760	NE	---	NA	Yes	Not Detected
2,2'-Oxybis(1-Chloropropane)[Bis(2-chloroisopropyl)ether]	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
2,3,4,6-Tetrachlorophenol	0/4	NA	360U - 380U	186	380	1,001	MHSPE 1994	0.38	No	Below SSSV
2,4,5-Trichlorophenol	0/4	NA	1800U - 1900U	925	1,900	4,000	Efroymson et al. 1997b	0.48	No	Below SSSV
2,4,6-Trichlorophenol	0/4	NA	360U - 380U	186	380	10,000	Efroymson et al. 1997a	0.04	No	Below SSSV
2,4-Dichlorophenol	0/4	NA	360U - 380U	186	380	1,001	MHSPE 1994	0.38	No	Below SSSV
2,4-Dimethylphenol	0/4	NA	360U - 380U	186	380	100	CCME 2002	3.80	Yes	Not Detected
2,4-Dinitrophenol	0/4	NA	1800U - 1900U	925	1,900	20,000	Efroymson et al. 1997b	0.10	No	Below SSSV
2,4-Dinitrotoluene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
2,6-Dichlorophenol	0/4	NA	360U - 380U	186	380	1,001	MHSPE 1994	0.38	No	Below SSSV
2,6-Dinitrotoluene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
2-Acetylaminofluorene	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
2-Chloronaphthalene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
2-Chlorophenol	0/4	NA	360U - 380U	186	380	1,001	MHSPE 1994	0.38	No	Below SSSV
2-Naphthylamine	0/4	NA	910U - 960U	468	960	NE	---	NA	Yes	Not Detected
2-Nitroaniline (o-Nitroaniline)	0/4	NA	1800U - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
2-Nitrophenol (o-Nitrophenol)	0/4	NA	360U - 380U	186	380	7,000	---	0.05	No	Below SSSV
2-Picoline	0/4	NA	360U - 380UJ	186	380	NE	---	NA	Yes	Not Detected
3,3'-Dichlorobenzidine	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
3,3'-Dimethylbenzidine	0/4	NA	1800UJ - 1900UJ	925	1,900	NE	---	NA	Yes	Not Detected
3-Methylcholanthrene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
3-Nitroaniline (m-Nitroaniline)	0/4	NA	1800U - 1900UJ	925	1,900	NE	---	NA	Yes	Not Detected
4,6-Dinitro-2-Methylphenol (4,6-Dinitro-o-cresol)	0/4	NA	1800U - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
4-Aminobiphenyl	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
4-Bromophenylphenyl ether	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
4-Chloro-3-methylphenol (p-Chloro-m-cresol)	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
4-Chloroaniline (p-Chloroaniline)	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected

TABLE 4-16

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Surface Soil Screening Values (SSSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Semi-Volatile Organics (ug/kg)										
4-Chlorophenylphenyl ether	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
4-Nitroaniline (p-Nitroaniline)	0/4	NA	1800UJ - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
4-Nitrophenol (p-Nitrophenol)	0/4	NA	1800U - 1900U	925	1,900	7,000	Efroymson et al. 1997a	0.27	No	Below SSSV
4-Nitroquinoline-1-oxide	0/4	NA	1800U - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
5-Nitro-o-toluidine	0/4	NA	730UJ - 760UJ	374	760	NE	---	NA	Yes	Not Detected
7,12-Dimethylbenz(a)anthracene	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
Acetophenone	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
alpha,alpha-Dimethylphenethylamine	0/4	NA	1800UJ - 1900UJ	925	1,900	NE	---	NA	Yes	Not Detected
Aniline	0/4	NA	1800U - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
Aramite, Total	0/4	NA	730UJ - 760U	374	760	NE	---	NA	Yes	Not Detected
Benzyl alcohol	0/4	NA	360U - 380UJ	186	380	NE	---	NA	Yes	Not Detected
Bis(2-chloroethoxy)methane	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Bis(2-chloroethyl)ether	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Bis(2-ethylhexyl)phthalate	0/4	NA	360U - 380U	186	380	6,010	MHSPE 1994	0.06	No	Below SSSV
Butylbenzylphthalate	0/4	NA	360U - 380U	186	380	6,010	MHSPE 1994	0.06	No	Below SSSV
Chlorobenzilate	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Cresol (ortho)	0/4	NA	360U - 380U	186	380	100	CCME 2002	3.80	Yes	Not Detected
Cresol, m & p	0/4	NA	360U - 380U	186	380	100	CCME 2002	3.80	Yes	Not Detected
Diallate, Total	0/4	NA	360UJ - 380U	186	380	NE	---	NA	Yes	Not Detected
Dibenzofuran	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Diethylphthalate	0/4	NA	360U - 380U	186	380	100,000	Efroymson et al. 1997b	<0.01	No	Below SSSV
Dimethylphthalate	0/4	NA	360U - 380U	186	380	200,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
Di-n-butylphthalate	0/4	NA	360U - 380U	186	380	200,000	Efroymson et al 1997b	<0.01	No	Below SSSV
Di-n-octylphthalate	0/4	NA	360U - 380U	186	380	6,010	MHSPE 1994	0.06	No	Below SSSV
Dinoseb (2-Sec-butyl-4,6-dinitrophenol)	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
Ethyl methanesulfonate	0/4	NA	360U - 380UJ	186	380	NE	---	NA	Yes	Not Detected
Hexachlorobenzene	0/4	NA	360U - 380U	186	380	1,000,000	Efroymson et al. 1997a	<0.01	No	Below SSSV
Hexachlorobutadiene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Hexachlorocyclopentadiene	0/4	NA	360U - 380U	186	380	10,000	Efroymson et al. 1997b	0.04	No	Below SSSV
Hexachloroethane	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Hexachlorophene	0/4	NA	3600U - 3800U	1,863	3,800	NE	---	NA	Yes	Not Detected
Hexachloropropene	0/4	NA	1800U - 1900U	925	1,900	NE	---	NA	Yes	Not Detected
Isophorone	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Isosafrole	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
m-Dinitrobenzene	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
Methapyrilene	0/4	NA	910U - 960U	468	960	NE	---	NA	Yes	Not Detected
Methyl methanesulfonate	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Nitrobenzene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
N-Nitrosodiethylamine	0/4	NA	360U - 380U	186	380	20,000	---	0.02	No	Below SSSV
N-Nitrosodimethylamine	0/4	NA	360U - 380U	186	380	20,000	---	0.02	No	Below SSSV
N-Nitrosodi-n-butylamine	0/4	NA	360U - 380U	186	380	20,000	---	0.02	No	Below SSSV
N-Nitrosodi-n-propylamine	0/4	NA	360U - 380U	186	380	20,000	---	0.02	No	Below SSSV
N-Nitrosodiphenylamine	0/4	NA	360U - 380U	186	380	20,000	Efroymson et al. 1997a	0.02	No	Below SSSV

TABLE 4-16

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Surface Soil Screening Values (SSSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Semi-Volatile Organics (ug/kg)										
N-Nitrosomethylethylamine	0/4	NA	360UJ - 380U	186	380	20,000	---	0.02	No	Below SSSV
N-Nitrosomorpholine	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
N-Nitrosopiperidine	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
N-Nitrosopyrrolidine	0/4	NA	1800UJ - 1900UJ	925	1,900	NE	---	NA	Yes	Not Detected
O-Toluidine	0/4	NA	360UJ - 380UJ	186	380	NE	---	NA	Yes	Not Detected
P-(Dimethylamino)azobenzene	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
Pentachlorobenzene	0/4	NA	360U - 380U	186	380	1,150	USEPA 1999a	0.33	No	Below SSSV
Pentachloronitrobenzene	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Pentachlorophenol	0/4	NA	1800U - 1900U	925	1,900	1,730	USEPA 1999a	1.10	Yes	Not Detected
Phenacetin	0/4	NA	360U - 380UJ	186	380	NE	---	NA	Yes	Not Detected
Phenol	0/4	NA	360U - 380U	186	380	30,000	Efroymson et al. 1997a	0.01	No	Below SSSV
Pronamide	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
Pyridine	0/4	NA	730U - 760U	374	760	NE	---	NA	Yes	Not Detected
Safrole	0/4	NA	360U - 380U	186	380	NE	---	NA	Yes	Not Detected
PAHs (ug/kg)										
2-Methylnaphthalene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Acenaphthene	0/4	NA	360U - 380U	186	380	20,000	Efroymson et al. 1997b	0.02	No	Below SSSV
Acenaphthylene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Anthracene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Benzo(a)anthracene	0/4	NA	360U - 380U	186	380	1,200	USEPA 1999a	0.32	No	Below SSSV
Benzo(a)pyrene	0/4	NA	360U - 380U	186	380	1,200	USEPA 1999a	0.32	No	Below SSSV
Benzo(b)fluoranthene	0/4	NA	360U - 380U	186	380	1,200	USEPA 1999a	0.32	No	Below SSSV
Benzo(g,h,i)perylene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Benzo(k)fluoranthene	0/4	NA	360U - 380U	186	380	1,200	USEPA 1999a	0.32	No	Below SSSV
Chrysene	0/4	NA	360U - 380U	186	380	1,200	USEPA 1999a	0.32	No	Below SSSV
Dibenzo(a,h)anthracene	0/4	NA	360U - 380U	186	380	1,200	USEPA 1999a	0.32	No	Below SSSV
Fluoranthene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Fluorene	0/4	NA	360U - 380U	186	380	30,000	Efroymson et al. 1997a	0.01	No	Below SSSV
Indeno(1,2,3-cd)pyrene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Naphthalene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Phenanthrene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
Pyrene	0/4	NA	360U - 380U	186	380	1,200	---	0.32	No	Below SSSV
PCBs (ug/kg)										
Aroclor-1016	0/4	NA	44U - 46U	22.5	46.0	2,510	USEPA 1999a	0.02	No	Below SSSV
Aroclor-1221	0/4	NA	44U - 46U	22.5	46.0	2,510	---	0.02	No	Below SSSV
Aroclor-1232	0/4	NA	44U - 46U	22.5	46.0	2,510	---	0.02	No	Below SSSV
Aroclor-1242	0/4	NA	44U - 46U	22.5	46.0	2,510	---	0.02	No	Below SSSV
Aroclor-1248	0/4	NA	44U - 46U	22.5	46.0	2,510	---	0.02	No	Below SSSV
Aroclor-1254	0/4	NA	87U - 91U	44.8	91.0	2,510	USEPA 1999a	0.04	No	Below SSSV
Aroclor-1260	2/4	100 - 150	87U - 90U	84.6	150	2,510	---	0.06	No	Below SSSV
Inorganics (mg/kg)										
Arsenic	3/4	2.3J - 3.3J	0.7UJ - 0.7UJ	2.14	3.30	10.0	Efroymson et al. 1997b	0.33	No	Below SSSV
Barium	4/4	218 - 284	NA	253	284	500	Efroymson et al. 1997b	0.57	No	Below SSSV
Cadmium	4/4	0.25 - 0.42	NA	0.33	0.42	4.00	Efroymson et al. 1997b	0.11	No	Below SSSV

TABLE 4-16

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Soil Screening Values (SSSV)	Reference	Max. HQ [2]	Ecological COPC?	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]					
Inorganics (mg/kg)										
Chromium	4/4	19.5 - 29.9	NA	24.3	29.9	0.40	Efroymson et al. 1997a	74.8	Yes	
Lead	4/4	2.8J - 8.2	NA	5.90	8.20	50.0	Efroymson et al. 1997b	0.16	No	Below SSSV
Mercury	4/4	0.03 - 0.04	NA	0.03	0.04	0.10	Efroymson et al. 1997a	0.40	No	Below SSSV
Selenium	0/4	NA	0.15UJ - 0.79UJ	0.22	0.79	1.00	Efroymson et al. 1997b	0.79	No	Below SSSV
Silver	0/4	NA	0.64U - 0.8U	0.35	0.80	2.00	Efroymson et al. 1997b	0.40	No	Below SSSV

Notes:

COPC = Chemical of Potential Concern
HQ = Hazard Quotient
J = Estimated Value
U = Non-detected
UJ = Non-detected, Estimated Value
NA = Not Applicable
NE = Not Established

(1) Maximum detected concentration (or maximum reporting limit for non-detected chemicals).
(2) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum reporting limit for non-detected chemicals) divided by the screening value.

TABLE 4-17

FREQUENCY AND RANGE OF SURFACE WATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Water Screening Values (SWSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)					
Volatile Organics (ug/L)										
1,1,1,2-Tetrachloroethane	0/9	NA	1U - 1U	0.50	1.00	902	Buchman 1999	<0.01	No	Below SWSV
1,1,1-Trichloroethane	0/9	NA	1UJ - 1UJ	0.50	1.00	312	USEPA 2001	<0.01	No	Below SWSV
1,1,2,2-Tetrachloroethane	0/9	NA	1U - 1U	0.50	1.00	90.2	USEPA 2001	0.01	No	Below SWSV
1,1,2-Trichloroethane	0/9	NA	1U - 1U	0.50	1.00	340	USEPA 2003b	<0.01	No	Below SWSV
1,1-Dichloroethane	0/9	NA	1U - 1U	0.50	1.00	47.0	USEPA 1996b	0.02	No	Below SWSV
1,1-Dichloroethene	0/9	NA	1U - 1U	0.50	1.00	2240	USEPA 2001	<0.01	No	Below SWSV
1,2,3-Trichloropropane	0/9	NA	1U - 1U	0.50	1.00	274	USEPA 2003b	<0.01	No	Below SWSV
1,2-Dibromo-3-chloropropane	0/9	NA	1UJ - 1UJ	0.50	1.00	100	USEPA 2003b	0.01	No	Below SWSV
1,2-Dibromoethane (EDB)	0/9	NA	1U - 1U	0.50	1.00	48.0	USEPA 2003b	0.02	No	Below SWSV
1,2-Dichloroethane	0/9	NA	1UJ - 1UJ	0.50	1.00	1130	USEPA 2001	<0.01	No	Below SWSV
1,2-Dichloropropane	0/9	NA	1U - 1U	0.50	1.00	2400	USEPA 2001	<0.01	No	Below SWSV
2-Butanone (Methyl ethyl ketone)	2/9	0.75J - 0.79J	10U - 10U	4.06	0.79	40,000	USEPA 2003b	<0.01	No	Below SWSV
2-Hexanone	0/9	NA	10U - 10U	5.00	10.0	98.8	Suter II 1996	0.10	No	Below SWSV
3-Chloropropene (Allyl chloride)	0/9	NA	1U - 1U	0.50	1.00	3.40	USEPA 2003b	0.29	No	Below SWSV
4-Methyl-2-Pentanone (MIBK)	0/9	NA	10U - 10U	5.00	10.0	164	Suter II 1996	0.06	No	Below SWSV
Acetone	0/4	NA	25U - 25U	12.5	25.0	1,000	USEPA 2003b	0.03	No	Below SWSV
Acetonitrile	0/9	NA	40U - 40U	20.0	40.0	160,000	USEPA 2003b	<0.01	No	Below SWSV
Acrylonitrile	0/9	NA	20UJ - 20UJ	10.0	20.0	58.1	USEPA 2003b	0.34	No	Below SWSV
Benzene	0/9	NA	1U - 1U	0.50	1.00	109	USEPA 2001	<0.01	No	Below SWSV
Bromodichloromethane	0/9	NA	1U - 1U	0.50	1.00	6,400	Buchman 1999	<0.01	No	Below SWSV
Bromoform	0/9	NA	1UJ - 1UJ	0.50	1.00	640	USEPA 2001	<0.01	No	Below SWSV
Bromomethane (Methyl bromide)	0/9	NA	1UJ - 1UJ	0.50	1.00	120	USEPA 2003b	<0.01	No	Below SWSV
Carbon disulfide	0/9	NA	1U - 1U	0.50	1.00	650	USEPA 2003b	<0.01	No	Below SWSV
Carbon tetrachloride	0/9	NA	1U - 1U	0.50	1.00	1,500	USEPA 2001	<0.01	No	Below SWSV
Chlorobenzene	0/9	NA	1U - 1U	0.50	1.00	105	USEPA 2001	<0.01	No	Below SWSV
Chloroethane	0/9	NA	1UJ - 1UJ	0.50	1.00	NE	---	NA	Yes	Not Detected
Chloroform	0/9	NA	1U - 1U	0.50	1.00	815	USEPA 2001	<0.01	No	Below SWSV
Chloromethane (Methyl chloride)	0/9	NA	1UJ - 1UJ	0.50	1.00	2,700	USEPA 2003b	<0.01	No	Below SWSV
Chloroprene	0/9	NA	1U - 1U	0.50	1.00	NE	---	NA	Yes	Not Detected
Cis-1,3-dichloropropene	0/9	NA	1U - 1U	0.50	1.00	7.90	USEPA 2001	0.13	No	Below SWSV
Dibromochloromethane	0/9	NA	1U - 1U	0.50	1.00	6,400	Buchman 1999	<0.01	No	Below SWSV
Dibromomethane (Methylene bromide)	0/9	NA	1U - 1U	0.50	1.00	6,400	Buchman 1999	<0.01	No	Below SWSV
Dichlorodifluoromethane	0/9	NA	1U - 1U	0.50	1.00	6,400	Buchman 1999	<0.01	No	Below SWSV
Ethyl methacrylate	0/9	NA	1U - 1U	0.50	1.00	NE	---	NA	Yes	Not Detected
Ethylbenzene	1/9	0.13J - 0.13J	1U - 1U	0.46	0.13	4.30	USEPA 2001	0.03	No	Below SWSV
Iodomethane (Methyl iodide)	0/9	NA	1UJ - 1UJ	0.50	1.00	NE	---	NA	Yes	Not Detected
Methacrylonitrile	0/9	NA	20U - 20U	10.0	20.0	NE	---	NA	Yes	Not Detected
Methyl methacrylate	0/9	NA	1U - 1U	0.50	1.00	1,300	USEPA 2003b	<0.01	No	Below SWSV
Methylene chloride (Dichloromethane)	0/9	NA	5U - 5U	2.50	5.00	2,560	USEPA 2001	<0.01	No	Below SWSV
Pentachloroethane	0/4	NA	5UJ - 5UJ	2.50	5.00	281	Buchman 1999	0.02	No	Below SWSV
Propionitrile	0/9	NA	20U - 20U	10.0	20.0	15,200	USEPA 2003b	<0.01	No	Below SWSV
Styrene	2/9	0.45J - 0.57J	1U - 1.2U	0.51	0.57	510	USEPA 2003b	<0.01	No	Below SWSV
Tetrachloroethene	0/9	NA	1U - 1U	0.50	1.00	45.0	USEPA 2001	0.02	No	Below SWSV
Toluene	1/9	0.17J - 0.17J	1U - 1U	0.46	0.17	37.0	USEPA 2001	<0.01	No	Below SWSV

TABLE 4-17

FREQUENCY AND RANGE OF SURFACE WATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Water Screening Values (SWSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)					
Volatile Organics (ug/L)										
Trans-1,2-dichloroethene	0/9	NA	1U - 1U	0.50	1.00	22,400	Buchman 1999	<0.01	No	Below SWSV
Trans-1,3-dichloropropene	0/9	NA	1U - 1U	0.50	1.00	7.90	USEPA 2001	0.13	No	Below SWSV
Trans-1,4-dichloro-2-butene	0/9	NA	2U - 2U	1.00	2.00	NE	---	NA	Yes	Not Detected
Trichloroethene	0/9	NA	1U - 1U	0.50	1.00	200	Buchman 1999	<0.01	No	Below SWSV
Trichlorofluoromethane	0/9	NA	1UJ - 1UJ	0.50	1.00	6,400	Buchman 1999	<0.01	No	Below SWSV
Vinyl acetate	0/9	NA	2U - 2U	1.00	2.00	100	USEPA 2003b	0.02	No	Below SWSV
Vinyl chloride	0/9	NA	1U - 1U	0.50	1.00	87.8	Suter II 1996	0.01	No	Below SWSV
Xylenes, Total	1/9	0.44J - 0.44J	2U - 2U	0.94	0.44	41.0	USEPA 2003b	0.01	No	Below SWSV
Semi-Volatile Organics (ug/L)										
1,2,4,5-Tetrachlorobenzene	0/9	NA	10U - 10U	5.00	10.0	30.0	USEPA 2003b	0.33	No	Below SWSV
1,2,4-Trichlorobenzene	0/9	NA	10U - 10U	5.00	10.0	4.50	USEPA 2001	2.22	Yes	Not Detected
1,2-Dichlorobenzene (o-Dichlorobenzene)	0/9	NA	10U - 10U	5.00	10.0	19.7	USEPA 2001	0.51	No	Below SWSV
1,3,5-Trinitrobenzene	0/2	NA	10U - 10U	5.00	10.0	80.0	USEPA 2003b	0.13	No	Below SWSV
1,3-Dichlorobenzene (m-Dichlorobenzene)	0/9	NA	10U - 10U	5.00	10.0	28.5	USEPA 2001	0.35	No	Below SWSV
1,4-Dichlorobenzene (p-Dichlorobenzene)	0/9	NA	10U - 10U	5.00	10.0	19.9	USEPA 2001	0.50	No	Below SWSV
1,4-Dioxane	0/6	NA	10UJ - 10UJ	5.00	10.0	67,000	USEPA 2003b	<0.01	No	Below SWSV
1,4-Naphthoquinone	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
1-Naphthylamine	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
2,2'-Oxybis(1-Chloropropane)[Bis(2-chloroisopropyl)ether]	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
2,3,4,6-Tetrachlorophenol	0/9	NA	10UJ - 10UJ	5.00	10.0	44.0	Buchman 1999	0.23	No	Below SWSV
2,4,5-Trichlorophenol	0/9	NA	10U - 10U	5.00	10.0	11.0	Buchman 1999	0.91	No	Below SWSV
2,4,6-Trichlorophenol	0/9	NA	10U - 10U	5.00	10.0	12.1	USEPA 2003b	0.83	No	Below SWSV
2,4-Dichlorophenol	0/9	NA	10U - 10U	5.00	10.0	5.00	USEPA 2003b	2.00	Yes	Not Detected
2,4-Dimethylphenol	0/9	NA	10U - 10U	5.00	10.0	131	USEPA 2003b	0.08	No	Below SWSV
2,4-Dinitrophenol	0/9	NA	50U - 50U	25.0	50.0	48.5	USEPA 2001	1.03	Yes	Not Detected
2,4-Dinitrotoluene	0/9	NA	10U - 10U	5.00	10.0	20.0	USEPA 2003b	0.50	No	Below SWSV
2,6-Dichlorophenol	0/9	NA	10U - 10U	5.00	10.0	54.0	USEPA 2003b	0.19	No	Below SWSV
2,6-Dinitrotoluene	0/9	NA	10U - 10U	5.00	10.0	60.0	USEPA 2003b	0.17	No	Below SWSV
2-Acetylaminofluorene	0/9	NA	10U - 10U	5.00	10.0	100	USEPA 2003b	0.10	No	Below SWSV
2-Chloronaphthalene	0/9	NA	10U - 10U	5.00	10.0	0.75	Buchman 1999	13.33	Yes	Not Detected
2-Chlorophenol	0/9	NA	10U - 10U	5.00	10.0	53.0	USEPA 2003b	0.19	No	Below SWSV
2-Naphthylamine	0/9	NA	10UJ - 10UJ	5.00	10.0	NE	---	NA	Yes	Not Detected
2-Nitroaniline (o-Nitroaniline)	0/9	NA	50U - 50U	25.0	50.0	48.9	USEPA 2003b	1.02	Yes	Not Detected
2-Nitrophenol (o-Nitrophenol)	0/9	NA	10U - 10U	5.00	10.0	10,000	USEPA 2003b	<0.01	No	Below SWSV
2-Picoline	0/9	NA	10UJ - 10UJ	5.00	10.0	8,979	USEPA 2003b	<0.01	No	Below SWSV
3,3'-Dichlorobenzidine	0/9	NA	20U - 20U	10.0	20.0	10.5	USEPA 2003b	1.90	Yes	Not Detected
3,3'-Dimethylbenzidine	0/9	NA	20UJ - 20UJ	10.0	20.0	160	USEPA 2003b	0.13	No	Below SWSV
3-Methylcholanthrene	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
3-Nitroaniline (M-Nitroaniline)	0/9	NA	50U - 50U	25.0	50.0	9.80	USEPA 2003b	5.10	Yes	Not Detected
4,6-Dinitro-2-Methylphenol (4,6-Dinitro-o-cresol)	0/9	NA	50U - 50U	25.0	50.0	10.0	USEPA 2003b	5.00	Yes	Not Detected
4-Aminobiphenyl	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
4-Bromophenylphenyl ether	0/9	NA	10U - 10U	5.00	10.0	3.60	USEPA 2003b	2.78	Yes	Not Detected
4-Chloro-3-methylphenol (p-Chloro-m-cresol)	0/9	NA	10U - 10U	5.00	10.0	1,300	USEPA 2003b	<0.01	No	Below SWSV
4-Chloroaniline (p-Chloroaniline)	0/9	NA	20U - 20U	10.0	20.0	129	Buchman 1999	0.16	No	Below SWSV

TABLE 4-17

FREQUENCY AND RANGE OF SURFACE WATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Surface Water Screening Values (SWSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Semi-Volatile Organics (ug/L)										
4-Chlorophenylphenyl ether	0/9	NA	10U - 10U	5.00	10.0	7.30	USEPA 2003b	1.37	Yes	Not Detected
4-Nitroaniline (p-Nitroaniline)	0/9	NA	50U - 50U	25.0	50.0	170	USEPA 2003b	0.29	No	Below SWSV
4-Nitrophenol (p-Nitrophenol)	0/9	NA	50U - 50U	25.0	50.0	71.7	USEPA 2001	0.70	No	Below SWSV
5-Nitro-o-toluidine	0/9	NA	10U - 10U	5.00	10.0	190	USEPA 2003b	0.05	No	Below SWSV
7,12-Dimethylbenz(a)anthracene	0/9	NA	10U - 10U	5.00	10.0	30.0	Buchman 1999	0.33	No	Below SWSV
Acetophenone	0/9	NA	10UJ - 10UJ	5.00	10.0	1,550	USEPA 2003b	<0.01	No	Below SWSV
alpha,alpha-Dimethylphenethylamine	0/9	NA	2000UJ - 2000UJ	1,000	2000.0	NE	---	NA	Yes	Not Detected
Aniline	0/9	NA	20UJ - 20UJ	10.0	20.0	294	USEPA 2003b	0.07	No	Below SWSV
Aramite, Total	0/2	NA	10U - 10U	5.00	10.0	0.60	USEPA 2003b	16.7	Yes	Not Detected
Benzyl alcohol	0/9	NA	10U - 10U	5.00	10.0	150	USEPA 2003b	0.07	No	Below SWSV
Bis(2-chloroethoxy)methane	0/9	NA	10U - 10U	5.00	10.0	6,400	Buchman 1999	<0.01	No	Below SWSV
Bis(2-chloroethyl)ether	0/9	NA	10U - 10U	5.00	10.0	910	USEPA 2003b	0.01	No	Below SWSV
Bis(2-ethylhexyl)phthalate	0/9	NA	10U - 10U	5.00	10.0	360	Buchman 1999	0.03	No	Below SWSV
Butylbenzylphthalate	0/9	NA	10U - 10U	5.00	10.0	29.4	USEPA 2001	0.34	No	Below SWSV
Cresol (ortho)	0/9	NA	10U - 10U	5.00	10.0	102	USEPA 2003b	0.10	No	Below SWSV
Cresol, m & p	0/9	NA	10U - 10U	5.00	10.0	50.0	USEPA 2003b	0.20	No	Below SWSV
Diallate, Total	0/6	NA	10UJ - 10UJ	5.00	10.0	82.0	USEPA 2003b	0.12	No	Below SWSV
Dibenzofuran	0/9	NA	10U - 10U	5.00	10.0	100	USEPA 2003b	0.10	No	Below SWSV
Diethylphthalate	0/9	NA	10U - 10U	5.00	10.0	75.9	USEPA 2001	0.13	No	Below SWSV
Dimethylphthalate	0/9	NA	10U - 10U	5.00	10.0	580	USEPA 2001	0.02	No	Below SWSV
Di-n-butylphthalate	0/9	NA	10U - 10U	5.00	10.0	3.40	USEPA 2001	2.94	Yes	Not Detected
Di-n-octylphthalate	0/9	NA	10U - 10U	5.00	10.0	3,450	USEPA 2003b	<0.01	No	Below SWSV
Dinoseb (2-Sec-butyl-4,6-dinitrophenol)	0/9	NA	10UJ - 10UJ	5.00	10.0	1.70	USEPA 2003b	5.88	Yes	Not Detected
Ethyl methanesulfonate	0/9	NA	10UJ - 10UJ	5.00	10.0	NE	---	NA	Yes	Not Detected
Hexachlorobenzene	0/9	NA	10U - 10U	5.00	10.0	10.0	USEPA 2003b	1.00	Yes	Not Detected
Hexachlorobutadiene	0/9	NA	10U - 10U	5.00	10.0	0.32	USEPA 2001	31.3	Yes	Not Detected
Hexachlorocyclopentadiene	0/9	NA	10U - 10U	5.00	10.0	0.07	USEPA 2001	143	Yes	Not Detected
Hexachloroethane	0/9	NA	10U - 10U	5.00	10.0	9.40	USEPA 2001	1.06	Yes	Not Detected
Hexachloropropene	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
Isophorone	0/9	NA	10U - 10U	5.00	10.0	129	USEPA 2001	0.08	No	Below SWSV
Isosafrole	0/7	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
M-Dinitrobenzene	0/9	NA	10U - 10U	5.00	10.0	500	USEPA 2003b	0.02	No	Below SWSV
Methyl Methanesulfonate	0/9	NA	10UJ - 10UJ	5.00	10.0	NE	---	NA	Yes	Not Detected
Nitrobenzene	0/9	NA	10U - 10U	5.00	10.0	66.8	USEPA 2001	0.15	No	Below SWSV
N-Nitrosodiethylamine	0/9	NA	10UJ - 10UJ	5.00	10.0	330,000	Buchman 1999	<0.01	No	Below SWSV
N-Nitrosodimethylamine	0/9	NA	10U - 10U	5.00	10.0	13,650	USEPA 2003b	<0.01	No	Below SWSV
N-NitrosoDi-n-Butylamine	0/9	NA	10UJ - 10UJ	5.00	10.0	330,000	Buchman 1999	<0.01	No	Below SWSV
N-NitrosoDi-n-Propylamine	0/9	NA	10U - 10U	5.00	10.0	330,000	Assumed	<0.01	No	Below SWSV
N-Nitrosodiphenylamine	0/9	NA	10U - 10U	5.00	10.0	33,000	USEPA 2001	<0.01	No	Below SWSV
N-Nitrosomethylethylamine	0/9	NA	10UJ - 10UJ	5.00	10.0	330,000	Assumed	<0.01	No	Below SWSV
N-Nitrosomorpholine	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
N-Nitrosopiperidine	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
N-Nitrosopyrrolidine	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected

TABLE 4-17

FREQUENCY AND RANGE OF SURFACE WATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Water Screening Values (SWSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)					
Semi-Volatile Organics (ug/L)										
O-Toluidine	0/9	NA	10UJ - 10UJ	5.00	10.0	400	USEPA 2003b	0.03	No	Below SWSV
P-(Dimethylamino)azobenzene	0/9	NA	10UJ - 10UJ	5.00	10.0	NE	---	NA	Yes	Not Detected
Pentachlorobenzene	0/9	NA	10U - 10U	5.00	10.0	129	USEPA 2001	0.08	No	Below SWSV
Pentachlorophenol	0/9	NA	50U - 50U	25.0	50.0	7.90	USEPA 2002a	6.33	Yes	Not Detected
Phenacetin	0/9	NA	10UJ - 10UJ	5.00	10.0	NE	---	NA	Yes	Not Detected
Phenol	0/9	NA	10U - 10U	5.00	10.0	58.0	USEPA 2001	0.17	No	Below SWSV
Pronamide	0/9	NA	10U - 10U	5.00	10.0	35.0	USEPA 2003b	0.29	No	Below SWSV
Pyridine	0/9	NA	50UJ - 50UJ	25.0	50.0	500	USEPA 2003b	0.10	No	Below SWSV
Safrole	0/9	NA	10U - 10U	5.00	10.0	NE	---	NA	Yes	Not Detected
PAHs (ug/L)										
1-Methylnaphthalene	0/9	NA	0.2U - 0.2U	0.10	0.20	19.0	USEPA 2003b	0.01	No	Below SWSV
2-Methylnaphthalene	0/9	NA	0.2U - 0.2U	0.10	0.20	3.00	USEPA 2003b	0.07	No	Below SWSV
Acenaphthene	0/9	NA	0.2U - 0.2U	0.10	0.20	9.70	USEPA 2001	0.02	No	Below SWSV
Acenaphthylene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Anthracene	0/9	NA	0.2U - 0.2U	0.10	0.20	50.0	USEPA 1996a	<0.01	No	Below SWSV
Benzo(a)anthracene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Benzo(a)pyrene	0/9	NA	10U - 10U	5.00	10.0	10.0	USEPA 1996a	1.00	Yes	Not Detected
Benzo(b)fluoranthene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Benzo(g,h,i)perylene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Benzo(k)fluoranthene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Chrysene	0/9	NA	0.2U - 0.2U	0.10	0.20	10.0	USEPA 1996a	0.02	No	Below SWSV
Dibenzo(a,h)anthracene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Fluoranthene	0/9	NA	0.2U - 0.2U	0.10	0.20	11.0	USEPA 1996b	0.02	No	Below SWSV
Fluorene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Indeno(1,2,3-cd)pyrene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
Naphthalene	0/9	NA	0.2U - 0.2U	0.10	0.20	23.5	USEPA 2001	<0.01	No	Below SWSV
Phenanthrene	0/9	NA	0.2U - 0.2U	0.10	0.20	8.30	USEPA 1996b	0.02	No	Below SWSV
Pyrene	0/9	NA	0.2U - 0.2U	0.10	0.20	30.0	Buchman 1999	<0.01	No	Below SWSV
PCBs (ug/L)										
Aroclor-1016	0/9	NA	1U - 1U	0.50	1.00	0.03	USEPA 2002a	33.3	Yes	Not Detected
Aroclor-1221	0/9	NA	2U - 2U	1.00	2.00	0.03	USEPA 2002a	66.7	Yes	Not Detected
Aroclor-1232	0/9	NA	1U - 1U	0.50	1.00	0.03	USEPA 2002a	33.3	Yes	Not Detected
Aroclor-1242	0/9	NA	1U - 1U	0.50	1.00	0.03	USEPA 2002a	33.3	Yes	Not Detected
Aroclor-1248	0/9	NA	1U - 1U	0.50	1.00	0.03	USEPA 2002a	33.3	Yes	Not Detected
Aroclor-1254	0/9	NA	1U - 1U	0.50	1.00	0.03	USEPA 2002a	33.3	Yes	Not Detected
Aroclor-1260	0/9	NA	1U - 1U	0.50	1.00	0.03	USEPA 2002a	33.3	Yes	Not Detected
Total Inorganics (ug/L)										
Antimony	9/9	0.41J - 1.8J	NA	0.93	1.80	500	Buchman 1999	<0.01	No	Below SWSV
Arsenic	9/9	1.6J - 2.2J	NA	1.84	2.20	36.0	USEPA 2002a	0.06	No	Below SWSV
Barium	9/9	7.8 - 9.3	NA	8.48	9.30	50,000	USEPA 2003b	<0.01	No	Below SWSV
Beryllium	0/9	NA	0.5U - 0.5U	0.25	0.50	310	USEPA 2003b	<0.01	No	Below SWSV
Cadmium	0/9	NA	2.5U - 2.5U	1.25	2.50	8.90	USEPA 2002a	0.28	No	Below SWSV
Chromium	7/9	0.81J - 2.4J	5U - 5U	1.42	2.40	50.4	USEPA 2002a	0.05	No	Below SWSV
Cobalt	9/9	0.72J - 1.2J	NA	0.85	1.20	45.0	USEPA 2003b	0.03	No	Below SWSV

TABLE 4-17

FREQUENCY AND RANGE OF SURFACE WATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Surface Water Screening Values (SWSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Total Inorganics (ug/L)										
Copper	9/9	0.7J - 5J	NA	2.23	5.00	3.70	USEPA 2002a	1.35	Yes	
Cyanide, Total	0/9	NA	10U - 10U	5.00	10.0	1.00	USEPA 2002a	10.0	Yes	Not Detected
Lead	9/9	0.09J - 1.2J	NA	0.37	1.20	8.50	USEPA 2002a	0.14	No	Below SWSV
Mercury	0/9	NA	0.2U - 0.2U	0.10	0.20	1.10	USEPA 2002a	0.18	No	Below SWSV
Nickel	9/9	0.15J - 0.83J	NA	0.37	0.83	8.30	USEPA 2002a	0.10	No	Below SWSV
Selenium	9/9	0.19J - 0.3J	NA	0.23	0.30	71.1	USEPA 2002a	<0.01	No	Below SWSV
Silver	1/9	0.076J - 0.076J	5U - 5U	2.23	0.08	0.23	USEPA 2001	0.33	No	Below SWSV
Thallium	3/9	0.32J - 0.45J	1U - 1U	0.46	0.45	21.3	USEPA 2001	0.02	No	Below SWSV
Tin	9/9	0.24J - 0.72J	NA	0.45	0.72	NE	---	NA	Yes	
Vanadium	9/9	2.6J - 6.9	NA	3.34	6.90	120	USEPA 2003b	0.06	No	Below SWSV
Zinc	9/9	8J - 14	NA	10.4	14.0	85.6	USEPA 2002a	0.16	No	Below SWSV

Notes:

COPC = Chemical of Potential Concern
HQ = Hazard Quotient
J = Estimated Value
U = Non-detected
UJ = Non-detected, Estimated Value
NA = Not Applicable
NE = Not Established

(1) Maximum detected concentration (or maximum reporting limit for non-detected chemicals).
(2) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum reporting limit for non-detected chemicals) divided by the screening value.

TABLE 4-18

FREQUENCY AND RANGE OF SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range: No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Sediment Screening Values (SSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Volatile Organics (ug/kg)										
1,1,1,2-Tetrachloroethane	0/18	NA	10U - 26U	8.39	26.0	3,474	USEPA 1993a	<0.01	No	Below SSV
1,1,1-Trichloroethane	0/18	NA	8U - 19U	5.75	19.0	856	USEPA 1993a	0.02	No	Below SSV
1,1,2,2-Tetrachloroethane	0/18	NA	8U - 19U	5.75	19.0	202	USEPA 1993a	0.09	No	Below SSV
1,1,2-Trichloroethane	0/18	NA	8U - 19U	5.75	19.0	352	USEPA 1993a	0.05	No	Below SSV
1,1-Dichloroethane	0/18	NA	8U - 19U	5.75	19.0	27.0	USEPA 1993a	0.70	No	Below SSV
1,1-Dichloroethene	0/18	NA	8U - 19UJ	5.75	19.0	2,782	USEPA 1993a	<0.01	No	Below SSV
1,2,3-Trichloropropane	0/18	NA	10U - 26U	8.39	26.0	446	USEPA 1993a	0.06	No	Below SSV
1,2-Dibromo-3-chloropropane	0/18	NA	20U - 51UJ	16.7	51.0	200	USEPA 1993a	0.26	No	Below SSV
1,2-Dibromoethane (EDB)	0/18	NA	10U - 51U	13.6	51.0	44.4	USEPA 1993a	1.15	Yes	Not Detected
1,2-Dichloroethane	0/18	NA	8U - 19U	5.75	19.0	315	USEPA 1993a	0.06	No	Below SSV
1,2-Dichloroethene (Total)	0/9	NA	8U - 13UJ	5.33	13.0	4,614	Di Toro and McGrath 2000	<0.01	No	Below SSV
1,2-Dichloropropane	0/18	NA	8U - 19U	5.75	19.0	2,075	USEPA 1993a	<0.01	No	Below SSV
2-Butanone (Methyl ethyl ketone)	9/18	14J - 85J	17UJ - 26UJ	19.0	85.0	754	USEPA 1993a	0.11	No	Below SSV
2-Hexanone	1/18	230J - 230J	17UJ - 66UJ	30.9	230	22.5	USEPA 1993a	10.2	Yes	
3-Chloropropene (Allyl chloride)	0/18	NA	10UJ - 51U	13.6	51.0	2.69	USEPA 1993a	19.0	Yes	Not Detected
4-Methyl-2-Pentanone (MIBK)	0/18	NA	17U - 95UJ	20.8	95.0	31.8	USEPA 1993a	2.98	Yes	Not Detected
Acetone	18/18	28J - 320J	NA	74.0	320	5.8	USEPA 1993a	55.1	Yes	
Acetonitrile	0/9	NA	170UJ - 260UJ	106	260	742	USEPA 1993a	0.35	No	Below SSV
Acrolein (Propenal)	0/9	NA	830U - 1300UJ	531	1,300	0.01	USEPA 1993a	241,619	Yes	Not Detected
Acrylonitrile	0/18	NA	170U - 380U	115	380	1.02	USEPA 1993a	371	Yes	Not Detected
Benzene	0/18	NA	8U - 19U	5.75	19.0	135	USEPA 1993a	0.14	No	Below SSV
Bromodichloromethane	0/18	NA	8U - 19U	5.75	19.0	7,426	USEPA 1993a	<0.01	No	Below SSV
Bromoform	0/18	NA	8U - 19U	5.75	19.0	1,308	USEPA 1993a	0.01	No	Below SSV
Bromomethane (Methyl bromide)	0/18	NA	10UJ - 26UJ	8.39	26.0	17.8	USEPA 1993a	1.46	Yes	Not Detected
Carbon Disulfide	0/18	NA	8U - 19U	5.75	19.0	601	USEPA 1993a	0.03	No	Below SSV
Carbon Tetrachloride	0/18	NA	8U - 19U	5.75	19.0	7,244	USEPA 1993a	<0.01	No	Below SSV
Chlorobenzene	0/18	NA	8U - 19U	5.75	19.0	680.5	USEPA 1993a	0.03	No	Below SSV
Chloroethane	0/18	NA	10UJ - 26UJ	8.39	26.0	2,890	Di Toro and McGrath 2000	<0.01	No	Below SSV
Chloroform	0/18	NA	8U - 19U	5.75	19.0	629	USEPA 1993a	0.03	No	Below SSV
Chloromethane (Methyl chloride)	0/18	NA	10UJ - 26U	8.39	26.0	212	USEPA 1993a	0.12	No	Below SSV
Chloroprene	0/18	NA	10UJ - 260U	56.1	260	NA	---	NA	Yes	Not Detected
Cis-1,3-Dichloropropene	0/18	NA	8U - 19U	5.75	19.0	8.37	USEPA 1993a	2.27	Yes	Not Detected
Dibromochloromethane	0/18	NA	8U - 19U	5.75	19.0	8,701	USEPA 1993a	<0.01	No	Below SSV
Dibromomethane (Methylene bromide)	0/18	NA	10U - 26U	8.39	26.0	2,039	USEPA 1993a	0.01	No	Below SSV
Dichlorodifluoromethane	0/18	NA	10UJ - 51U	13.6	51.0	5,864	Di Toro and McGrath 2000	<0.01	No	Below SSV
Ethyl methacrylate	0/18	NA	10U - 51U	13.6	51.0	NA	---	NA	Yes	Not Detected
Ethylbenzene	1/18	0.78J - 0.78J	8U - 19U	5.46	0.78	4.00	Buchman 1999	0.20	No	Below SSV
Iodomethane (Methyl iodide)	0/18	NA	10UJ - 26UJ	8.39	26.0	NA	---	NA	Yes	Not Detected
Methacrylonitrile	0/18	NA	33U - 380UJ	72.2	380	NA	---	NA	Yes	Not Detected
Methyl methacrylate	0/18	NA	10U - 51U	13.6	51.0	296	USEPA 1993a	0.17	No	Below SSV
Methylene chloride (Dichloromethane)	0/18	NA	8U - 55U	6.97	55.0	434	USEPA 1993a	0.13	No	Below SSV
Pentachloroethane	0/18	NA	33U - 95U	26.0	95.0	2,864	USEPA 1993a	0.03	No	Below SSV
Propionitrile	0/18	NA	83U - 380UJ	88.2	380	218	USEPA 1993a	1.74	Yes	Not Detected

TABLE 4-18

FREQUENCY AND RANGE OF SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Sediment Screening Values (SSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Volatile Organics (ug/kg)										
Styrene	0/18	NA	8U - 19U	5.75	19.0	3,962	USEPA 1993a	<0.01	No	Below SSV
Tetrachloroethene	0/18	NA	8U - 19U	5.75	19.0	57.0	Buchman 1999	0.33	No	Below SSV
Toluene	2/18	2.1J - 2.5J	8U - 19U	5.31	2.50	187	USEPA 1993a	0.01	No	Below SSV
Trans-1,2-dichloroethene	0/9	NA	10U - 19U	6.17	19.0	4,614	Di Toro and McGrath 2000	<0.01	No	Below SSV
Trans-1,3-dichloropropene	0/18	NA	8U - 19U	5.75	19.0	7.82	USEPA 1993a	2.43	Yes	Not Detected
Trans-1,4-dichloro-2-butene	0/18	NA	20UJ - 51U	16.7	51.0	NA	---	NA	Yes	Not Detected
Trichloroethene	0/18	NA	8U - 19U	5.75	19.0	41.0	Buchman 1999	0.46	No	Below SSV
Trichlorofluoromethane	0/18	NA	10UJ - 26UJ	8.39	26.0	6,786	Di Toro and McGrath 2000	<0.01	No	Below SSV
Vinyl acetate	0/18	NA	17U - 38UJ	11.5	38.0	5.22	USEPA 1993a	7.28	Yes	Not Detected
Vinyl chloride	0/18	NA	10U - 26UJ	8.39	26.0	26.2	USEPA 1993a	0.99	No	Below SSV
Xylenes, Total	0/18	NA	8U - 38U	8.83	38.0	4.00	Buchman 1999	9.50	Yes	Not Detected
Semi-Volatile Organics (ug/kg)										
1,2,4,5-Tetrachlorobenzene	0/18	NA	550U - 8700U	1,564	8,700	10,928	USEPA 1993a	0.80	No	Below SSV
1,2,4-Trichlorobenzene	0/18	NA	550U - 8700U	1,564	8,700	4.80	Buchman 1999	1,813	Yes	Not Detected
1,2-Dichlorobenzene (o-Dichlorobenzene)	0/18	NA	550U - 8700U	1,564	8,700	13.0	Buchman 1999	669	Yes	Not Detected
1,3,5-Trinitrobenzene	0/9	NA	5500U - 8300U	3,467	8,300	11.6	USEPA 1993a	717	Yes	Not Detected
1,3-Dichlorobenzene (m-Dichlorobenzene)	0/18	NA	550U - 8700U	1,564	8,700	986	USEPA 1993a	8.82	Yes	Not Detected
1,4-Dichlorobenzene (p-Dichlorobenzene)	0/18	NA	550U - 8700U	1,564	8,700	110	Buchman 1999	79.1	Yes	Not Detected
1,4-Dioxane	0/18	NA	770UJ - 8700UJ	1,735	8,700	364	USEPA 1993a	23.9	Yes	Not Detected
1,4-Naphthoquinone	0/18	NA	770U - 8700U	2,257	8,700	NA	---	NA	Yes	Not Detected
1-Naphthylamine	0/18	NA	770U - 8700UJ	1,735	8,700	NA	---	NA	Yes	Not Detected
2,2'-Oxybis(1-Chloropropane)[Bis(2-chloroisopropyl)ether	0/18	NA	550U - 8700U	1,564	8,700	NA	---	NA	Yes	Not Detected
2,3,4,6-Tetrachlorophenol	0/18	NA	550U - 8700U	1,564	8,700	10,425	USEPA 1993a	0.83	No	Below SSV
2,4,5-Trichlorophenol	0/18	NA	770U - 8700U	2,257	8,700	3.00	Buchman 1999	2,900	Yes	Not Detected
2,4,6-Trichlorophenol	0/18	NA	550U - 8700U	1,564	8,700	6.00	Buchman 1999	1,450	Yes	Not Detected
2,4-Dichlorophenol	0/18	NA	550U - 8700U	1,564	8,700	5.00	Buchman 1999	1,740	Yes	Not Detected
2,4-Dimethylphenol	0/18	NA	550U - 8700U	1,564	8,700	18.0	Buchman 1999	483	Yes	Not Detected
2,4-Dinitrophenol	0/18	NA	2800U - 45000U	8,033	45,000	16.2	USEPA 1993a	2,777	Yes	Not Detected
2,4-Dinitrotoluene	0/18	NA	550U - 8700U	1,564	8,700	18.9	USEPA 1993a	460	Yes	Not Detected
2,6-Dichlorophenol	0/18	NA	550UJ - 8700U	1,564	8,700	273	USEPA 1993a	31.9	Yes	Not Detected
2,6-Dinitrotoluene	0/18	NA	550U - 8700U	1,564	8,700	41.4	USEPA 1993a	210	Yes	Not Detected
2-Acetylaminofluorene	0/18	NA	770U - 8700U	1,735	8,700	1,167	USEPA 1993a	7.45	Yes	Not Detected
2-Chloronaphthalene	0/18	NA	550U - 8700U	1,564	8,700	15.8	USEPA 1993a	552	Yes	Not Detected
2-Chlorophenol	0/18	NA	550U - 8700U	1,564	8,700	8.00	Buchman 1999	1,088	Yes	Not Detected
2-Naphthylamine	0/18	NA	770U - 8700UJ	1,826	8,700	NA	---	NA	Yes	Not Detected
2-Nitroaniline (o-Nitroaniline)	0/18	NA	2800U - 45000U	8,033	45,000	32.2	USEPA 1993a	1,397	Yes	Not Detected
2-Nitrophenol (o-Nitrophenol)	0/18	NA	550U - 8700U	1,564	8,700	5,752	USEPA 1993a	1.51	Yes	Not Detected
2-Picoline	0/18	NA	550U - 8700UJ	1,564	8,700	1,108	USEPA 1993a	7.85	Yes	Not Detected
3,3'-Dichlorobenzidine	0/18	NA	1100U - 17000UJ	3,106	17,000	296	USEPA 1993a	57.4	Yes	Not Detected
3,3'-Dimethylbenzidine	0/10	NA	2800UJ - 45000UJ	13,040	45,000	690	USEPA 1993a	65.2	Yes	Not Detected
3-Methylcholanthrene	0/18	NA	550U - 8700U	1,564	8,700	NA	---	NA	Yes	Not Detected
3-Nitroaniline (M-Nitroaniline)	0/18	NA	2800U - 45000U	8,033	45,000	2.18	USEPA 1993a	20,654	Yes	Not Detected
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	0/18	NA	2800U - 45000U	8,033	45,000	12.1	USEPA 1993a	3,707	Yes	Not Detected

TABLE 4-18

FREQUENCY AND RANGE OF SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range: No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Sediment Screening Values (SSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Semi-Volatile Organics (ug/kg)										
4-Aminobiphenyl	0/18	NA	770U - 8700U	1,735	8,700	NA	---	NA	Yes	Not Detected
4-Bromophenylphenyl ether	0/18	NA	550U - 8700U	1,564	8,700	312	Di Toro and McGrath 2000	27.9	Yes	Not Detected
4-Chloro-3-methylphenol (p-Chloro-m-cresol)	0/18	NA	770U - 8700U	1,735	8,700	14,505	USEPA 1993a	0.60	No	Below SSV
4-Chloroaniline (P-Chloroaniline)	0/18	NA	1100U - 17000U	3,106	17,000	85.0	USEPA 1993a	200	Yes	Not Detected
4-Chlorophenylphenyl Ether	0/18	NA	550U - 8700U	1,564	8,700	287	Di Toro and McGrath 2000	30.31	Yes	Not Detected
4-Nitroaniline (P-Nitroaniline)	0/18	NA	2800U - 45000U	8,033	45,000	39.5	USEPA 1993a	1138	Yes	Not Detected
4-Nitrophenol (P-Nitrophenol)	0/18	NA	2800U - 45000U	8,033	45,000	54.1	USEPA 1993a	832	Yes	Not Detected
4-Nitroquinoline-1-oxide	0/1	NA	2800UJ - 2800UJ	1,400	2,800	NA	---	NA	Yes	Not Detected
5-Nitro-o-toluidine	0/18	NA	770U - 8700U	1,735	8,700	131	USEPA 1993a	66.4	Yes	Not Detected
7,12-Dimethylbenz(a)anthracene	0/18	NA	770U - 8700U	1,735	8,700	965,742	USEPA 1993a	<0.01	No	Below SSV
Acetophenone	0/18	NA	550U - 8700UJ	1,564	8,700	635	USEPA 1993a	13.70	Yes	Not Detected
alpha,alpha-Dimethylphenethylamine	0/17	NA	2800U - 1800000UJ	295,035	1,800,000	NA	---	NA	Yes	Not Detected
Aniline	0/18	NA	770U - 8700UJ	2,257	8,700	27.0	USEPA 1993a	322	Yes	Not Detected
Aramite, Total	0/9	NA	1100UJ - 1700UJ	689	1,700	328	USEPA 1993a	5.18	Yes	Not Detected
Benzyl alcohol	0/18	NA	550U - 8700U	1,564	8,700	52.0	Buchman 1999	167	Yes	Not Detected
Bis(2-chloroethoxy)methane	0/18	NA	550U - 8700U	1,564	8,700	350	USEPA 1993a	24.88	Yes	Not Detected
Bis(2-chloroethyl)ether	0/18	NA	550U - 8700U	1,564	8,700	141	USEPA 1993a	61.8	Yes	Not Detected
Bis(2-ethylhexyl)phthalate	9/18	200J - 700J	550UJ - 8700U	1,574	700	182	MacDonald 1994	3.85	Yes	
Butylbenzylphthalate	0/18	NA	550U - 8700U	1,564	8,700	63.0	Buchman 1999	138	Yes	Not Detected
Chlorobenzilate	0/9	NA	550U - 830U	347	830	1,759	USEPA 1993a	0.47	No	Below SSV
Cresol (ortho)	0/18	NA	550U - 8700U	1,564	8,700	8.00	Buchman 1999	1,088	Yes	Not Detected
Cresol, m & p	0/18	NA	550U - 8700U	1,564	8,700	100	Buchman 1999	87.0	Yes	Not Detected
Diallate, Total	0/18	NA	550U - 8700UJ	1,564	8,700	21,270	USEPA 1993a	0.41	No	Below SSV
Dibenzofuran	0/18	NA	550U - 8700U	1,564	8,700	110	Buchman 1999	79.1	Yes	Not Detected
Diethylphthalate	0/18	NA	550U - 8700U	1,564	8,700	6.00	Buchman 1999	1,450	Yes	Not Detected
Dimethylphthalate	0/18	NA	550U - 8700U	1,564	8,700	6.00	Buchman 1999	1,450	Yes	Not Detected
Di-n-butylphthalate	9/18	88J - 460J	550U - 8700U	1,467	460	58.0	Buchman 1999	7.93	Yes	
Di-n-octylphthalate	0/18	NA	550U - 8700U	1,564	8,700	61.0	Buchman 1999	143	Yes	Not Detected
Dinoseb (2-Sec-butyl-4,6-dinitrophenol)	0/16	NA	770UJ - 8700UJ	1,667	8,700	72.1	USEPA 1993a	121	Yes	Not Detected
Ethyl methanesulfonate	0/18	NA	550U - 8700UJ	1,564	8,700	NA	---	NA	Yes	Not Detected
Hexachlorobenzene	0/18	NA	550U - 8700U	1,564	8,700	6.00	Buchman 1999	1,450	Yes	Not Detected
Hexachlorobutadiene	0/18	NA	550U - 8700U	1,564	8,700	1.30	Buchman 1999	6,692	Yes	Not Detected
Hexachlorocyclopentadiene	0/18	NA	550U - 8700UJ	1,564	8,700	139	USEPA 1993a	62.5	Yes	Not Detected
Hexachloroethane	0/18	NA	550U - 8700U	1,564	8,700	73.0	Buchman 1999	119	Yes	Not Detected
Hexachlorophene	0/1	NA	5300UJ - 5300UJ	2,650	5,300	2,272,912	USEPA 1993a	<0.01	No	Below SSV
Hexachloropropene	0/18	NA	770U - 8700UJ	2,257	8,700	NA	---	NA	Yes	Not Detected
Isophorone	0/18	NA	550U - 8700U	1,564	8,700	60.5	USEPA 1993a	144	Yes	Not Detected
Isosafrole	0/18	NA	550U - 8700U	1,564	8,700	NA	---	NA	Yes	Not Detected
M-Dinitrobenzene	0/18	NA	770U - 8700U	1,735	8,700	149	USEPA 1993a	58.3	Yes	Not Detected
Methapyrilene	0/9	NA	1400U - 2100U	872	2,100	NA	---	NA	Yes	Not Detected
Methyl methanesulfonate	0/18	NA	550UJ - 8700UJ	1,564	8,700	NA	---	NA	Yes	Not Detected
Nitrobenzene	0/18	NA	550U - 8700U	1,564	8,700	21.0	Buchman 1999	414	Yes	Not Detected
N-Nitrosodiethylamine	0/18	NA	550UJ - 8700UJ	1,564	8,700	9,787	USEPA 1993a	0.89	No	Below SSV

TABLE 4-18

FREQUENCY AND RANGE OF SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Sediment Screening Values (SSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Semi-Volatile Organics (ug/kg)										
N-Nitrosodimethylamine	0/18	NA	550U - 8700U	1,564	8,700	37.6	USEPA 1993a	231	Yes	Not Detected
N-Nitrosodi-n-butylamine	0/18	NA	550U - 8700UJ	1,564	8,700	772,367	USEPA 1993a	0.01	No	Below SSV
N-Nitrosodi-n-propylamine	0/18	NA	550UJ - 8700U	1,564	8,700	78,522	USEPA 1993a	0.11	No	Below SSV
N-Nitrosodiphenylamine	0/18	NA	550U - 8700U	1,564	8,700	28.0	Buchman 1999	311	Yes	Not Detected
N-Nitrosomethylethylamine	0/18	NA	550U - 8700UJ	1,564	8,700	2,517	USEPA 1993a	3.46	Yes	Not Detected
N-Nitrosomorpholine	0/18	NA	770U - 8700UJ	1,735	8,700	NA	---	NA	Yes	Not Detected
N-Nitrosopiperidine	0/18	NA	550U - 8700U	1,564	8,700	NA	---	NA	Yes	Not Detected
N-Nitrosopyrrolidine	0/18	NA	770UJ - 8700UJ	2,257	8,700	NA	---	NA	Yes	Not Detected
O-Toluidine	0/16	NA	550U - 8700UJ	1,475	8,700	83.1	USEPA 1993a	105	Yes	Not Detected
P-(Dimethylamino)azobenzene	0/18	NA	770UJ - 8700UJ	1,735	8,700	NA	---	NA	Yes	Not Detected
Pentachlorobenzene	0/18	NA	550U - 8700U	1,564	8,700	191,183	USEPA 1993a	0.05	No	Below SSV
Pentachlorophenol	0/18	NA	2800U - 45000U	8,033	45,000	17.0	Buchman 1999	2,647	Yes	Not Detected
Phenacetin	0/18	NA	550U - 8700U	1,564	8,700	NA	---	NA	Yes	Not Detected
Phenol	0/18	NA	550U - 8700U	1,564	8,700	130	Buchman 1999	66.9	Yes	Not Detected
Pronamide	0/18	NA	550U - 8700U	1,564	8,700	988	USEPA 1993a	8.81	Yes	Not Detected
Pyridine	0/18	NA	770UJ - 8700UJ	1,735	8,700	22.8	USEPA 1993a	382	Yes	Not Detected
Safrole	0/18	NA	550U - 8700U	1,564	8,700	NA	---	NA	Yes	Not Detected
PAHs (ug/kg)										
1-Methylnaphthalene	3/9	1.4J - 24J	13U - 24U	8.63	24.0	1,211	USEPA 1993a	0.02	No	Below SSV
2-Methylnaphthalene	4/18	1.5J - 32J	13U - 830U	178	32.0	20.2	MacDonald 1994	1.58	Yes	
Acenaphthene	5/18	4.1J - 220J	15U - 830U	190	220	6.71	MacDonald 1994	32.8	Yes	
Acenaphthylene	3/18	3.5J - 180J	13U - 830U	155	180	5.87	MacDonald 1994	30.7	Yes	
Anthracene	11/18	5.3J - 540J	16U - 830U	184	540	46.9	MacDonald 1994	11.51	Yes	
Benzo(a)anthracene	15/18	4.7J - 1200J	630U - 730U	234	1,200	74.8	MacDonald 1994	16.04	Yes	
Benzo(a)pyrene	8/18	96J - 3200	640U - 8700U	1,728	3,200	88.8	MacDonald 1994	36.0	Yes	
Benzo(b)fluoranthene	15/18	13J - 5000	18U - 730U	614	5,000	1,800	Buchman 1999	2.78	Yes	
Benzo(g,h,i)perylene	14/18	4.8J - 1800	630U - 730U	271	1,800	670	Buchman 1999	2.69	Yes	
Benzo(k)fluoranthene	5/18	110 - 2000	13U - 830U	300	2,000	1,800	Buchman 1999	1.11	Yes	
Chrysene	16/18	5J - 1900	640U - 730U	311	1,900	108	MacDonald 1994	17.6	Yes	
Dibenzo(a,h)anthracene	3/18	75J - 580J	13U - 830U	170	580	6.22	MacDonald 1994	93.2	Yes	
Fluoranthene	16/18	6.5J - 2600J	640U - 730U	332	2,600	113	MacDonald 1994	23.0	Yes	
Fluorene	5/18	2.8J - 220J	15U - 830U	189	220	21.2	MacDonald 1994	10.4	Yes	
Indeno(1,2,3-cd)pyrene	16/18	3.2J - 2100	640U - 730U	264	2,100	600	Buchman 1999	3.50	Yes	
Naphthalene	2/18	4.8J - 16J	13U - 830U	178	16.0	34.6	MacDonald 1994	0.46	No	Below SSV
Phenanthrene	12/18	20 - 2400J	16U - 830U	315	2,400	86.7	MacDonald 1994	27.7	Yes	
Pyrene	16/18	6.1J - 2100J	640U - 730U	311	2,100	153	MacDonald 1994	13.7	Yes	
PCBs (ug/kg)										
Aroclor-1016	0/23	NA	58U - 120U	39.1	120	21.6	MacDonald 1994	5.56	Yes	Not Detected
Aroclor-1221	0/23	NA	66U - 240U	62.8	240	21.6	MacDonald 1994	11.1	Yes	Not Detected
Aroclor-1232	0/23	NA	58U - 120U	39.1	120	21.6	MacDonald 1994	5.56	Yes	Not Detected
Aroclor-1242	0/23	NA	58U - 120U	39.1	120	21.6	MacDonald 1994	5.56	Yes	Not Detected
Aroclor-1248	0/23	NA	58U - 120U	39.1	120	21.6	MacDonald 1994	5.56	Yes	Not Detected
Aroclor-1254	0/23	NA	58U - 200U	55.4	200	21.6	MacDonald 1994	9.26	Yes	Not Detected
Aroclor-1260	19/23	12J - 150	58U - 77U	43.8	150	21.6	MacDonald 1994	6.94	Yes	

TABLE 4-18

FREQUENCY AND RANGE OF SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Sediment Screening Values (SSV)	Reference	Max. HQ (2)	Ecological COPC?	Comments
Inorganics (mg/kg)										
Antimony	15/18	0.21J - 0.71J	0.3UJ - 0.51UJ	0.42	0.71	2.00	Long and Morgan 1991	0.36	No	Below SSV
Arsenic	18/18	3.2 - 12	NA	5.63	12.0	7.24	MacDonald 1994	1.66	Yes	
Barium	18/18	13J - 33	NA	20.0	33.0	48.0	Buchman 1999	0.69	No	Below SSV
Beryllium	12/18	0.054J - 0.12J	0.04U - 0.09U	0.06	0.12	NA	---	NA	Yes	
Cadmium	11/18	0.08J - 1.3	0.06U - 0.08U	0.21	1.30	0.68	MacDonald 1994	1.91	Yes	
Chromium	19/19	NA	NA	11.0	19.0	52.3	MacDonald 1994	0.36	No	Below SSV
Cobalt	18/18	1.8J - 7.3J	NA	3.69	7.30	10.0	Buchman 1999	0.73	No	Below SSV
Copper	17/17	18.1J - 59J	NA	31.9	59.0	18.7	MacDonald 1994	3.16	Yes	
Cyanide, Total	0/9	NA	0.94U - 1.8U	0.61	1.80	NA	---	NA	Yes	Not Detected
Lead	9/9	6.4J - 25J	NA	12.7	25.0	30.2	MacDonald 1994	0.83	No	Below SSV
Mercury	9/18	0.015J - 0.42	0.03U - 0.07U	0.05	0.42	0.13	MacDonald 1994	3.23	Yes	
Nickel	18/18	1.7J - 7.1	NA	3.94	7.10	15.9	MacDonald 1994	0.45	No	Below SSV
Selenium	10/18	0.21J - 0.78J	0.32U - 0.44U	0.29	0.78	1.00	Buchman 1999	0.78	No	Below SSV
Silver	12/18	0.05J - 0.36J	0.09U - 0.12U	0.09	0.36	0.73	MacDonald 1994	0.49	No	Below SSV
Thallium	9/18	0.046J - 0.23J	0.3UJ - 0.63U	0.16	0.23	NA	---	NA	Yes	
Tin	18/18	2.2J - 6.4J	NA	4.02	6.40	3.40	Buchman 1999	1.88	Yes	
Vanadium	18/18	15.8 - 73.4J	NA	29.0	73.4	57.0	Buchman 1999	1.29	Yes	
Zinc	17/17	26J - 83.9	NA	49.3	83.9	124	MacDonald 1994	0.68	No	Below SSV

Notes:

COPC = Chemical of Potential Concern
HQ = Hazard Quotient
J = Estimated Value
NA = Not Applicable
U = Non-detected
UJ = Non-detected, Estimated Value

(1) Maximum detected concentration (or maximum reporting limit for non-detected chemicals).

(2) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum reporting limit for non-detected chemicals) divided by the screening value.

Revised: September 22, 2004

TABLE 4-19

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - TERRESTRIAL HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organics:									
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes (total)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Semi-Volatile Organics:									
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,3-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,4-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyphenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4-19

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - TERRESTRIAL HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organics:									
4-Chlorophenylphenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	0.27	0.03	0.09	0.08	<0.01	0.02	0.03	<0.01	<0.01
Di-n-octylphthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.61	0.06	0.19	0.05	<0.01	0.02	0.06	<0.01	0.02
Hexachlorobutadiene	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylaminoazobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs:									
2-Methylnaphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TABLE 4-19

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - TERRESTRIAL HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
PAHs:									
Anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCBs:									
Aroclor-1016	0.13	0.01	0.04	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Aroclor-1221	0.13	0.01	0.04	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Aroclor-1232	0.13	0.01	0.04	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Aroclor-1242	0.13	0.01	0.04	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Aroclor-1248	0.29	0.03	0.09	<0.01	<0.01	<0.01	0.03	<0.01	<0.01
Aroclor-1254	0.57	0.06	0.18	<0.01	<0.01	<0.01	0.05	<0.01	0.02
Aroclor-1260	0.94	0.09	0.30	<0.01	<0.01	<0.01	0.08	<0.01	0.03
Inorganics:									
Arsenic	0.08	0.03	0.04	0.25	0.08	0.14	<0.01	<0.01	<0.01
Barium	0.48	0.24	0.34	0.45	0.22	0.32	0.05	0.03	0.04
Cadmium	0.84	0.06	0.23	0.15	0.01	0.04	<0.01	<0.01	<0.01
Chromium	6.91	1.38	3.09	0.29	0.06	0.13	0.45	0.09	0.20
Lead	0.87	0.09	0.28	0.61	0.06	0.19	0.03	<0.01	<0.01
Mercury	9.47	0.95	2.99	5.10	0.51	1.61	0.04	<0.01	0.01

TABLE 4-19

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - TERRESTRIAL HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics:									
Selenium	0.27	0.13	0.19	0.98	0.49	0.69	0.10	0.05	0.07
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Not Applicable (HQ could not be calculated due to the lack of an ingestion-based screening value)

Shaded cells indicate the Hazard Quotient (HQ) for the ecological receptor is greater than 1.0.

TABLE 4-20

Revised: September 22, 2004

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	West Indian Manatee			Belted Kingfisher			Double-Crested Cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organics:									
1,1,1,2-Tetrachloroethane	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Chlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Chloroform	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Ethylbenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Styrene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Toluene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Trichloroethene	0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Xylenes (total)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Semi-Volatile Organics:									
1,2,4,5-Tetrachlorobenzene	4.59	0.46	1.45	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,3-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,4-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,3,4,6-Tetrachlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	0.02	<0.01	0.01	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyphenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenylphenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	<0.01	<0.01	<0.01	0.14	0.01	0.04	0.03	<0.01	0.01
Butylbenzylphthalate	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA

TABLE 4-20

Revised: September 22, 2004

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	West Indian Manatee			Belted Kingfisher			Double-Crested Cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organics:									
Diethylphthalate	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	<0.01	<0.01	<0.01	0.89	0.09	0.28	0.21	0.02	0.07
Di-n-octylphthalate	<0.01	<0.01	<0.01	0.04	<0.01	0.01	<0.01	<0.01	<0.01
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	5.08	0.51	1.61	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.03	<0.01	<0.01	23.2	2.32	7.33	5.51	0.55	1.74
Hexachlorobutadiene	0.06	<0.01	0.02	0.74	0.23	0.41	0.18	0.06	0.10
Hexachlorocyclopentadiene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Hexachloroethane	34.24	0.23	2.80	NA	NA	NA	NA	NA	NA
Hexachlorophene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
p-Dimethylaminoazobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Pentachlorophenol	0.16	0.02	0.05	0.10	0.05	0.07	0.02	0.01	0.02
Pronamide	0.04	<0.01	0.01	NA	NA	NA	NA	NA	NA
PAHs:									
1-Methylnaphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.03	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	0.04	<0.01	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TABLE 4-20 Revised: September 22, 2004

SUMMARY OF HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	West Indian Manatee			Belted Kingfisher			Double-Crested Cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
PAHs:									
Phenanthrene	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCBs:									
Aroclor-1016	<0.01	<0.01	<0.01	0.72	0.07	0.23	0.17	0.02	0.05
Aroclor-1221	0.05	<0.01	0.02	1.44	0.14	0.45	0.33	0.03	0.11
Aroclor-1232	0.03	<0.01	<0.01	0.72	0.07	0.23	0.17	0.02	0.05
Aroclor-1242	<0.01	<0.01	<0.01	0.72	0.07	0.23	0.17	0.02	0.05
Aroclor-1248	0.02	<0.01	<0.01	1.64	0.16	0.52	0.38	0.04	0.12
Aroclor-1254	0.02	<0.01	<0.01	2.73	0.27	0.86	0.63	0.06	0.20
Aroclor-1260	0.01	<0.01	<0.01	2.04	0.20	0.65	0.47	0.05	0.15
Inorganics:									
Antimony	0.45	0.04	0.14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	38.77	3.88	12.26	0.18	0.06	0.11	0.03	0.01	0.02
Barium	0.53	0.05	0.17	0.35	0.17	0.24	0.08	0.04	0.06
Beryllium	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA
Cadmium	6.15	0.62	1.94	0.06	<0.01	0.02	<0.01	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	0.28	0.06	0.13	0.04	<0.01	0.02
Cobalt	<0.01	<0.01	<0.01	1.09	0.11	0.34	0.26	0.03	0.08
Copper	0.49	0.38	0.43	0.14	0.11	0.12	<0.01	<0.01	<0.01
Lead	0.30	0.03	0.09	0.51	0.05	0.16	0.08	<0.01	0.03
Mercury	21.35	12.81	16.54	60.90	6.09	19.26	15.23	1.52	4.82
Nickel	0.05	0.02	0.04	0.02	0.01	0.02	<0.01	<0.01	<0.01
Selenium	2.33	1.41	1.82	0.80	0.40	0.57	0.20	0.10	0.14
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium	<0.01	<0.01	<0.01	0.15	0.01	0.05	0.04	<0.01	0.01
Tin	0.10	0.07	0.08	0.20	0.08	0.13	0.05	0.02	0.03
Vanadium	1.16	0.12	0.37	1.39	0.14	0.44	0.33	0.03	0.10
Zinc	1.12	0.11	0.36	0.67	0.07	0.22	0.09	0.01	0.03

Notes:

NOAEL = No Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
LOAEL = Lowest Observed Adverse Effect Level
NA = Not Applicable (HQ could not be calculated due to the lack of an ingestion-based screening value)

Shaded cells indicate the Hazard Quotient (HQ) for the ecological receptor is greater than 1.0.

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Volatile Organics (ug/kg)					
1,1,1,2-Tetrachloroethane		No SV			No SV
1,1,1-Trichloroethane					
1,1,2,2-Tetrachloroethane		No SV			No SV
1,1,2-Trichloroethane					
1,1-Dichloroethane					
1,1-Dichloroethene					
1,2,3-Trichloropropane	No SV				
1,2-Dibromo-3-chloropropane	No SV				
1,2-Dibromoethane (EDB)				HQ > 1.0	
1,2-Dichloroethane					
1,2-Dichloropropane					
2-Butanone (Methyl ethyl ketone)	No SV				
2-Hexanone	No SV			HQ > 1.0	
3-Chloropropene (Allyl chloride)	No SV			HQ > 1.0	
4-Methyl-2-Pentanone (MIBK)	No SV			HQ > 1.0	
Acetone	No SV			HQ > 1.0	
Acetonitrile	No SV				
Acrolein (Propenal)	No SV			HQ > 1.0	
Acrylonitrile				HQ > 1.0	
Benzene					
Bromodichloromethane	No SV				
Bromoform	No SV				
Bromomethane (Methyl bromide)	No SV			HQ > 1.0	
Carbon Disulfide	No SV				
Carbon Tetrachloride		No SV			
Chlorobenzene		No SV			
Chloroethane	No SV		No SV		

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Volatile Organics (ug/kg)					
Chloroform		No SV			
Chloromethane (Methyl chloride)	No SV				
Chloroprene			No SV	No SV	
Cis-1,3-Dichloropropene				HQ > 1.0	
Dibromochloromethane	No SV				
Dibromomethane (Methylene bromide)	No SV				
Dichlorodifluoromethane	No SV				
Ethyl methacrylate	No SV		No SV	No SV	
Ethylbenzene		No SV			
Iodomethane (Methyl iodide)	No SV		No SV	No SV	
Methacrylonitrile	No SV		No SV	No SV	
Methyl methacrylate	No SV				
Methylene chloride (Dichloromethane)					
Pentachloroethane	No SV	No SV			No SV
Propionitrile	No SV			HQ > 1.0	
Styrene		No SV			
Tetrachloroethene					
Toluene		No SV			
Trans-1,3-dichloropropene				HQ > 1.0	
Trans-1,4-dichloro-2-butene			No SV	No SV	
Trichloroethene		No SV			
Trichlorofluoromethane	No SV				
Vinyl acetate	No SV			HQ > 1.0	
Vinyl chloride	HQ > 1.0				
Xylenes, Total				HQ > 1.0	

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Semi-Volatile Organics (ug/kg)					
1,2,4,5-Tetrachlorobenzene	HQ > 1.0	No SV			No SV
1,2,4-Trichlorobenzene		No SV	HQ > 1.0	HQ > 1.0	
1,2-Dichlorobenzene (o-Dichlorobenzene)				HQ > 1.0	
1,3,5-Trinitrobenzene	HQ > 1.0			HQ > 1.0	
1,3-Dichlorobenzene (m-Dichlorobenzene)				HQ > 1.0	
1,4-Dichlorobenzene (p-Dichlorobenzene)				HQ > 1.0	
1,4-Dioxane	No SV			HQ > 1.0	
1,4-Naphthoquinone	No SV		No SV	No SV	
1-Naphthylamine	No SV		No SV	No SV	
2,2'-Oxybis(1-Chloropropane)[Bis(2-chloroisopropyl)ether]	No SV		No SV	No SV	
2,3,4,6-Tetrachlorophenol		No SV			No SV
2,4,5-Trichlorophenol		No SV		HQ > 1.0	
2,4,6-Trichlorophenol		No SV		HQ > 1.0	
2,4-Dichlorophenol		No SV	HQ > 1.0	HQ > 1.0	
2,4-Dimethylphenol	HQ > 1.0			HQ > 1.0	
2,4-Dinitrophenol			HQ > 1.0	HQ > 1.0	
2,4-Dinitrotoluene	No SV			HQ > 1.0	
2,6-Dichlorophenol				HQ > 1.0	
2,6-Dinitrotoluene	No SV			HQ > 1.0	
2-Acetylaminofluorene	No SV	No SV		HQ > 1.0	No SV
2-Chloronaphthalene	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV
2-Chlorophenol				HQ > 1.0	
2-Naphthylamine	No SV		No SV	No SV	
2-Nitroaniline (o-Nitroaniline)	No SV		HQ > 1.0	HQ > 1.0	
2-Nitrophenol (o-Nitrophenol)				HQ > 1.0	
2-Picoline	No SV			HQ > 1.0	
3,3'-Dichlorobenzidine	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Semi-Volatile Organics (ug/kg)					
3,3'-Dimethylbenzidine	No SV	No SV		HQ > 1.0	No SV
3-Methylcholanthrene	No SV	No SV	No SV	No SV	No SV
3-Nitroaniline (M-Nitroaniline)	No SV		HQ > 1.0	HQ > 1.0	
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	No SV		HQ > 1.0	HQ > 1.0	
4-Aminobiphenyl	No SV		No SV	No SV	
4-Bromophenylphenyl ether	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV
4-Chloro-3-methylphenol (p-Chloro-m-cresol)	No SV	No SV			No SV
4-Chloroaniline (P-Chloroaniline)	No SV			HQ > 1.0	
4-Chlorophenylphenyl Ether	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV
4-Nitroaniline (P-Nitroaniline)	No SV			HQ > 1.0	
4-Nitrophenol (P-Nitrophenol)				HQ > 1.0	
4-Nitroquinoline-1-oxide	No SV			No SV	
5-Nitro-o-toluidine	No SV			HQ > 1.0	
7,12-Dimethylbenz(a)anthracene	No SV	No SV			No SV
Acetophenone	No SV			HQ > 1.0	
alpha,alpha-Dimethylphenethylene	No SV		No SV	No SV	
Aniline	No SV			HQ > 1.0	
Aramite, Total	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV
Benzyl alcohol	No SV			HQ > 1.0	
Bis(2-chloroethoxy)methane	No SV			HQ > 1.0	
Bis(2-chloroethyl)ether	No SV			HQ > 1.0	
Bis(2-ethylhexyl)phthalate				HQ > 1.0	
Butylbenzylphthalate		No SV		HQ > 1.0	
Chlorobenzilate	No SV				
Cresol (ortho)	HQ > 1.0			HQ > 1.0	
Cresol, m & p	HQ > 1.0			HQ > 1.0	
Diallate, Total	No SV	No SV			No SV

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Semi-Volatile Organics (ug/kg)					
Dibenzofuran	No SV			HQ > 1.0	
Diethylphthalate		No SV		HQ > 1.0	
Dimethylphthalate				HQ > 1.0	
Di-n-butylphthalate			HQ > 1.0	HQ > 1.0	
Di-n-octylphthalate				HQ > 1.0	
Dinoseb (2-Sec-butyl-4,6-dinitrophenol)	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV
Ethyl methanesulfonate	No SV		No SV	No SV	
Hexachlorobenzene			HQ = 1.0	HQ > 1.0	HQ > 1.0
Hexachlorobutadiene	No SV		HQ > 1.0	HQ > 1.0	
Hexachlorocyclopentadiene		No SV	HQ > 1.0	HQ > 1.0	
Hexachloroethane	No SV	No SV	HQ > 1.0	HQ > 1.0	No SV
Hexachlorophene	No SV	No SV			
Hexachloropropene	No SV	No SV	No SV	No SV	No SV
Isophorone	No SV			HQ > 1.0	
Isosafrole	No SV	No SV	No SV	No SV	No SV
M-Dinitrobenzene	No SV			HQ > 1.0	
Methapyrilene	No SV			No SV	
Methyl methanesulfonate	No SV		No SV	No SV	
Nitrobenzene	No SV			HQ > 1.0	
N-Nitrosodiethylamine					
N-Nitrosodimethylamine				HQ > 1.0	
N-Nitrosodi-n-butylamine					
N-Nitrosodi-n-propylamine					
N-Nitrosodiphenylamine		No SV		HQ > 1.0	
N-Nitrosomethylethylamine				HQ > 1.0	
N-Nitrosomorpholine	No SV		No SV	No SV	
N-Nitrosopiperidine	No SV		No SV	No SV	

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Semi-Volatile Organics (ug/kg)					
N-Nitrosopyrrolidine	No SV		No SV	No SV	
O-Toluidine	No SV			HQ > 1.0	
P-(Dimethylamino)azobenzene	No SV	No SV	No SV	No SV	No SV
Pentachlorobenzene		No SV			
Pentachloronitrobenzene	No SV				
Pentachlorophenol	HQ > 1.0		HQ > 1.0	HQ > 1.0	
Phenacetin	No SV		No SV	No SV	No SV
Phenol				HQ > 1.0	
Pronamide	No SV	No SV		HQ > 1.0	
Pyridine	No SV			HQ > 1.0	
Safrole	No SV		No SV	No SV	
PAHs (ug/kg)					
1-Methylnaphthalene					
2-Methylnaphthalene				HQ > 1.0	
Acenaphthene				HQ > 1.0	
Acenaphthylene				HQ > 1.0	
Anthracene				HQ > 1.0	
Benzo(a)anthracene				HQ > 1.0	
Benzo(a)pyrene			HQ = 1.0	HQ > 1.0	
Benzo(b)fluoranthene				HQ > 1.0	
Benzo(g,h,i)perylene				HQ > 1.0	
Benzo(k)fluoranthene				HQ > 1.0	
Chrysene				HQ > 1.0	
Dibenzo(a,h)anthracene				HQ > 1.0	
Fluoranthene				HQ > 1.0	
Fluorene				HQ > 1.0	
Indeno(1,2,3-cd)pyrene				HQ > 1.0	

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
PAHs (ug/kg)					
Naphthalene					
Phenanthrene				HQ > 1.0	
Pyrene				HQ > 1.0	
PCBs (ug/kg)					
Aroclor-1016			HQ > 1.0	HQ > 1.0	
Aroclor-1221			HQ > 1.0	HQ > 1.0	HQ > 1.0
Aroclor-1232			HQ > 1.0	HQ > 1.0	
Aroclor-1242			HQ > 1.0	HQ > 1.0	
Aroclor-1248			HQ > 1.0	HQ > 1.0	HQ > 1.0
Aroclor-1254			HQ > 1.0	HQ > 1.0	HQ > 1.0
Aroclor-1260			HQ > 1.0	HQ > 1.0	HQ > 1.0
Inorganics (mg/kg)					
Antimony					
Arsenic				HQ > 1.0	HQ > 1.0
Barium					
Beryllium				No SV	
Cadmium				HQ > 1.0	HQ > 1.0
Chromium	HQ > 1.0	HQ > 1.0			
Cobalt					HQ > 1.0
Copper			HQ > 1.0	HQ > 1.0	
Cyanide, Total			HQ > 1.0	HQ > 1.0	
Lead					
Mercury		HQ > 1.0		HQ > 1.0	HQ > 1.0
Nickel					
Selenium					HQ > 1.0
Silver					
Thallium				No SV	

TABLE 4-21

SUMMARY OF PRELIMINARY ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Ecological Contaminant of Potential Concern	Terrestrial Habitat		Open Water Habitat (Embayment)		
	Surface Soil	Terrestrial Food Web Exposures	Surface Water	Surface Sediment	Aquatic Food Web Exposures
Inorganics (mg/kg)					
Tin			No SV	HQ > 1.0	
Vanadium				HQ > 1.0	HQ > 1.0
Zinc					HQ > 1.0

Notes:

HQ > 1.0 indicates that the maximum detected concentration or (if not detected) maximum reporting limit exceedes the screening value; chemical ideniffied as an ecological COPC.

HQ = 1.0 indicates that the maximum detected concentration or (if not detected) maximum reporting limit is equal to the screening value; chemical ideniffied as an ecological COPC.

No SV indicates that no screening value is available; chemical identified as an ecological COPC

A shaded cell indicates that the compound was detected.

TABLE 4-22

LESS CONSERVATIVE SOIL BIOCONCENTRATION FACTORS USED FOR TERRESTRIAL PLANTS
AND SOIL BIOACCUMULATION FACTORS USED FOR TERRESTRIAL INVERTEBRATES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE
BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference	Value	Reference
Volatile Organics:				
1,1,1,2-Tetrachloroethane	1.1691	Travis and Arms 1988	1	Assumed
Carbon Tetrachloride	1.0234	Travis and Arms 1988	1	Assumed
Chlorobenzene	0.8608	Travis and Arms 1988	1	Assumed
Chloroform	3.0077	Travis and Arms 1988	1	Assumed
Ethylbenzene	0.5930	Travis and Arms 1988	1	Assumed
Pentachloroethane	0.6597	Travis and Arms 1988	1	Assumed
Styrene	0.7739	Travis and Arms 1988	1	Assumed
Toluene	0.9966	Travis and Arms 1988	1	Assumed
Trichloroethene	1.0510	Travis and Arms 1988	1	Assumed
Semi-Volatile Organics:				
1,2,4,5-Tetrachlorobenzene	0.0806	Travis and Arms 1988	1	Assumed
1,2,4-Trichlorobenzene	0.1863	Travis and Arms 1988	0.56	Beyer 1996
2,3,4,6-Tetrachlorophenol	0.1051	Travis and Arms 1988	1	Assumed
2,4,5-Trichlorophenol	0.2157	Travis and Arms 1988	3.2	van Gestel and Ma 1988
2,4,6-Trichlorophenol	0.2814	Travis and Arms 1988	1	Assumed
2,4-Dichlorophenol	0.6423	Travis and Arms 1988	1	Assumed
2-Acetylaminofluorene	0.6090	Travis and Arms 1988	1	Assumed
2-Chloronaphthalene	0.1567	Travis and Arms 1988	1	Assumed
3,3'-Dichlorobenzidine	0.3624	Travis and Arms 1988	1	Assumed
3,3'-Dimethylbenzidine	1.0939	Travis and Arms 1988	1	Assumed
3-Methylcholanthrene	0.0075	Travis and Arms 1988	1	Assumed
4-Bromophenylphenyl ether	0.0499	Travis and Arms 1988	1	Assumed
4-Chloro-3-methylphenol	0.6255	Travis and Arms 1988	1	Assumed
4-Chlorophenylphenyl ether	0.0533	Travis and Arms 1988	1	Assumed
7,12-Dimethylbenz(a)anthracene	0.0058	Travis and Arms 1988	1	Assumed
Aramite	0.0634	Travis and Arms 1988	1	Assumed
Butylbenzylphthalate	0.0617	Travis and Arms 1988	1	Assumed
Diallate	0.0984	Travis and Arms 1988	1	Assumed
Dibenzofuran	0.1447	Travis and Arms 1988	1	Assumed
Diethylphthalate	1.3900	Travis and Arms 1988	1	Assumed
Di-n-butylphthalate	0.0838	Travis and Arms 1988	1	Assumed
Hexachlorocyclopentadiene	0.0297	Travis and Arms 1988	1	Assumed
Hexachloroethane	0.1888	Travis and Arms 1988	1	Assumed
Hexachloropropene	0.1139	Travis and Arms 1988	1	Assumed
Isosafrole	0.4367	Travis and Arms 1988	1	Assumed
n-Nitrosodiphenylamine	0.5775	Travis and Arms 1988	1	Assumed
p-Dimethylaminoazobenzene	0.0872	Travis and Arms 1988	1	Assumed
Pentachlorobenzene	0.0353	Travis and Arms 1988	1	Assumed
Pronamide	0.3624	Travis and Arms 1988	1	Assumed
Inorganics:				
Chromium (total)	0.0075	Baes et al. 1984	0.32	Sample et al. 1998a
Mercury	0.344	Bechtel Jacobs 1998a	1.186	Sample et al. 1998a

Notes:

BCF = Bioconcentration Factor
BAF = Bioaccumulation Factor

TABLE 4-23

LESS CONSERVATIVE SOIL BIOACCUMULATION FACTORS
USED FOR SMALL MAMMAL PREY ITEMS
SWMU 45 - AREA OUTSIDE BUILDING 45 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND
STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Soil-Omnivore BAF (dry weight)	
	Value	Reference
Volatile Organics:		
1,1,1,2-Tetrachloroethane	---	see text
Carbon Tetrachloride	---	see text
Chlorobenzene	---	see text
Chloroform	---	see text
Ethylbenzene	---	see text
Pentachloroethane	---	see text
Styrene	---	see text
Toluene	---	see text
Trichloroethene	---	see text
Semi-Volatile Organics:		
1,2,4,5-Tetrachlorobenzene	---	see text
1,2,4-Trichlorobenzene	---	see text
2,3,4,6-Tetrachlorophenol	---	see text
2,4,5-Trichlorophenol	---	see text
2,4,6-Trichlorophenol	---	see text
2,4-Dichlorophenol	---	see text
2-Acetylaminofluorene	---	see text
2-Chloronaphthalene	---	see text
3,3'-Dichlorobenzidine	---	see text
3,3'-Dimethylbenzidine	---	see text
3-Methylcholanthrene	---	see text
4-Bromophenylphenyl ether	---	see text
4-Chloro-3-methylphenol	---	see text
4-Chlorophenylphenyl ether	---	see text
7,12-Dimethylbenz(a)anthracene	---	see text
Aramite	---	see text
Butylbenzylphthalate	---	see text
Diallate	---	see text
Dibenzofuran	---	see text
Diethylphthalate	---	see text
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	---	see text
Hexachlorocyclopentadiene	---	see text
Hexachloroethane	---	see text
Hexachlorophene	---	see text
Hexachloropropene	---	see text
Isosafrole	---	see text
n-Nitrosodiphenylamine	---	see text
p-Dimethylaminoazobenzene	---	see text
Pentachlorobenzene	---	see text
Pronamide	---	see text
Inorganics:		
Chromium (total)	0.092	Sample et al. 1998b
Mercury	0.0731	Sample et al. 1998b

Notes:

BAF = Bioaccumulation Factor

TABLE 4-24

LESS CONSERVATIVE SEDIMENT BIOACCUMULATION FACTORS USED FOR AQUATIC INVERTEBRATES AND FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE
BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference
Volatile Organics:				
1,1,1,2-Tetrachloroethane	1	Assumed	1	Assumed
Carbon Tetrachloride	1	Assumed	1	Assumed
Chlorobenzene	1	Assumed	1	Assumed
Chloroform	1	Assumed	1	Assumed
Ethylbenzene	1	Assumed	1	Assumed
Pentachloroethane	1	Assumed	1	Assumed
Styrene	1	Assumed	1	Assumed
Toluene	1	Assumed	1	Assumed
Trichloroethene	1	Assumed	1	Assumed
Semi-Volatile Organics:				
1,2,4,5-Tetrachlorobenzene	1	Assumed	1	Assumed
1,2,4-Trichlorobenzene	1	Assumed	1	Assumed
2,3,4,6-Tetrachlorophenol	1	Assumed	1	Assumed
2,4,5-Trichlorophenol	1	Assumed	1	Assumed
2,4,6-Trichlorophenol	1	Assumed	1	Assumed
2,4-Dichlorophenol	1	Assumed	1	Assumed
2-Acetylaminofluorene	1	Assumed	1	Assumed
2-Chloronaphthalene	1	Assumed	1	Assumed
3,3'-Dichlorobenzidine	1	Assumed	1	Assumed
3,3'-Dimethylbenzidine	1	Assumed	1	Assumed
3-Methylcholanthrene	1	Assumed	1	Assumed
4-Bromophenylphenyl ether	1	Assumed	1	Assumed
4-Chloro-3-methylphenol	1	Assumed	1	Assumed
4-Chlorophenylphenyl ether	1	Assumed	1	Assumed
7,12-Dimethylbenz(a)anthracene	1	Assumed	1	Assumed
Aramite	1	Assumed	1	Assumed
Butylbenzylphthalate	1	Assumed	1	Assumed
Diallate	1	Assumed	1	Assumed
Dibenzofuran	1	Assumed	1	Assumed
Diethylphthalate	1	Assumed	1	Assumed
Dinoseb (2-sec-butyl-4,6-Dinitrop	1	Assumed	1	Assumed
Hexachlorobenzene	1	Assumed	1	Assumed
Hexachlorocyclopentadiene	1	Assumed	1	Assumed
Hexachloroethane	1	Assumed	1	Assumed
Hexachlorophene	1	Assumed	1	Assumed
Hexachloropropene	1	Assumed	1	Assumed
Isosafrole	1	Assumed	1	Assumed
n-Nitrosodiphenylamine	1	Assumed	1	Assumed
p-Dimethylaminoazobenzene	1	Assumed	1	Assumed
Pronamide	1	Assumed	1	Assumed
PCBs:				
Aroclor-1221	1.92	Bechtel Jacobs 1998b	8.64	Oliver and Niimi 1988
Aroclor-1248	1.92	Bechtel Jacobs 1998b	8.64	Oliver and Niimi 1988
Aroclor-1254	1.92	Bechtel Jacobs 1998b	8.64	Oliver and Niimi 1988
Aroclor-1260	1.92	Bechtel Jacobs 1998b	8.64	Oliver and Niimi 1988

TABLE 4-24

LESS CONSERVATIVE SEDIMENT BIOACCUMULATION FACTORS USED FOR AQUATIC INVERTEBRATES AND FISH
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE
BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference
Inorganics:				
Beryllium	1	Assumed	1	Assumed
Cobalt	1	Assumed	1	Assumed
Mercury	1.022	Bechtel Jacobs 1998b	3.25	Cope et al. 1990
Vanadium	1	Assumed	1	Assumed

Notes:

BAF = Bioaccumulation Factor

TABLE 4-25

LESS CONSERVATIVE EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Receptor	Habitat	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Area Use Factor
		Value	Reference	Value	Reference	
Birds:						
American robin	Terrestrial	0.0773	USEPA 1993b	0.00426	Levey and Karasov 1989	1.0
Belted kingfisher	Aquatic	0.148	Dunning 1993	0.01835	USEPA 1993b	1.0
Mourning dove	Terrestrial	0.1265	Tomlinson et al. 1994	0.01515	Allometric equation from Nagy 1987 for all birds	1.0
Red-tailed hawk	Terrestrial	1.126	Sample and Suter II 1996	0.03603	Sample and Suter II 1994	1.0
Double-crested cormorant	Aquatic	2.33	Glahn and McCoy 1995	0.09250	Bivings et al. 1989	1.0
Mammals:						
Small Mammal Omnivore (prye item)	Terrestrial	0.275	Jackson 1992	0.01477	Allometric equation from Nagy 1987 for rodents	1.0

TABLE 4-26

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Soil Screening Values (SSSV)	Reference	Mean HQ (2)	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen (1)				
Volatile Organics (ug/kg)									
1,2,3-Trichloropropane	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
1,2-Dibromo-3-Chloropropane	0/4	NA	22U - 23U	11.3	11.3	NE	---	NA	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
2-Hexanone	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
3-Chloropropene (Allylchloride)	0/4	NA	22UJ - 23UJ	11.3	11.3	NE	---	NA	Not Detected
4-Methyl-2-Pentanone (MIBK)	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
Acetone	0/4	NA	11UJ - 12UJ	5.6	5.6	NE	---	NA	Not Detected
Acetonitrile	0/4	NA	110UJ - 120UJ	56.3	56.3	NE	---	NA	Not Detected
Acrolein (Propenal)	0/4	NA	550UJ - 580U	282.5	282.5	NE	---	NA	Not Detected
Bromodichloromethane	0/4	NA	5U - 6U	2.9	2.9	NE	---	NA	Not Detected
Bromoform	0/4	NA	5UJ - 6UJ	2.9	2.9	NE	---	NA	Not Detected
Bromomethane (Methyl Bromide)	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
Carbon Disulfide	0/4	NA	5U - 6UJ	2.9	2.9	NE	---	NA	Not Detected
Chloroethane	0/4	NA	11UJ - 12UJ	5.6	5.6	NE	---	NA	Not Detected
Chloromethane (Methyl Chloride)	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
Dibromochloromethane	0/4	NA	5UJ - 6U	2.9	2.9	NE	---	NA	Not Detected
Dibromomethane (Methylene Bromide)	0/4	NA	11U - 12UJ	5.6	5.6	NE	---	NA	Not Detected
Dichlorodifluoromethane	0/4	NA	22U - 23U	11.3	11.3	NE	---	NA	Not Detected
Ethyl Methacrylate	0/4	NA	22UJ - 23UJ	11.3	11.3	NE	---	NA	Not Detected
Iodomethane (Methyl Iodide)	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
Methacrylonitrile	0/4	NA	22UJ - 23UJ	11.3	11.3	NE	---	NA	Not Detected
Methyl Methacrylate	0/4	NA	22UJ - 23U	11.3	11.3	NE	---	NA	Not Detected
Pentachloroethane	0/4	NA	22UJ - 23UJ	11.3	11.3	NE	---	NA	Not Detected
Propionitrile	0/4	NA	55U - 58U	28.3	28.3	NE	---	NA	Not Detected
Trichlorofluoromethane	0/4	NA	11U - 12U	5.6	5.6	NE	---	NA	Not Detected
Vinyl Acetate	0/4	NA	11UJ - 12UJ	5.6	5.6	NE	---	NA	Not Detected
Vinyl chloride	0/4	NA	11U - 12U	5.63	5.63	11.0	MHSPE 1994	0.51	Below SSSV
Semi-Volatile Organics (ug/kg)									
1,2,4,5-Tetrachlorobenzene	0/4	NA	360U - 380U	186	186	50.0	CCME 2002	3.73	Not Detected
1,3,5-Trinitrobenzene	0/2	NA	3700UJ - 3800UJ	1,875	1,875	50.0	CCME 2002	37.5	Not Detected
1,4-Dioxane	0/4	NA	730U - 760UJ	374	374	NE	---	NA	Not Detected
1,4-Naphthoquinone	0/4	NA	1800U - 1900U	925	925	NE	---	NA	Not Detected
1-Naphthylamine	0/4	NA	730U - 760UJ	374	374	NE	---	NA	Not Detected
2,2'-Oxybis(1-Chloropropane)[Bis(2-Chloroisopropyl)Ether]	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
2,4-Dimethylphenol	0/4	NA	360U - 380U	186	186	100	CCME 2002	1.86	Not Detected
2,4-Dinitrotoluene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
2,6-Dinitrotoluene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
2-Acetylaminofluorene	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
2-Chloronaphthalene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
2-Naphthylamine	0/4	NA	910U - 960U	468	468	NE	---	NA	Not Detected
2-Nitroaniline (O-Nitroaniline)	0/4	NA	1800U - 1900U	925	925	NE	---	NA	Not Detected
2-Picoline	0/4	NA	360U - 380UJ	186	186	NE	---	NA	Not Detected
3,3'-Dichlorobenzidine	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected

TABLE 4-26

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Soil Screening Values (SSSV)	Reference	Mean HQ [2]	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen [1]				
Semi-Volatile Organic Compounds (ug/kg)									
3,3'-Dimethylbenzidine	0/4	NA	1800UJ - 1900UJ	925	925	NE	---	NA	Not Detected
3-Methylcholanthrene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
3-Nitroaniline (M-Nitroaniline)	0/4	NA	1800U - 1900UJ	925	925	NE	---	NA	Not Detected
4,6-Dinitro-2-Methylphenol (4,6-Dinitro-O-Cresol)	0/4	NA	1800U - 1900U	925	925	NE	---	NA	Not Detected
4-Aminobiphenyl	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
4-Bromophenylphenyl Ether	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
4-Chloro-3-Methylphenol (P-Chloro-M-Cresol)	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
4-Chloroaniline (P-Chloroaniline)	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
4-Chlorophenylphenyl Ether	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
4-Nitroaniline (P-Nitroaniline)	0/4	NA	1800UJ - 1900U	925	925	NE	---	NA	Not Detected
4-Nitroquinoline-1-Oxide	0/4	NA	1800U - 1900U	925	925	NE	---	NA	Not Detected
5-Nitro-O-Toluidine	0/4	NA	730UJ - 760UJ	374	374	NE	---	NA	Not Detected
7,12-Dimethylbenz(a)Anthracene	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
Acetophenone	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Alpha,Alpha-Dimethylphenethylamine	0/4	NA	1800UJ - 1900UJ	925	925	NE	---	NA	Not Detected
Aniline	0/4	NA	1800U - 1900U	925	925	NE	---	NA	Not Detected
Aramite, Total	0/4	NA	730UJ - 760U	374	374	NE	---	NA	Not Detected
Benzyl Alcohol	0/4	NA	360U - 380UJ	186	186	NE	---	NA	Not Detected
Bis(2-Chloroethoxy)Methane	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Bis(2-Chloroethyl)Ether	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Chlorobenzilate	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Cresol (ortho)	0/4	NA	360U - 380U	186	186	100	CCME 2002	1.86	Not Detected
Cresol, m & p	0/4	NA	360U - 380U	186	186	100	CCME 2002	1.86	Not Detected
Diallate, Total	0/4	NA	360UJ - 380U	186	186	NE	---	NA	Not Detected
Dibenzofuran	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Dinoseb (2-Sec-Butyl-4,6-Dinitrophenol)	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
Ethyl Methanesulfonate	0/4	NA	360U - 380UJ	186	186	NE	---	NA	Not Detected
Hexachlorobutadiene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Hexachloroethane	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Hexachlorophene	0/4	NA	3600U - 3800U	1,863	1863	NE	---	NA	Not Detected
Hexachloropropene	0/4	NA	1800U - 1900U	925	925	NE	---	NA	Not Detected
Isophorone	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Isosafrole	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
m-Dinitrobenzene	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
Methapyrilene	0/4	NA	910U - 960U	468	468	NE	---	NA	Not Detected
Methyl Methanesulfonate	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Nitrobenzene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
N-Nitrosomorpholine	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected
N-Nitrosopiperidine	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
N-Nitrosopyrrolidine	0/4	NA	1800UJ - 1900UJ	925	925	NE	---	NA	Not Detected
O-Toluidine	0/4	NA	360UJ - 380UJ	186	186	NE	---	NA	Not Detected
P-(Dimethylamino)Azobenzene	0/4	NA	730U - 760U	374	374	NE	---	NA	Not Detected

TABLE 4-26

FREQUENCY AND RANGE OF SURFACE SOIL DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE SOIL SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen (1)	Surface Soil Screening Values (SSSV)	Reference	Mean HQ (2)	Comments
Semi-Volatile Organic Compounds (ug/kg)									
Pentachloronitrobenzene	0/4	NA	360U - 380U	186	186	NE	---	NA	Not Detected
Pentachlorophenol	0/4	NA	1800U - 1900U	925	925	1,730	USEPA 1999a	0.53	Below SSSV
Phenacetin	0/4	NA	360U - 380UJ	186.3	186.3	NE	---	NA	Not Detected
Pronamide	0/4	NA	360U - 380U	186.3	186.3	NE	---	NA	Not Detected
Pyridine	0/4	NA	730U - 760U	373.8	373.8	NE	---	NA	Not Detected
Safrole	0/4	NA	360U - 380U	186.3	186.3	NE	---	NA	Not Detected
Inorganics (mg/kg)									
Chromium	4/4	19.5 - 29.9	NA	24.3	24.3	0.40	Efroymson et al. 1997a	60.8	

Notes:

U = Non-detect
UJ = Non-detect, Estimated Value
NE = Not Established
NA = Not Applicable
Shaded cells indicate a mean Hazard Quotient (HQ) greater than 1.0.

(1) Mean concentration unless the mean exceeds the maximum concentration.

(2) The mean Hazard Quotient (HQ) value is the mean concentration (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

Revised: September 22, 2004

TABLE 4-27

SUMMARY STATISTICS AND RESULTS - SWMU 45 SURFACE SOIL
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	SSSV [2]	Population	Descriptive Statistics					Distributional Statistics [4]	
								Mean of the Distribution [5]	Right Tail of the Distribution [6]
			Frequency of Detection	Range of Detections	Mean [3]	SE	95% UCL		Slippage Test
Chromium	0.40	SWMU 45	4/4	19.5 - 29.9	24.3	2.15	29.4	t-test, p < 0.4835 Equivalent at α = 0.05 (Power = 0.05423)	Equivalent at α = 0.05
		Background	9/9	9.6 - 44.1J	24.0	4.19	31.8		
Mercury	Foodweb COPC	SWMU 45	4/4	0.03 - 0.04	0.03	0.003	0.04	WRS, p < 0.9985 Equivalent at α = 0.05 (Power = 0.00018)	Equivalent at α = 0.05
		Background	8/9	0.03J - 0.12J	0.06	0.01	0.08		

Notes:

COPC = Chemical of Potential Concern
J = Estimated Value
SE = Standard Error
SSSV = Surface Soil Screening Value
WRS = Wilcoxon Rank-Sum Test
95% UCL = 95% Upper Confidence Limit of the Mean

(1) Units in mg/kg.
(2) See Table 4-5 for information on screening values.
(3) Mean based on 1/2 non-detected values.
(4) Unless otherwise noted, α = 0.05
(5) Normality verified with Shapiro-Wilks test; Homogeneity of variance verified with F-test.
(6) Slippage test only determines whether or not a particluar contaminant is likely present at equivalent or elevated concentrations relative to background.

TABLE 4-28

FREQUENCY AND RANGE OF SURFACE WATER DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Water Screening Values (SWSV)	Reference	Mean HQ [2]	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen [1]				
Volatile Organics (ug/L)									
Chloroethane	0/9	NA	1UJ - 1UJ	0.5	0.5	NE	---	NA	Not Detected
Chloroprene	0/9	NA	1U - 1U	0.50	0.50	NE	---	NA	Not Detected
Ethyl Methacrylate	0/9	NA	1U - 1U	0.5	0.5	NE	---	NA	Not Detected
Iodomethane (Methyl Iodide)	0/9	NA	1UJ - 1UJ	0.5	0.5	NE	---	NA	Not Detected
Methacrylonitrile	0/9	NA	20U - 20U	10.0	10.0	NE	---	NA	Not Detected
Trans-1,4-Dichloro-2-Butene	0/9	NA	2U - 2U	1.0	1.0	NE	---	NA	Not Detected
Semi-Volatile Organics (ug/L)									
1,2,4-Trichlorobenzene	0/9	NA	10U - 10U	5.00	5.00	4.50	USEPA 2001a	1.11	Not Detected
1,4-Naphthoquinone	0/9	NA	10U - 10U	5.00	5.00	NE	---	NA	Not Detected
1-Naphthylamine	0/9	NA	10U - 10U	5.00	5.00	NE	---	NA	Not Detected
2,2'-Oxybis(1-Chloropropane)[Bis(2-Chloroisopropyl)Ether	0/9	NA	10U - 10U	5.00	5.00	NE	---	NA	Not Detected
2,4-Dichlorophenol	0/9	NA	10U - 10U	5.00	5.00	5.00	USEPA 2003b	1.00	Not Detected
2,4-Dinitrophenol	0/9	NA	50U - 50U	25.0	25.0	48.5	USEPA 2001a	0.52	Below SWSV
2-Chloronaphthalene	0/9	NA	10U - 10U	5.00	5.00	0.75	Buchman 1999	6.67	Not Detected
2-Nitroaniline (o-Nitroaniline)	0/9	NA	50U - 50U	25.0	25.0	48.9	USEPA 2003b	0.51	Below SWSV
3,3'-Dichlorobenzidine	0/9	NA	20U - 20U	10.0	10.0	10.5	USEPA 2003b	0.95	Below SWSV
3-Methylcholanthrene	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
3-Nitroaniline (m-Nitroaniline)	0/9	NA	50U - 50U	25.0	25.0	9.80	USEPA 2003b	2.55	Not Detected
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	0/9	NA	50U - 50U	25.0	25.0	10.0	USEPA 2003b	2.50	Not Detected
4-Aminobiphenyl	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
4-Bromophenylphenyl ether	0/9	NA	10U - 10U	5.00	5.00	3.60	USEPA 2003b	1.39	Not Detected
4-Chlorophenylphenyl ether	0/9	NA	10U - 10U	5.00	5.00	7.30	USEPA 2003b	0.68	Below SWSV
alpha,alpha-Dimethylphenethylamine	0/9	NA	2000UJ - 2000UJ	1000.00	1000.00	NE	---	NA	Not Detected
Aramite, Total	0/2	NA	10U - 10U	5.00	5.00	0.60	USEPA 2003b	8.33	Not Detected
Di-n-butylphthalate	0/9	NA	10U - 10U	5.00	5.00	3.40	USEPA 2001a	1.47	Not Detected
Dinoseb (2-Sec-butyl-4,6-dinitrophenol)	0/9	NA	10UJ - 10UJ	5.00	5.00	1.70	USEPA 2003b	2.94	Not Detected
Ethyl Methanesulfonate	0/9	NA	10UJ - 10UJ	5.00	5.00	NE	---	NA	Not Detected
Hexachlorobenzene	0/9	NA	10U - 10U	5.00	5.00	10.0	USEPA 2003b	0.50	Below SWSV
Hexachlorobutadiene	0/9	NA	10U - 10U	5.00	5.00	0.32	USEPA 2001a	15.6	Not Detected
Hexachlorocyclopentadiene	0/9	NA	10U - 10U	5.00	5.00	0.07	USEPA 2001a	71.4	Not Detected
Hexachloroethane	0/9	NA	10U - 10U	5.00	5.00	9.40	USEPA 2001a	0.53	Below SWSV
Hexachloropropene	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
Isosafrole	0/7	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
Methyl Methanesulfonate	0/9	NA	10UJ - 10UJ	5.0	5.0	NE	---	NA	Not Detected
N-Nitrosomorpholine	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
N-Nitrosopiperidine	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
N-Nitrosopyrrolidine	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected
P-(Dimethylamino)Azobenzene	0/9	NA	10UJ - 10UJ	5.0	5.0	NE	---	NA	Not Detected
Pentachlorophenol	0/9	NA	50U - 50U	25.0	25.0	7.90	USEPA 2002a	3.16	Not Detected
Phenacetin	0/9	NA	10UJ - 10UJ	5.0	5.0	NE	---	NA	Not Detected
Safrole	0/9	NA	10U - 10U	5.0	5.0	NE	---	NA	Not Detected

TABLE 4-28

FREQUENCY AND RANGE OF SURFACE WATER DATA (MEAN CONCENTRATIONS) COMPARED TO SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range								
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen [1]	Surface Water Screening Values (SWSV)	Reference	Mean HQ [2]	Comments
PAHs (ug/L)									
Benzo(a)pyrene	0/9	NA	10U - 10U	5.00	5.00	10.0	USEPA 1996a	0.50	Below SWSV
PCBs (ug/L)									
Aroclor-1016	0/9	NA	1U - 1U	0.50	0.50	0.03	USEPA 2002a	16.7	Not Detected
Aroclor-1221	0/9	NA	2U - 2U	1.00	1.00	0.03	USEPA 2002a	33.3	Not Detected
Aroclor-1232	0/9	NA	1U - 1U	0.50	0.50	0.03	USEPA 2002a	16.7	Not Detected
Aroclor-1242	0/9	NA	1U - 1U	0.50	0.50	0.03	USEPA 2002a	16.7	Not Detected
Aroclor-1248	0/9	NA	1U - 1U	0.50	0.50	0.03	USEPA 2002a	16.7	Not Detected
Aroclor-1254	0/9	NA	1U - 1U	0.50	0.50	0.03	USEPA 2002a	16.7	Not Detected
Aroclor-1260	0/9	NA	1U - 1U	0.50	0.50	0.03	USEPA 2002a	16.7	Not Detected
Total Inorganics (ug/L)									
Copper	9/9	0.7J - 5J	NA	2.23	2.23	3.70	USEPA 2002a	0.60	Below SWSV
Cyanide, Total	0/9	NA	10U - 10U	5.00	5.00	1.00	USEPA 2002a	5.00	Not Detected
Tin	9/9	0.24J - 0.72J	NA	0.45	0.45	NE	---	NA	

Notes:

U = Non-detect
J = Estimated Value
UJ = Non-detect, Estimated Value
NE = Not Established
NA = Not Applicable
Shaded cells indicate a mean Hazard Quotient (HQ) greater than 1.0.

(1) Mean concentration unless the mean exceeds the maximum concentration.

(2) The mean Hazard Quotient (HQ) value is the mean (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

TABLE 4-29

FREQUENCY AND RANGE OF DISSOLVED SURFACE WATER DATA (MEAN CONCENTRATIONS) COMPARED TO DISSOLVED SURFACE WATER SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range								
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen (1)	Surface Water Screening Values (SWSV)	Reference	Mean HQ (2)	Comments
Dissolved Inorganics (ug/L)									
Copper	9/9	0.4J - 0.88J	NA	0.58	0.58	3.10	USEPA 2002a	0.19	Below SWSV

Notes:

J = Estimated Value
NA = Not Applicable

(1) Mean concentration unless the mean exceeds the maximum concentration.

(2) The mean Hazard Quotient (HQ) value is the mean (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

TABLE 4-30

SUMMARY STATISTICS AND RESULTS - EMBAYMENT SURFACE WATER
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	SWSV [2]	Population	Descriptive Statistics					Distributional Statistics [4]	
								Mean of the Distribution [5]	Right Tail of the Distribution [6]
			Frequency of Detection	Range of Detections	Mean [3]	SE	95% UCL		Slippage Test
Total Recoverable:									
Copper	3.7	SWMU 45	9/9	0.7J - 5J	2.23	0.50	3.15	t-test, $p < 0.3703$ Equivalent at $\alpha = 0.05$ (Power = 0.09190)	Equivalent at $\alpha = 0.05$
		Background	9/9	1.8J - 2.5J	2.10	0.10	2.30		
Tin	NA	SWMU 45	9/9	0.24J - 0.72J	0.45	0.05	0.55	Gehan $G(-1.714) > Z_{0.95}$ (1.645) Equivalent at $\alpha = 0.05$	Equivalent at $\alpha = 0.05$
		Background	2/9	6.5J - 7.3J	21.0	2.67	26.0		
Dissolved Fraction:									
Copper	3.1	SWMU 45	9/9	0.4J - 0.88J	0.58	0.06	0.69	WRS, $p < 0.9998$ Equivalent at $\alpha = 0.05$ (Power = 0.000001)	Equivalent at $\alpha = 0.05$
		Background	9/9	2.7J - 9.9J	3.80	0.77	5.20		

Notes:

COPC = Chemical of Potential Concern
J = Estimated Value
NA = Test Not Applicable
ND = Not Detected
SE = Standard Error
SWSV = Surface Water Screening Value
WRS = Wilcoxon Rank-Sum Test
95% UCL = 95% Upper Confidence Limit of the Mean

(1) Units in ug/L.
(2) See Table 4-6 for information on screening values.
(3) Mean based on 1/2 non-detected values.
(4) Unless otherwise noted, $\alpha = 0.05$
(5) Normality verified with Shapiro-Wilks test; Homogeneity of variance verified with F-test.
(6) Slippage test only determines whether or not a particluar contaminant is likely present at equivalent or elevated concentrations relative to background.

TABLE 4-31

FREQUENCY AND RANGE OF SEDIMENT DATA (MEAN CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Sediment Screening Values (SSV)	Reference	Mean HQ [2]	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen [1]				
Volatile Organics (ug/kg)									
1,2-Dibromoethane (EDB)	0/18	NA	10U - 51U	13.6	13.6	44.4	USEPA 1993a	0.31	Below SSV
2-Hexanone	1/18	230J - 230J	17UJ - 66UJ	30.9	30.9	22.5	USEPA 1993a	1.38	
3-Chloropropene (Allyl chloride)	0/18	NA	10UJ - 51U	13.6	13.6	2.69	USEPA 1993a	5.06	Not Detected
4-Methyl-2-pentanone (MIBK)	0/18	NA	17U - 95UJ	20.8	20.8	31.8	USEPA 1993a	0.65	Below SSV
Acetone	18/18	28J - 320J	NA	74.0	74.0	5.81	USEPA 1993a	12.73	
Bromomethane (Methyl bromide)	0/18	NA	10UJ - 26UJ	8.39	8.39	17.8	USEPA 1993a	0.47	Below SSV
Chloroprene	0/18	NA	10UJ - 260U	56.14	56.1	NE	---	NA	Not Detected
Cis-1,3-dichloropropene	0/18	NA	8U - 19U	5.75	5.75	8.37	USEPA 1993a	0.69	Below SSV
Ethyl Methacrylate	0/18	NA	10U - 51U	14	13.6	NE	---	NA	Not Detected
Iodomethane (Methyl Iodide)	0/18	NA	10UJ - 26UJ	8	8.4	NE	---	NA	Not Detected
Methacrylonitrile	0/18	NA	33U - 380UJ	72	72.2	NE	---	NA	Not Detected
Propionitrile	0/18	NA	83U - 380UJ	88.2	88.2	218	USEPA 1993a	0.40	Below SSV
Trans-1,3-dichloropropene	0/18	NA	8U - 19U	5.75	5.75	7.82	USEPA 1993a	0.73	Below SSV
Trans-1,4-Dichloro-2-Butene	0/18	NA	20UJ - 51U	17	16.7	NE	---	NA	Not Detected
Vinyl acetate	0/18	NA	17U - 38UJ	11.5	11.5	5.22	USEPA 1993a	2.20	Not Detected
Xylenes, Total	0/18	NA	8U - 38U	8.83	8.83	4.00	Buchman 1999	2.21	Not Detected
Semi-Volatile Organics (ug/kg)									
1,2,4-Trichlorobenzene	0/18	NA	550U - 8700U	1,564	1,564	4.80	Buchman 1999	325.75	Not Detected
1,2-Dichlorobenzene (o-Dichlorobenzene)	0/18	NA	550U - 8700U	1,564	1,564	13.0	Buchman 1999	120.28	Not Detected
1,3,5-Trinitrobenzene	0/9	NA	5500U - 8300U	3,467	3,467	11.6	USEPA 1993a	299.64	Not Detected
1,3-Dichlorobenzene (m-Dichlorobenzene)	0/18	NA	550U - 8700U	1,564	1,564	986	USEPA 1993a	1.59	Not Detected
1,4-Dichlorobenzene (p-Dichlorobenzene)	0/18	NA	550U - 8700U	1,564	1,564	110	Buchman 1999	14.21	Not Detected
1,4-Dioxane	0/18	NA	770UJ - 8700UJ	1,735	1,735	364	USEPA 1993a	4.77	Not Detected
1,4-Naphthoquinone	0/18	NA	770U - 8700U	2,257	2,257	NE	---	NA	Not Detected
1-Naphthylamine	0/18	NA	770U - 8700UJ	1,735	1,735	NE	---	NA	Not Detected
2,2'-Oxybis(1-Chloropropane)[Bis(2-Chloroisopropyl)Ether]	0/18	NA	550U - 8700U	1,564	1,564	NE	---	NA	Not Detected
2,4,5-Trichlorophenol	0/18	NA	770U - 8700U	2,257	2,257	3.00	Buchman 1999	752.31	Not Detected
2,4,6-Trichlorophenol	0/18	NA	550U - 8700U	1,564	1,564	6.00	Buchman 1999	260.60	Not Detected
2,4-Dichlorophenol	0/18	NA	550U - 8700U	1,564	1,564	5.00	Buchman 1999	312.72	Not Detected
2,4-Dimethylphenol	0/18	NA	550U - 8700U	1,564	1,564	18.0	Buchman 1999	86.87	Not Detected
2,4-Dinitrophenol	0/18	NA	2800U - 45000U	8,033	8,033	16.2	USEPA 1993a	495.71	Not Detected
2,4-Dinitrotoluene	0/18	NA	550U - 8700U	1,564	1,564	18.9	USEPA 1993a	82.60	Not Detected
2,6-Dichlorophenol	0/18	NA	550UJ - 8700U	1,564	1,564	273	USEPA 1993a	5.73	Not Detected
2,6-Dinitrotoluene	0/18	NA	550U - 8700U	1,564	1,564	41.4	USEPA 1993a	37.80	Not Detected
2-Acetylaminofluorene	0/18	NA	770U - 8700U	1,735	1,735	1,167	USEPA 1993a	1.49	Not Detected
2-Chloronaphthalene	0/18	NA	550U - 8700U	1,564	1,564	15.8	USEPA 1993a	99.14	Not Detected
2-Chlorophenol	0/18	NA	550U - 8700U	1,564	1,564	8.00	Buchman 1999	195.45	Not Detected
2-Naphthylamine	0/18	NA	770U - 8700UJ	1,826	1,826	NE	---	NA	Not Detected
2-Nitroaniline (o-Nitroaniline)	0/18	NA	2800U - 45000U	8,033	8,033	32.2	USEPA 1993a	249.32	Not Detected

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TABLE 4-31

FREQUENCY AND RANGE OF SEDIMENT DATA (MEAN CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Sediment Screening Values (SSV)	Reference	Mean HQ (2)	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen (1)				
Semi-Volatile Organics (ug/kg)									
2-Nitrophenol (o-Nitrophenol)	0/18	NA	550U - 8700U	1,564	1,564	5,752	USEPA 1993a	0.27	Below SSV
2-Picoline	0/18	NA	550U - 8700UJ	1,564	1,564	1,108	USEPA 1993a	1.41	Not Detected
3,3'-Dichlorobenzidine	0/18	NA	1100U - 17000UJ	3,106	3,106	296	USEPA 1993a	10.48	Not Detected
3,3'-Dimethylbenzidine	0/10	NA	2800UJ - 45000UJ	13,040	13,040	690	USEPA 1993a	18.90	Not Detected
3-Methylcholanthrene	0/18	NA	550U - 8700U	1,564	1,564	NE	---	NA	Not Detected
3-Nitroaniline (m-Nitroaniline)	0/18	NA	2800U - 45000U	8,033	8,033	2.18	USEPA 1993a	3687.06	Not Detected
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	0/18	NA	2800U - 45000U	8,033	8,033	12.1	USEPA 1993a	661.69	Not Detected
4-Aminobiphenyl	0/18	NA	770U - 8700U	1,735	1,735	NE	---	NA	Not Detected
4-Bromophenylphenyl ether	0/18	NA	550U - 8700U	1,564	1,564	312	Di Toro and McGrath 2000	5.01	Not Detected
4-Chloroaniline (P-Chloroaniline)	0/18	NA	1100U - 17000U	3,106	3,106	85.0	USEPA 1993a	36.54	Not Detected
4-Chlorophenylphenyl ether	0/18	NA	550U - 8700U	1,564	1,564	287	Di Toro and McGrath 2000	5.45	Not Detected
4-Nitroaniline (p-Nitroaniline)	0/18	NA	2800U - 45000U	8,033	8,033	39.5	USEPA 1993a	203.14	Not Detected
4-Nitrophenol (p-Nitrophenol)	0/18	NA	2800U - 45000U	8,033	8,033	54.1	USEPA 1993a	148.45	Not Detected
4-Nitroquinoline-1-Oxide	0/1	NA	2800UJ - 2800UJ	1,400	1,400	NE	---	NA	Not Detected
5-Nitro-o-toluidine	0/18	NA	770U - 8700U	1,735	1,735	131	USEPA 1993a	13.24	Not Detected
Acetophenone	0/18	NA	550U - 8700UJ	1,564	1,564	635	USEPA 1993a	2.46	Not Detected
Alpha,Alpha-Dimethylphenethylamine	0/17	NA	2800U - 1800000UJ	295,035	295,035	NE	---	NA	Not Detected
Aniline	0/18	NA	770U - 8700UJ	2,257	2,257	27.0	USEPA 1993a	83.47	Not Detected
Aramite, Total	0/9	NA	1100UJ - 1700UJ	689	689	328	USEPA 1993a	2.10	Not Detected
Benzyl alcohol	0/18	NA	550U - 8700U	1,564	1,564	52.0	Buchman 1999	30.07	Not Detected
Bis(2-chloroethoxy)methane	0/18	NA	550U - 8700U	1,564	1,564	350	USEPA 1993a	4.47	Not Detected
Bis(2-chloroethyl)ether	0/18	NA	550U - 8700U	1,564	1,564	141	USEPA 1993a	11.10	Not Detected
Bis(2-ethylhexyl)phthalate	9/18	200J - 700J	550UJ - 8700U	1,574	700	182	MacDonald 1994	3.85	
Butylbenzylphthalate	0/18	NA	550U - 8700U	1,564	1,564	63.0	Buchman 1999	24.82	Not Detected
Cresol (ortho)	0/18	NA	550U - 8700U	1,564	1,564	8.00	Buchman 1999	195.45	Not Detected
Cresol, m & p	0/18	NA	550U - 8700U	1,564	1,564	100	Buchman 1999	15.64	Not Detected
Dibenzofuran	0/18	NA	550U - 8700U	1,564	1,564	110	Buchman 1999	14.21	Not Detected
Diethylphthalate	0/18	NA	550U - 8700U	1,564	1,564	6.00	Buchman 1999	260.60	Not Detected
Dimethylphthalate	0/18	NA	550U - 8700U	1,564	1,564	6.00	Buchman 1999	260.60	Not Detected
Di-n-butylphthalate	9/18	88J - 460J	550U - 8700U	1,467	460	58.0	Buchman 1999	7.93	
Di-n-octylphthalate	0/18	NA	550U - 8700U	1,564	1,564	61.0	Buchman 1999	25.63	Not Detected
Dinoseb (2-Sec-butyl-4,6-dinitrophenol)	0/16	NA	770UJ - 8700UJ	1,667	1,667	72.1	USEPA 1993a	23.12	Not Detected
Ethyl Methanesulfonate	0/18	NA	550U - 8700UJ	1,564	1,564	NE	---	NA	Not Detected
Hexachlorobenzene	0/18	NA	550U - 8700U	1,564	1,564	6.00	Buchman 1999	260.60	Not Detected
Hexachlorobutadiene	0/18	NA	550U - 8700U	1,564	1,564	1.30	Buchman 1999	1202.78	Not Detected
Hexachlorocyclopentadiene	0/18	NA	550U - 8700UJ	1,564	1,564	139	USEPA 1993a	11.23	Not Detected
Hexachloroethane	0/18	NA	550U - 8700U	1,564	1,564	73.0	Buchman 1999	21.42	Not Detected
Hexachloropropene	0/18	NA	770U - 8700UJ	2,257	2,257	NE	---	NA	Not Detected
Isophorone	0/18	NA	550U - 8700U	1,564	1,564	60.5	USEPA 1993a	25.83	Not Detected

TABLE 4-31

FREQUENCY AND RANGE OF SEDIMENT DATA (MEAN CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Contaminant Frequency/Range								
Analyte	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen (1)	Sediment Screening Values (SSV)	Reference	Mean HQ (2)	Comments
Semi-Volatile Organic Compounds (ug/kg)									
Isosafrole	0/18	NA	550U - 8700U	1,564	1,564	NE	---	NA	Not Detected
M-Dinitrobenzene	0/18	NA	770U - 8700U	1,735	1,735	149	USEPA 1993a	11.63	Not Detected
Methapyrilene	0/9	NA	1400U - 2100U	872	872	NE	---	NA	Not Detected
Methyl Methanesulfonate	0/18	NA	550UJ - 8700UJ	1,564	1,564	NE	---	NA	Not Detected
Nitrobenzene	0/18	NA	550U - 8700U	1,564	1,564	21.0	Buchman 1999	74.46	Not Detected
N-Nitrosodimethylamine	0/18	NA	550U - 8700U	1,564	1,564	37.6	USEPA 1993a	41.59	Not Detected
N-Nitrosodiphenylamine	0/18	NA	550U - 8700U	1,564	1,564	28.0	Buchman 1999	55.84	Not Detected
N-Nitrosomethylethylamine	0/18	NA	550U - 8700UJ	1,564	1,564	2,517	USEPA 1993a	0.62	Below SSV
N-Nitrosomorpholine	0/18	NA	770U - 8700UJ	1,735	1,735	NE	---	NA	Not Detected
N-Nitrosopiperidine	0/18	NA	550U - 8700U	1,564	1,564	NE	---	NA	Not Detected
N-Nitrosopyrrolidine	0/18	NA	770UJ - 8700UJ	2,257	2,257	NE	---	NA	Not Detected
O-Toluidine	0/16	NA	550U - 8700UJ	1,475	1,475	83.1	USEPA 1993a	17.75	Not Detected
P-(Dimethylamino)Azobenzene	0/18	NA	770UJ - 8700UJ	1,735	1,735	NE	---	NA	Not Detected
Pentachlorophenol	0/18	NA	2800U - 45000U	8,033	8,033	17.0	Buchman 1999	472.55	Not Detected
Phenacetin	0/18	NA	550U - 8700U	1,564	1,564	NE	---	NA	Not Detected
Phenol	0/18	NA	550U - 8700U	1,564	1,564	130.0	Buchman 1999	12.03	Not Detected
Pronamide	0/18	NA	550U - 8700U	1,564	1,564	988	USEPA 1993a	1.58	Not Detected
Pyridine	0/18	NA	770UJ - 8700UJ	1,735	1,735	22.8	USEPA 1993a	76.10	Not Detected
PAHs (ug/kg)									
2-Methylnaphthalene	4/18	1.5J - 32J	13U - 830U	178	32.0	20.2	MacDonald 1994	1.58	
Acenaphthene	5/18	4.1J - 220J	15U - 830U	190	190	6.71	MacDonald 1994	28.24	
Acenaphthylene	3/18	3.5J - 180J	13U - 830U	155	155	5.87	MacDonald 1994	26.37	
Anthracene	11/18	5.3J - 540J	16U - 830U	184	184	46.9	MacDonald 1994	3.91	
Benzo(a)anthracene	15/18	4.7J - 1200J	630U - 730U	234	234	74.8	MacDonald 1994	3.12	
Benzo(a)pyrene	8/18	96J - 3200	640U - 8700U	1,728	1,728	88.8	MacDonald 1994	19.45	
Benzo(b)fluoranthene	15/18	13J - 5000	18U - 730U	614	614	1,800	Buchman 1999	0.34	Below SSV
Benzo(g,h,i)perylene	14/18	4.8J - 1800	630U - 730U	271	271	670	Buchman 1999	0.40	Below SSV
Benzo(k)fluoranthene	5/18	110 - 2000	13U - 830U	300	300	1,800	Buchman 1999	0.17	Below SSV
Chrysene	16/18	5J - 1900	640U - 730U	311	311	108	MacDonald 1994	2.88	
Dibenzo(a,h)anthracene	3/18	75J - 580J	13U - 830U	170	170	6.22	MacDonald 1994	27.32	
Fluoranthene	16/18	6.5J - 2600J	640U - 730U	332	332	113	MacDonald 1994	2.94	
Fluorene	5/18	2.8J - 220J	15U - 830U	189	189	21.2	MacDonald 1994	8.93	
Indeno(1,2,3-cd)pyrene	16/18	3.2J - 2100	640U - 730U	264	264	600	Buchman 1999	0.44	Below SSV
Phenanthrene	12/18	20 - 2400J	16U - 830U	315	315	86.7	MacDonald 1994	3.63	
Pyrene	16/18	6.1J - 2100J	640U - 730U	311	311	153	MacDonald 1994	2.03	

TABLE 4-31

FREQUENCY AND RANGE OF SEDIMENT DATA (MEAN CONCENTRATIONS) COMPARED TO SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Sediment Screening Values (SSV)	Reference	Mean HQ (2)	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen (1)				
PCBs (ug/kg)									
Aroclor-1016	0/23	NA	58U - 120U	39.1	39.1	21.6	MacDonald 1994	1.81	Not Detected
Aroclor-1221	0/23	NA	66U - 240U	62.8	62.8	21.6	MacDonald 1994	2.91	Not Detected
Aroclor-1232	0/23	NA	58U - 120U	39.1	39.1	21.6	MacDonald 1994	1.81	Not Detected
Aroclor-1242	0/23	NA	58U - 120U	39.1	39.1	21.6	MacDonald 1994	1.81	Not Detected
Aroclor-1248	0/23	NA	58U - 120U	39.1	39.1	21.6	MacDonald 1994	1.81	Not Detected
Aroclor-1254	0/23	NA	58U - 200U	55.4	55.4	21.6	MacDonald 1994	2.57	Not Detected
Aroclor-1260	19/23	12J - 150	58U - 77U	43.8	43.8	21.6	MacDonald 1994	2.03	
Inorganics (mg/kg)									
Arsenic	18/18	3.2 - 12	NA	5.63	5.63	7.24	MacDonald 1994	0.78	Below SSV
Beryllium	12/18	0.054J - 0.12J	0.04U - 0.09U	0.06	0.06	NE	---	NA	
Cadmium	11/18	0.08J - 1.3	0.06U - 0.08U	0.21	0.21	0.68	MacDonald 1994	0.31	Below SSV
Copper	17/17	18.1J - 59J	NA	31.9	31.9	18.7	MacDonald 1994	1.71	
Cyanide, Total	0/9	NA	0.94U - 1.8U	0.61	0.6	NE	---	NA	Not Detected
Mercury	9/18	0.015J - 0.42	0.03U - 0.07U	0.05	0.05	0.13	MacDonald 1994	0.36	Below SSV
Thallium	9/18	0.046J - 0.23J	0.3UJ - 0.63U	0.16	0.16	NE	---	NA	
Tin	18/18	2.2J - 6.4J	NA	4.02	4.02	3.40	Buchman 1999	1.18	
Vanadium	18/18	15.8 - 73.4J	NA	29.0	29.0	57.0	Buchman 1999	0.51	Below SSV

Notes:

U = Non-detect
J = Estimated Value
UJ = Non-detect, Estimated Value
NE = Not Estab;ished
NA = Not Applicable
Shaded cells indicate a mean Hazard Quotient (HQ) greater than 1.0.

(1) Mean concentration unless the mean exceeds the maximum concentration.

(2) The mean Hazard Quotient (HQ) value is the mean concentration (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

TABLE 4-32

FREQUENCY AND RANGE OF SEDIMENT DATA (MEAN CONCENTRATIONS) COMPARED TO EqP-BASED SEDIMENT SCREENING VALUES
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					EqP-Based Sediment Screening Values (SSV)	Reference	Mean HQ [(2)]	Comments
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 3a Screen [(1)]				
PAHs (ug/kg)									
2-Methylnaphthalene	4/18	1.5J - 32J	13U - 830U	178	32.0	7,565	Di Toro and McGrath 2000	<0.01	Below SSV
Acenaphthene	5/18	4.1J - 220J	15U - 830U	190	190	8,312	Di Toro and McGrath 2000	0.02	Below SSV
Acenaphthylene	3/18	3.5J - 180J	13U - 830U	155	155	7,656	Di Toro and McGrath 2000	0.02	Below SSV
Anthracene	11/18	5.3J - 540J	16U - 830U	184	184	10,050	Di Toro and McGrath 2000	0.02	Below SSV
Benzo(a)anthracene	15/18	4.7J - 1200J	630U - 730U	234	234	14,222	Di Toro and McGrath 2000	0.02	Below SSV
Benzo(a)pyrene	8/18	96J - 3200	640U - 8700U	1,728	1,728	16,324	Di Toro and McGrath 2000	0.11	Below SSV
Benzo(b)fluoranthene	15/18	13J - 5000	18U - 730U	614	614	16,552	Di Toro and McGrath 2000	0.04	Below SSV
Benzo(g,h,i)perylene	14/18	4.8J - 1800	630U - 730U	271	271	18,515	Di Toro and McGrath 2000	0.01	Below SSV
Benzo(k)fluoranthene	5/18	110 - 2000	13U - 830U	300	300	16,603	Di Toro and McGrath 2000	0.02	Below SSV
Chrysene	16/18	5J - 1900	640U - 730U	311	311	14,268	Di Toro and McGrath 2000	0.02	Below SSV
Dibenzo(a,h)anthracene	3/18	75J - 580J	13U - 830U	170	170	18,983	Di Toro and McGrath 2000	<0.01	Below SSV
Fluoranthene	16/18	6.5J - 2600J	640U - 730U	332	332	11,974	Di Toro and McGrath 2000	0.03	Below SSV
Fluorene	5/18	2.8J - 220J	15U - 830U	189	189	9,108	Di Toro and McGrath 2000	0.02	Below SSV
Indeno(1,2,3-cd)pyrene	16/18	3.2J - 2100	640U - 730U	264	264	18,874	Di Toro and McGrath 2000	0.01	Below SSV
Phenanthrene	12/18	20 - 2400J	16U - 830U	315	315	10,086	Di Toro and McGrath 2000	0.03	Below SSV
Pyrene	16/18	6.1J - 2100J	640U - 730U	311	311	11,792	Di Toro and McGrath 2000	0.03	Below SSV

Notes:

U = Non-detect
J = Estimated Value
UJ = Non-detect, Estimated Value
Shaded cells indicate a mean Hazard Quotient (HQ) greater than 1.0.

(1) Mean concentration unless the mean exceeds the maximum concentration.

(2) The mean Hazard Quotient (HQ) value is the mean concentration (half non-detects) divided by the screening value. If the mean concentration exceeds the maximum concentration, the maximum concentration is used.

TABLE 4-33

SUMMARY STATISTICS AND RESULTS - EMBAYMENT SEDIMENT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	SSV [2]	Population	Descriptive Statistics					Distributional Statistics [4]		
								Mean of the Distribution [5]	Right Tail of the Distribution [6]	
			Frequency of Detection	Range of Detections	Mean [3]	SE	95% UCL		Quantile Test	Slippage Test
Arsenic	7	SWMU 45	18/18	3.2 - 12	5.63	0.49	6.48	t-test, $p < 0.0001$ Elevated at $\alpha = 0.05$ (Power = 0.99999)	Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$
		Background	9/9	1.8 - 3	2.34	0.17	2.66			
Beryllium	NA	SWMU 45	12/18	0.054J - 0.12J	0.06	0.01	0.07	---	---	---
		Background	0/9	ND	0.27	0.01	0.28			
Cadmium	1	SWMU 45	11/18	0.08J - 1.3	0.21	0.07	0.34	---	---	---
		Background	0/9	ND	0.34	0.01	0.35			
Cobalt	Food Web COPC (6.6)	SWMU 45	18/18	1.8J - 7.3J	3.69	0.32	4.24	t-test, $p < 0.0001$ Elevated at $\alpha = 0.05$ (Power = 0.99999)	Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$
		Background	9/9	0.35J - 0.93J	0.73	0.07	0.85			
Copper	19	SWMU 45	17/17	18.1J - 59J	31.92	2.59	36.44	t-test, $p < 0.0001$ Elevated at $\alpha = 0.05$ (Power = 0.99999)	Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$
		Background	9/9	2.2J - 3.2	2.82	0.12	3.04			
Mercury	0.1	SWMU 45	9/18	0.015J - 0.42	0.05	0.02	0.09	Gehan $G(3.181) > Z_{0.95}$ (1.645) Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$
		Background	5/9	0.0042J - 0.0062J	0.01	0.00	0.01			
Selenium	Food Web COPC (0.33)	SWMU 45	10/18	0.21J - 0.78J	0.29	0.04	0.35	---	---	---
		Background	0/9	ND	0.67	0.01	0.69			
Thallium	NA	SWMU 45	9/18	0.046J - 0.23J	0.16	0.01	0.19	---	Equivalent at $\alpha = 0.05$	Equivalent at $\alpha = 0.05$
		Background	1/9	0.91J - 0.91J	0.68	0.03	0.74			
Tin	3.4	SWMU 45	18/18	2.2J - 6.4J	4.02	0.24	4.43	---	---	---
		Background	0/9	ND	3.36	0.08	3.51			
Vanadium	57	SWMU 45	18/18	15.8 - 73.4J	29.01	3.14	34.46	t-test, $p < 0.0001$ Elevated at $\alpha = 0.05$ (Power = 0.99999)	Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$
		Background	9/9	3.6 - 9.6	7.20	0.74	8.58			

TABLE 4-33

SUMMARY STATISTICS AND RESULTS - EMBAYMENT SEDIMENT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical [1]	SSV [2]	Population	Descriptive Statistics					Distributional Statistics [4]		
								Mean of the Distribution [5]	Right Tail of the Distribution [6]	
			Frequency of Detection	Range of Detections	Mean [3]	SE	95% UCL		Quantile Test	Slippage Test
Zinc	Food Web COPC (74)	SWMU 45	17/17	26J - 83.9	49.26	4.13	56.69	t-test, $p < 0.0001$ Elevated at $\alpha = 0.05$ (Power = 0.99999)	Elevated at $\alpha = 0.05$	Elevated at $\alpha = 0.05$
		Background	9/9	2.6 - 4.5	3.82	0.24	4.26			

Notes:

NA = Test Not Applicable
ND = Not Detected
SE = Standard Error
SSV = Sediment Screening Value
WRS = Wilcoxon Rank-Sum Test
95% UCL = 95% Upper Confidence Limit of the Mean
--- = Indeterminate test due to censoring of data set

(1) Units in mg/kg.
(2) See Table 7-2 for information on screening values.
(3) Mean based on 1/2 non-detected values.
(4) Unless otherwise noted, $\alpha = 0.05$.
(5) Normality verified with Shapiro-Wilks test; Homogeneity of variance verified with F-test.
(6) Quantile and Slippage tests only determines whether or not a particluar contaminant is likely present at equivalent or elevated concentrations relative to background.

TABLE 4-34

SUMMARY OF REFINED HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - TERRESTRIAL HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatilve Organic Chemicals:									
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Chemicals:									
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenylphenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenylphenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4-34

SUMMARY OF REFINED HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - TERRESTRIAL HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organic Chemicals:									
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylaminoazobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics:									
Chromium	0.46	0.09	0.21	0.17	0.03	0.07	0.09	0.02	0.04
Mercury	0.30	0.03	0.09	0.23	0.02	0.07	0.02	<0.01	<0.01

Notes:

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Not Applicable (HQ could not be calculated due to the lack of an ingestion-based screening value)

TABLE 4-35

SUMMARY OF REFINED HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Belted kingfisher			Double-crested cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organics:						
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA
Semi-Volatile Organics:						
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA
4-Bromophenylphenyl ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chlorophenylphenyl ether	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA

TABLE 4-35

SUMMARY OF REFINED HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Belted kingfisher			Double-crested cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organics:						
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	2.42	0.24	0.77	0.78	0.08	0.25
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA
p-Dimethylaminoazobenzene	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA
PCBs:						
Aroclor-1221	0.15	0.02	0.05	0.05	<0.01	0.02
Aroclor-1248	0.22	0.02	0.07	0.07	<0.01	0.02
Aroclor-1254	0.31	0.03	0.10	0.11	0.01	0.03
Aroclor-1260	0.24	0.02	0.08	0.08	<0.01	0.03
Inorganics:						
Beryllium	NA	NA	NA	NA	NA	NA
Cobalt	0.31	0.03	0.10	0.10	<0.01	0.03
Mercury	2.81	0.28	0.89	0.95	0.09	0.30
Vanadium	0.32	0.03	0.10	0.10	0.01	0.03

Notes:

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Not Applicable (HQ could not be calculated due to the lack of an ingestion-based screening value)

Shaded cells indicate the Hazard Quotient (HQ) for the ecological receptor is greater than 1.0.

TABLE 4-35

SUMMARY OF REFINED HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Belted kingfisher			Double-crested cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organics:						
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA
Semi-Volatile Organics:						
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA
4-Bromophenylphenyl ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chlorophenylphenyl ether	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA

TABLE 4-35

SUMMARY OF REFINED HAZARD QUOTIENTS FOR FOOD WEB EXPOSURES - AQUATIC HABITAT
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Chemical	Belted kingfisher			Double-crested cormorant		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organics:						
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	2.42	0.24	0.77	0.78	0.08	0.25
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA
p-Dimethylaminoazobenzene	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA
PCBs:						
Aroclor-1221	0.15	0.02	0.05	0.05	<0.01	0.02
Aroclor-1248	0.22	0.02	0.07	0.07	<0.01	0.02
Aroclor-1254	0.31	0.03	0.10	0.11	0.01	0.03
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Inorganics:						
Beryllium	NA	NA	NA	NA	NA	NA
Cobalt	0.31	0.03	0.10	0.10	<0.01	0.03
Mercury	2.81	0.28	0.89	0.95	0.09	0.30
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Notes:

NOAEL = No Observed Adverse Effect Level
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Shaded cells indicate the Hazard Quotient (HQ) for the ecological receptor is greater than 1.0.

TABLE 4-36

SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN AND POTENTIAL RISK DRIVERS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

	Terrestrial Habitats		Aquatic Habitats		
	Invertebrate and Plant Communites	Upper Trophic Level Food Web Exposures	Invertebrate, Plant, and Fish Communities		Upper Trophic Level Food Web Exposures
Chemcials			Surface Water	Sediment	
Risk Drivers Recommended for Further Evaluation in the Baseline Risk Assessment	None	None	None	Aroclor-1260	None
Ecological Chemicals of Potential Concern Not Recommended for Further Evaluation in the Baseline Risk Assessment	Chromium 27 non-detected VOCs [(1)] 63 non-detected SVOCs [(1)]	Chromium Mercury 6 non-detected VOCs [(2)] 36 non-detected SVOCs [(2)] 1 non-detected PAH [(2)] 7 non-detected PCBs [(2)] 1 non-detected inorganic [(2)]	Copper Tin 16 non-detected VOCs [(3)] 78 non-detected SVOCs [(3)] 6 non-detected PCBs [(3)] 1 Non-detected inorganic [(3)]	Arsenic Beryllium Cadmium Copper Tin Thallium 2-Hexanone Acetone Bis(2-ethylhexyl)phthalate Di-n-butylphthalate 2-Methylnaphthalene Acenaphthene Acenaphthylene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Fluoranthene Fluorene Indeno(1,2,3-cd)pyrene Phananthrene Pyrene 9 non-detected VOCs [(4)] 30 non-detected SVOCs [(4)]	Arsenic Beryllium Cadmium Cobalt Mercury Selenium Vanadium Zinc Ethylbenzene Styrene Toluene 9 non-detected VOCs [(5)] 34 non-detected SVOCs [(5)] 3 non-detected PCBs [(5)]

TABLE 4-36

SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN AND POTENTIAL RISK DRIVERS
SWMU 45 - AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Notes:

(1) See Table 4-16 for specific non-detected chemicals identified as ecological COPCs for surface soil in the Step 2 screening-level risk calculation.

(2) See Table 4-17 for specific non-detected chemicals identified as ecological COPCs for surface water in the Step 2 screening-level risk calculation.

(3) See Table 4-18 for specific non-detected chemicals identified as ecological COPCs for sediment in the Step 2 screening-level risk calculation.

(4) See Table 4-19 for specific non-detected chemicals identified as ecological COPCs for terrestrial food web exposures in the Step 2 screening-level risk calculation.

(5) See Table 4-20 for specific non-detected chemicals as ecological COPCs for aquatic food web exposures in the Step 2 screening-level risk calculation.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The objective of the Additional Data Collection Field Investigation was to perform additional sampling of surface water and sediment at SWMU 45 to address the data gaps presented in the Draft Screening Level Ecological Risk Assessment Problem Formulation (Step 1) and Exposure Estimate for SWMU 45 (Baker, 2001a). This objective was met with the performance of the field investigation conducted in August 2003 as presented in the previous sections. An additional objective of the additional field investigation was to delineate the Aroclor 1260 contamination in the sediments within the embayment of Puerca Bay. Section 3.2 discusses the results from the samples analyzed for PCBs. With the outer ring of sediment samples collected at the mouth of the embayment all being non-detect for PCBs this objective was met.

The objective of this report was to present the revised Step 3A of the ERA incorporating the new data collected and make a determination whether or not this site will move forward to Step 3B of the ERA or continue in the Corrective Measures Study (CMS) planning stage.

Table 4-36 presents a summary of the ecological COPCs identified in Step 2 of the screening-level ERA, as well as the potential risk drivers identified in Step 3a of the baseline ERA. Based on refined media-specific risk calculation and risk evaluation presented in Sections 4.7.1.1 and 4.7.1.2, additional evaluation is not recommended for chemicals detected in surface soil and surface water, respectively. Additional evaluation also is not recommended for terrestrial food web exposures to chemicals detected in surface soil and aquatic food web exposures to chemicals detected in surface water, and sediment (see Section 4.7.1.4).

Based on the refined media-specific risk calculation and risk evaluation presented in Section 4.7.1.3, Aroclor-1260 has the potential to impact aquatic receptor communities (i.e., benthic macroinvertebrates) within the embayment downgradient from SWMU 45. Aroclor-1260 was detected in eighteen of twenty-three sediment samples. The detected concentration in seventeen samples exceeded the sediment screening value. Based on historical activities conducted at Building 38 (storage and maintenance of PCB transformers) and the evaluation of potential transport pathways presented in Section 4.3.1.2, Aroclor-1260 may have migrated to the embayment via the cooling water intake tunnel. Based on a mean HQ greater than 1.0 (2.03) and the frequency of detections exceeding the sediment screening value (17/23), it is recommended that Aroclor-1260 be carried on to Step 3b of the baseline ERA (baseline ERA problem formulation). Given the Federal status of sea turtles in Puerto Rico, additional evaluation of these potential ecological receptors is recommended in Step 3b of the baseline ERA. The evaluation will include an examination of their life history information to determine their potential for exposure to chemicals detected in embayment sediment. Any toxicological data identified from the literature for aquatic reptiles also will be presented and discussed in Step 3b.

6.0 REFERENCES

Baker Environmental, Inc. (Baker). 1993. Draft Supplemental Investigation, Installation Restoration Program Activities, Naval Station Roosevelt Roads, Ceiba, Puerto Rico.

Baker, 1995. Final RCRA Facility Investigation, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. September 14, 1995.

Baker, 1998. Draft RCRA Facility Investigation Report for Operable Unit 3/5, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. March 20, 1998.

Baker, 1999. Revised Draft RCRA Facility Investigation Report for Operable Unit 3/5, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. April 1, 1999.

Baker, 2000. Revised Final II Corrective Measures Study Work Plan for SWMU 45, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. July 14, 2000.

Baker, 2001a. Draft Screening Level Ecological Risk Assessment Problem Formulation (Step 1) and Exposure Estimate for SWMU 45, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. August 10, 2001.

Baker. 2001b. Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment at SWMU 45, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. August 10, 2001.

Baker, 2003a. Final Additional Data Collection Investigation Report Tow Way Fuel Farm, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. April 23, 2003.

Naval Energy and Environmental Support Activity (NEESA). 1984. Initial Assessment Study of Naval Station Roosevelt Roads, Puerto Rico. NEESA 13-051. September 1984.

OHM Remediation Services Corp. and Metcalf & Eddy, Inc. (OHM). 1995. Final Closeout Report for Interim Remedial Action of PCB Contaminated Soils. Sites 15 and 16, Naval Station Roosevelt Roads, Puerto Rico. May 1995.

OHM Remediation Services Corp, 1997. Final Closeout Report for Cooling Water Tunnels and Underground Storage Tanks at SWMU 45, Naval Station Roosevelt Roads, Puerto Rico. June 17, 1997.